

Encyclopedia of
CREATIVITY

Second Edition

Volume I
A-I



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ENCYCLOPEDIA OF **CREATIVITY**

SECOND EDITION

Volume 1

A-I

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VOLUME 1

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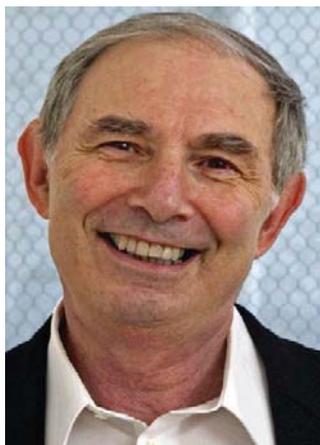
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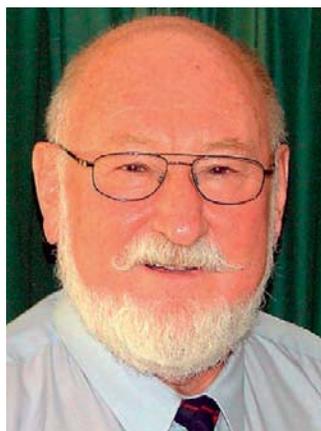
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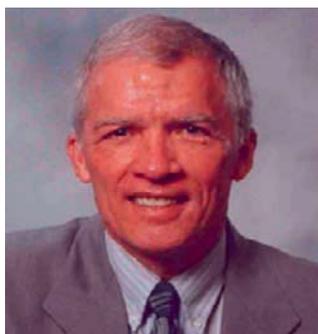
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SANDRA W. RUSS, a child clinical psychologist, is a Professor of Psychology at Case Western Reserve University. She has served as President of the Society for Personality Assessment, of the Clinical Child Section of APA, and most recently, of Division of Aesthetics, Creativity and the Arts. Her research program has focused on pretend play, creativity, and adaptive functioning in children. She developed the Affect in Play Scale which assesses pretend play in children. Also, she and her students are developing a play facilitation intervention. She is author of *Affect and Creativity: The Role of Affect and Play in the Creative Process* (1993) and *Play in Child Development and Psychotherapy: Toward Empirically Supported Practice* (2004). She teaches the Child and Family Intervention course and a Psychology of Creativity course.



DEAN KEITH SIMONTON is Distinguished Professor of Psychology at the University of California, Davis. Although he earned his Harvard Ph.D. in social psychology, Simonton's research also encompasses developmental, differential, and cognitive questions. The majority of his studies apply historiometric methods to large samples of highly eminent creators. His bibliography lists nearly 400 publications, including 11 books, such as his 2009 *Genius 101*. Simonton is former president of the Society for the Psychology of Aesthetics, Creativity and the Arts (Division 10 of the American Psychological Association) and the International Association for Empirical Aesthetics. He is Fellow of the American Association for the Advancement of Science, Association for Psychological Science, International Association for Empirical Aesthetics, and nine Divisions of the American Psychological Association (1, 2, 5, 7–10, 20, and 24). His honors include the William James Book Award, the George A. Miller Outstanding Article Award, the Theoretical Innovation Prize in Personality and Social Psychology, the Rudolf Arnheim Award for Outstanding Contributions to Psychology and the Arts, APA Master Lecturer, the Robert S. Daniel Award for Four-Year College/University Teaching, and the Sir Francis Galton Award for Outstanding Contributions to the Study of Creativity.



ELLEN WINNER is Professor of Psychology at Boston College, and Senior Research Associate at Project Zero, Harvard Graduate School of Education. She received her Ph.D. in Psychology from Harvard University in 1978 working with Roger Brown on child metaphor. Her research focuses on cognition in the arts in typical and gifted children. She is the author of over 100 articles and four books: *Invented Worlds: The Psychology of the Arts* (Harvard University Press, 1982); *The Point of Words: Children's Understanding of Metaphor and Irony* (Harvard University Press, 1988); *Gifted Children: Myths and Realities* (BasicBooks, 1997, translated into six languages and winner of the Alpha Sigma Nu National Jesuit Book Award in Science); and *Studio Thinking: The Real Benefits of Visual Arts Education* (Teachers College Press, 2007, co-authored with Lois Hetland, Shirley Veenema, and Kimberly Sheridan).

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PREFACE

When the first edition of *The Encyclopedia of Creativity* was published in 1999, creativity research had become broad and important enough to be treated as a legitimate field of scientific study. Since the first edition was published, interest in creativity has skyrocketed with more articles and books published than in the previous 40 years combined. This interest is an indication of the increasing complexity in our lives, where new ways of dealing with challenges on both individual and societal levels are essential. Creativity research is being conducted throughout the world in many different disciplines including psychology, arts and humanities, health sciences, education, and business. This global interest is reflected in the number of authors throughout the world who have contributed to this edition.

Some countries such as China, Korea, Singapore and New Zealand have made understanding, teaching, and encouraging creativity part of their national goals. Europe proclaimed 2009 the year of creativity. The leaders of these countries recognize that their primary natural resource is the ability of their citizens and organizations to develop new products and innovative concepts. As competition becomes more and more intense, the business community in the United States is finally accepting the concept that creativity can contribute directly to the bottom line. A recent poll of CEOs in the United States by IBM's Institute for Business Value indicated that creativity is the most important characteristic being sought in new executive hires. We have responded to the increased interest in the business community by including more entries on organizational creativity.

The *Encyclopedia of Creativity* is designed to inspire further recognition of the personal as well as professional benefits that accrue from encouraging creativity. We know, for example, that individuals who are more creative are healthier and more adaptive, and in some instances may even have a longer life expectancies. We also know that many innovations and ways of solving problems have already led to incredible benefits, such as cures for diseases, improved technologies, and higher living standards for billions of people. However, we are obviously losing a great deal of the creative potential on this planet by leaving so many of our children uneducated and unable to cope with the problems they face. Clearly we need new answers to such difficult problems as climate change, limited resources, religious and territorial conflicts, poverty, and energy.

If we want a more creative world, then we must construct an environment that allows creativity to flourish. This requires knowledge that crosses disciplines. The increased quantity and diversity of research continues for the most part to be focused on a specific area of interest. Most scientific research is still released only in academic journals. There is still not a broad cross-fertilization of knowledge that enhances the development of new ideas. One of the axioms in creativity research is that breakthroughs often occur when information or concepts from one field are applied to a different one. Darwin's theory of evolution was partially inspired by his reading Malthus' theory of population growth and Lyell on geological change. Jean Piaget, noted developmental psychologist, borrowed heavily from biology and epistemology. Freud used a medical model to understand the psyche. Our hope is that readers will roam outside their usual areas of interest in a search for new ways of thinking. The comprehensive nature of the encyclopedia offers readers the opportunity to find new perspectives, which we hope will suggest fresh insights about themselves, their work, and their place in the world.

In the first edition we stated that there was enough known about creativity that it could be integrated into every level of our educational system. Unfortunately "teaching to the test" has become more prevalent in the United States while arts programs have been all too often dropped. It is our hope that teachers at the elementary and high school level will learn about their own creativity and how to value and encourage students. It is not always an easy task, but it can help enhance and even save the lives of some creative students who are at risk.

Some progress is evident at the college and post-graduate levels where courses are taught in many schools throughout the country. There is still a tremendous need for degree earning programs and specializations in

creativity. The Torrance Center at The University of Georgia, Saybrook University, Buffalo State, and Drexel University are among the few schools that currently allow a specialization in creativity studies. By 2020 we hope that there are many more universities and professional schools which include courses and specialties in creativity studies.

Contents

Creativity is multifaceted and manifested in different ways in different domains. Moreover, there are different processes that can each lead to creative work. Thus a comprehensive *Encyclopedia of Creativity* required many different articles.

There are articles that present overviews of the research and theories about creativity from a variety of different areas:

- There are reviews of a number of domain-specific areas, such as acting, dance, expressive arts, film, food, music, religion, science, sports, theater, and writing.
- Creativity and education are examined in articles about thought processes, such as developmental trends in creative abilities and potentials, the enhancement of creativity, intelligence, knowledge, play, prodigies, programs and courses, talent and teaching creativity.
- Cognitive aspects of creativity can be investigated in articles about altered and transitional states, analogies, attention, cognitive style, divergent thinking, flow and optimal experience, metacognition, metaphors, problem-finding, problem-solving, and remote associates.
- Those interested in business and organizational creativity can view articles about advertising with art creative visuals, business/management, creativity coaching, creativity exercises, entrepreneurship, group dynamics, innovation, leadership, organizational culture, organizational development, teams, and training, among others.
- Many articles examine the creative process across domains, covering areas such as discovery, emotion/affect, gender differences, incubation, inspiration, insight, novelty and paradigm shifts.
- The complex interrelationship between society and creativity is explicitly examined in articles about awards, conformity and conventionality, the creative sector and class of society, cultural diversity, the dark side of creativity, East vs. West, networking, social psychology, war, zeitgeist, and others.
- Personal and interpersonal creativity is discussed in articles relating to collaboration, family, life stages, mentors, networking, personal creativity and self-actualization.
- Because the encyclopedia focuses on scientific information about creativity, there are also articles that discuss brain and neuropsychology, concepts of creativity, definitions of creativity, expertise, longitudinal studies, researching art, artists and art audiences, research methods, phenomenology research and qualitative research.
- Articles which look at theoretical perspectives include behavioral approaches, chaos theory, componential models, economic perspectives, the evolving systems approach, the four P's of creativity, and implicit theories.
- The creative process is examined in contrarianism, climate for creativity, discovery, dreams, heuristics, invention, motivation/drive, multiple discovery, novelty, time and rewards.
- Mental and physical health and creativity are reviewed in mental health: affective disorders, mad genius controversy, schizophrenia and psychosis, stress, suicide, and transforming illness and visual art.

Finally there are selected biographical studies selected with creativity as the key concern. The sampling of biographical subjects represents a much higher percentage of women in this second edition. Biographical subjects represent eminent individuals in different domains including composers, film directors, musicians, writers, painters, psychologists, scientists and spiritual leaders.

Audience

The encyclopedia is designed for use by students of creativity, as well as researchers, teachers, scientists, coaches and consultants, architects and designers, trainers, managers, actors, writers, directors, painters and other individuals in the creative arts, inventors, therapists and other professionals who utilize creativity in their work. Anyone who is interested in learning more about their own creativity and the creative process can benefit

from the articles presented here. Do not expect quick and easy self-help answers - individual creative growth requires work, time, serious thought and a commitment to deeper understanding of the process. And let's not forget the possibility of fun - creativity can help us experience the highest levels of involvement in work and play that ultimately leads to great joy. Readers are encouraged to follow their own interests and inclinations in exploring these volumes.

More than any other kind of book an encyclopedia is a collaborative effort. We thank our eminent panel of editorial advisors: Arthur Cropley, David Chan, Sandy Russ, Dean Keith Simonton, Ellen Winner and Jing Zhou. We also thank each of the distinguished contributors to the Encyclopedia. Finally, we appreciate the efforts of our editor, Nikki Levy, and our developmental editor Anna Gebicka. We hope this encyclopedia will not only inform but inspire readers to become more creative in their personal and professional lives.

*Mark A. Runco
Steven R. Pritzker*

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HOW TO USE THE ENCYCLOPEDIA

The *Encyclopedia of Creativity* is intended for use by students, research professionals, and interested others. Articles have been chosen to reflect major disciplines in the study of creativity, common topics of research by professionals in this domain, and areas of public interest and concern. Each article serves as a comprehensive overview of a given area, providing both breadth of coverage for students and depth of coverage for research professionals. We have designed the encyclopedia with the following features for maximum accessibility for all readers.

Articles in the encyclopedia are arranged alphabetically by subject. Complete tables of contents appear in both volumes. The Index is located in Volume 2. Because the reader's topic of interest may be listed under a broader article title, we encourage use of the Index for access to a subject area, rather than use of the Table of Contents alone.

Each article contains an outline, a glossary, cross-references, a further reading list and a list of relevant websites. The outline allows a quick scan of the major areas discussed within each article. The glossary contains terms that may be unfamiliar to the reader, with each term defined *in the context of its use in that article*. Thus, a term may appear in the glossary for another article defined in a slightly different manner, or with a subtle nuance specific to that article. For clarity, we have allowed these differences to remain

so that terms are defined relative to the context of each article.

Each article has been cross-referenced to other related articles in the encyclopedia. Cross-references will always appear at the end of an entry. Where multiple cross-references apply to an article, the cross-references will be listed alphabetically. We encourage readers to use the cross-references to locate other encyclopedia articles that will provide more detailed information about a subject.

The further reading lists recent secondary sources to aid the reader in locating more detailed or technical information. Review articles and research articles that are considered of primary importance to the understanding of a given subject area are also listed. The further reading lists are not intended to provide a full reference listing of all the material covered in the context of a given article, but are provided as guides.

A select number of biographies have been included. These biographies discuss the lives of individuals famous for their creative endeavors. No living people have been included because we wanted creators whose work had stood the test of time. Although there are many individuals famous for their creative pursuits, you may not find coverage of your favorite here. Inclusion is not intended to be a judgment on the impact or value of these individuals or their creations.

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A

Acting

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Glossary

Brahma In Hinduism, the creator, the first member of the Trimurti, with Vishnu, the preserver and Shiva, the destroyer.

Commedia dell'arte Italian, meaning literally comedy of the artists (or guilds) is a form of improvised theatre encompassing a set group of characters played in masks that began in Italy in the sixteenth century and is still performed today.

Dissociation To break the association, to disconnect, to separate, to regard as separate in concept or nature. The essential feature of dissociation is a disruption in usually integrated functions of consciousness, memory, identity, or perception. The disturbance may be sudden or gradual, transient or chronic.

Kabuki Popular drama of Japan developed in the seventeenth century characterized by elaborate costuming with a stylized acting style comprised of rhythmic dialogue, music and dance; men playing both male and female roles.

Kathakali Highly stylized Indian dance-drama noted for codified body movements and gestures, involving elaborate

costume and make-up. Name derived from Malayalam words; katha (meaning story) and kali (meaning play or performance).

Method acting Derived from Stanislavski's system, a theory and technique of acting in which the actor identifies with the character and renders the part in a naturalistic, nondeclamatory and individualistic manner.

Noh theatre Traditional Japanese theatre and one of the oldest theatrical forms in the world. Name derived from Japanese meaning talent or skill. Performers are storytellers who rely less on plot than visual imagery.

Psychophysical Literally mind-body, pertaining to the idea that the mind and body experience events in parallel, and that the exploration of the body is a tool which at once creates and reveals deep emotional responses to express the human condition on a visceral level.

Sanskrit An indo-European, Indic language in use since c.1200 BC as the religious and literary language of India.

Introduction

Acting is an ancient art form that has existed since the beginning of recorded time. Although styles range from the ritualized Noh theatre of Japan, the poignant eloquence of Shakespeare's plays, the stark minimalism of Ingmar Bergman films, to the compelling energy of Bollywood movies, ultimately these theatrical forms share similar fundamental acting principles. The diversity of acting styles can be seen across time and across cultures with ancient acting, closer to what we understand as dance and mime, differing from what is presented today. Acting as a creative activity is one of several practices within the performing arts and all share three common phases of development; training/preparation, rehearsal/practice, and performance. Further, any study that investigates the performing arts must appreciate the reality that a performing artist is always embedded within a contextual setting and is engaged in one or more of the three phases of development. Acting remains a relational enterprise that involves moment-to-moment interactions with others while maintaining an ability to draw from personal past relational

experiences and imaginings with self, other, and/or the environment. It directly reveals the creative process to an audience; both performer and audience share in the immediate yet transitory nature of this art form.

Generally, empirical research on the performing arts lags behind that of the other artistic domains. Perhaps it is because acting is more process-oriented, even though a product is being performed. To help provide some coherence to this topic creativity research studies are frequently grouped into two general approaches, individualistic and contextualistic. Individualistic studies include research on the traits of actors (cognitive, personality, biological) while contextualistic studies examine the socio-cultural dynamics operating within creative ensembles and between actors and their audience. Fundamentally, an understanding of acting requires an integration of both.

Etymological definitions shed light on the universal concepts inherent in acting. The Webster's Encyclopedic Unabridged Dictionary (1996) described acting as "serving as something temporary; the art, profession or activity of those who perform in stage plays, motion pictures, etc." (p. 19). The word actor ('person who acts') appeared at the same time as the word act

(1350 – 1400). Another common term that was used in place of actor is player (AD 382), a term that described “a person or thing that plays; a person who plays parts on stage” (p. 1485). In fact, the terms playwright and playwriting are drawn from this word. Play (AD 1377) means “a dramatic composition that involves action, activity or drama; to act the part of a person or character in a dramatic performance” (p. 1439). Play, player, and playwright can be found in many of Shakespeare’s dramas and to this day we commonly use these and other terms such as playbill, playgoer, and playback.

Along with examining the process of doing or performing actions while imitating a character, the enterprise of acting also stimulates and engages the creative imagination of the actor and the spectator. Creativity is regarded as “the process in which original or meaningful new ideas, forms, interpretations or methods transcend traditional ideas, rules, patterns or relationships” (Webster, p. 472). Creativity is a relatively new term used to describe human endeavors, since this term was originally only reserved for the actions of gods; however, an older term, imagination, did describe human creative actions. The word and concept of inspiration served to bridge the behaviors of gods and humans. According to Plato in c. 388 BCE, the gods literally inspired or breathed their spirit into the imagination of the artists, hence it was understood that artists, guided by divine beings, became the messengers or actors of the gods; they were inspired by god to communicate to mankind through divine or supernatural influence. Lastly, the Ancient Greek words *poesis*, *physis*, and *techne* all remain part of fundamental acting practices of today. *Poesis* (poetry) is an action that springs from *physis* (spirit), considered our dynamic life force. These concepts, *physis* and *poesis*, are the inherent power that is felt when a great actor has stage presence or star quality and when a play inspires and transforms us. The third term, *techne*, captures the technical aspects of how an actor portrays a character and tells a story. From these terms we can conclude that acting is a creative process of actions that reveal characters and situations while engaging the imagination of the performers and their audience. It is a dynamic relational enterprise that can inform, stimulate, and inspire.

In this entry a brief outline of the major historical developments of world theatre, the acting training practices of today, and some recent research findings on acting and actors are discussed. Regardless of the medium (stage, film, radio, television, or the internet), the general practice of acting has remained timeless. When examining the historical evolution of acting, both in the East and West, what is fascinating and humbling is that the essential principles of acting tend to persist. The writings of such giants as Aristotle and Shakespeare describe what we continue to seek. Ultimately, according to Tadashi Suzuki (1986), acting demands “the actors involve their whole selves, their living bodies, in a collective performance” (p. 83).

Origins of Acting

Historians and anthropologists have assumed that theatre evolved from (1) ritual, (2) storytelling, (3) man’s innate behavior to imitate as a way of learning, (4) man’s natural

ability to play, and/or (5) engage in fantasy to reduce anxiety. Ritual enactments of myths that recount sacred history are considered the most salient origins for theatre and acting. In essence myths were regarded as reality and truth; they were attempts to reestablish the sacred through the performance of actions originally done by the gods. It is believed that rituals were healing attempts to control that which was frightening and unknown. Dance, music, masks, costumes, chanting, and narration performed on sacred grounds became the basis for ceremonial theatrical performances. The sacred ground for ritual gatherings became an acting area and the priests ensured that these rituals were performed correctly. They were the ones who impersonated men, animals or supernatural beings, sang and wore costumes, and masks. Theatre emerged from these dramatic rituals, especially when secular stories began to take the place of religious practices.

Second, many myths became the inspirational sources for stories and storytelling in which a narrator would impersonate the action and dialogue of other figures. In this form of mythic storytelling, the integration of dance, gymnastics, and rhythmic chants facilitated the portrayal of animal movements and sounds. The third possible origin of acting is revealed in the writings of Aristotle (335 BCE) who viewed humans as instinctively imitative; both enjoying imitating others and watching imitations performed by others. Aristotle believed that humans desired to know how other’s felt and why others acted as they did. He believed that imitation was man’s chief method of learning about his world. The fourth and fifth theories posited are that mankind has an innate ability for fantasy and pretend play and that these capacities may be used to decrease anxiety while preparing for new experiences. These last two theories are clearly manifested and continue to be practiced within community group theatre projects and group psychodramas. They offer a direct way of engaging the individual to tell personal stories with the goal of healing the individual and the community at large. These five theories assume that society recognized and valued the performance of myth and ritual, storytelling, imitation, and pretend play.

Origins of Acting: The East

Our knowledge about the origins of Eastern theatre and acting begins to take shape about 4000 BCE when Egypt and the Near East entered an advanced stage. Egyptian hieroglyphics supply the first tangible evidence of drama enacted by priests. In the Far East, according to Hindu legend, Brahma taught the art of drama to the sage Bharata, author of *Natyastra* (The Science of Dramaturgy), written around 200 BCE. Since it gives details on acting, dance, costume, and makeup it is assumed that these acting elements had long been in existence. The early Sanskrit plays were organized around fundamental psychological moods or ‘*rasas*’ (nine *rasas* include erotic, comic, pathetic, furious, heroic, terrible, odious, marvelous, and peaceful). A Sanskrit play contained many *rasas* but all plays ended happily; the intention was to leave the spectator in a state of harmony. Violence and death were kept off stage, good and evil were clearly differentiated, and good was always triumphant. These plays were only performed on special occasions such as marriages, festivals, victories, or coronations.

Hindu theatre depended most upon the actor who in turn relied on four basic resources: (1) codified movement and gesture, (2) speech and song, (3) costume and makeup, and (4) psychological insight. Gestures were classified linking body parts to inner feelings while speech and music was regulated by intonation, pitch, and tempo. Costumes, props, and makeup were used as symbols and the overarching goal was to illustrate the Hindu search for peace of soul, rest after struggle, happiness after trials, and submission to fate. During the twelfth century Sanskrit theatre ended; however, dance survived and was integrated, in the seventeenth century, into the dance-drama, Kathakali. Like earlier Sanskrit drama, it was based on Hindu epics, with exaggerated style, musical support, and symbolic representations of good and evil, love and hate, and the passions of the gods and demons. Performances frequently lasted all night. Similar dance-dramas were performed in Southeast Asia and shadow plays performed with puppets dominated in Indonesia. In the eleventh century, actors began to replace the puppets and puppet-masters but the use of music and mimed actions continued.

In China the first known beginnings of acting originated around AD 714 when Emperor Ming Huang opened the first training program for performers of music and dance (Students of the Pear Garden). During the reign of Chen-tsung (998–1022) semi-dramatic tales of history were performed with dance and song. Plays of this period were long with complex plots spanning over 30 acts. Around 1736–1795, the northern and southern styles were now merged to form the Beijing Opera. Characteristic of this form of theatre is the use of narrative to impart details of plot followed by a dramatic stylized performance of the climactic moments of the play. The intention of Chinese theatre was to stimulate the imagination of the audience and not to give the illusion of reality. Though it was common to have musicians and property managers on the stage during the performance, the focal point for the audience was the actor, who generally performed highly stylized speech and movement sequences and wore symbolic makeup and costumes. Not until the early twentieth century did Western spoken drama begin to appear in China including the construction of proscenium theatres that supported these productions.

In Japan, the influence of Buddhism during the eighth century resulted in dance plays that were more ceremonial in form. These Bugaku dramas were handed down through generations of families who inherited the rights to perform them. During the tenth century, the more rural Sarugaku and Dengaku rituals incorporated song, dance, tumbling, and comic sketches which evolved by the fourteenth century into Noh theatre. Its staging reflected Zen Buddhist values of simplicity and minimalism. Today Noh drama continues to be highly stylized, uses elaborate ceremonial costumes and masks, and is performed only by males. Like the other Southeast Asian theater traditions, puppet performances incorporating musical accompaniment and a narrator remained popular in Japan. Later, Kabuki theatre, a cruder form of theatre inspired by Noh and puppet theatre, developed around 1600. With the fall of the shoguns, Kabuki became Japan's major dramatic form of theatre mingling comic and serious performances, along with dance and song. All traditional Japanese theatrical forms required long and careful study. Only during

the early twentieth century did Western theatre appear in Japan, including the adaptation of Stanislavski's System approach to acting.

The common denominator for all theatre in the East is that of a long training tradition essential to integrate the acting demands of codified movement, voice and characterization, expert application of makeup and costumes, and the mastery of skillful use of props and musical instruments. The performers' ability to contain and engage energy and spirit, whether during stillness or acrobatic feats, defines the nature of acting in the East. It is a tradition that honors practice and discipline.

Origins of Acting: The West

Western drama began in Greece at festivals honoring Dionysus. Dances, hymns, and dramas (comedies, tragedies, and satyrs) were presented at these festivals. The earliest records of dramatic contests date back to 534 BCE. One of the first known playwrights, Thespis, involved only one actor and a chorus, but what was remarkable about Thespis is that he was the first individual to break out from the chorus and assume the role of the character (in honor of his achievement performers are still referred to as Thespians). Thespis used masks to perform all the characters. When he left to change characters the chorus remained on stage and filled the intervals with singing and dancing, hence the chorus was regarded as the principal unifying force in early drama. Aeschylus introduced a second actor into the action in order to allow face-to-face conflict; as this practice increased the role of the chorus began to decrease. Euripides reduced the chorus to the point where they were almost insignificant and instigated a more intense focus on questions regarding social norms, psychological realism, and philosophy.

By the fifth century, Greek plays were produced by wealthy citizens, choregus, who financed the costumes, scenery, musicians, and prepared the chorus and actors for the productions. The playwright/dramatists applied to have their plays performed at the festivals, were responsible for writing the work, directing, and acting. They were paired with a choregus who would help produce the work and if the play won the contest, the playwright received money and honor. The city Dionysia, the location where all festivals were held, contained the Theatre of Dionysus (a raked hill area for the audience and a flat terrace structure at the foot of the hill designated as the performing space).

Roman theatre followed the traditions of Greek theatre but expanded the notion of spectacle. The growing immorality and decadence of later Roman theatre alienated the early Christian followers and so Medieval theatre rose as a reaction to the theatrical productions of the Roman Empire. Although actors at this time were denigrated by the Christian church, elaborate Passion (Mystery) plays emerged as a way to celebrate religious festivals outside of the church. The emergence of Renaissance theatre saw an increase of support by the courts and academies and the church became less involved in theatre. Renaissance productions followed the spectacle nature of the earlier Roman theatre. In an effort to amplify the spectacles, intermezzi were provided between the acts of the drama. These intermezzi always included dance and song and set the stage for the development of ballet and opera. Renaissance

theatre was presented in ornate indoor venues including the introduction of proscenium stages that facilitated the use of elaborate scenery.

The Italian Commedia dell'arte grew in tandem with the drama of the Renaissance court and academy. This form of theatre was not spectacle-based: rather it was actor-centered. Skills in improvisation, vocal range, and physical movement facilitated strong characterizations (Pantolone, Dottore, and Capitano). Similar to the practices of Eastern theatre traditions, these acting ensembles worked together and individual actors developed the same role over time. Influenced by the power of Commedia dell'arte ensembles, other European professional acting companies developed strong dramatic works written by such great playwrights as Marlow, Moliere, Tartuffe, Johnson, and Shakespeare. Instead of focusing on elaborate spectacle these acting ensembles focused on the words of the playwrights; once again Western theatre returned to the wisdom offered by the early Greek theatre practitioners.

As the eighteenth century arrived, acting companies came under the increasing control of businessmen. Now the actors and playwrights were the employees, rather than active participants in the management of the productions. Restoration drama, especially the comedy of manner genre, grew more sentimental and pantomime became a weaker version of commedia dell'arte. Opera started to separate from the dramatic presentations and was now performed independent of plays performed by actors. During the nineteenth century, along with the firm theatrical control of businessmen, Romantic drama and Melodrama held sway. Repertory companies increased during this period but so did the star system in acting. Celebrity artists such as Henry Irving, Edwin Booth, Elenora Duse, and Sarah Bernhardt travelled widely, drawing audiences from all walks of life. Theatres now specialized in particular forms of drama (pantomime, variety hall, opera, ballet, drama), and audiences were provided greater freedom to select productions that specifically interested them. Diversification and possibilities made available by new technology such as radio, cinema, television, and the new electronic mediums led to even more specialization.

The Director and Acting

Western theatre shifted from the earlier focus on the poet in the Elizabethan stage, to the actor in the eighteenth century, and finally to the 'metteur en scene' (master of the scene) who controlled the appearance of the stage in the nineteenth century. With growing value placed on appearance, actors changed their approach as well. The words of the playwright had less meaning and in its place virtuoso performances matched the elaborate sets and costumes of the day. At the pinnacle of nineteenth century theatre, the 'metteur en scene,' now known as the director, moved from the role of stage manager to the one who conceptualized the images that appeared on the stage. At the end of the nineteenth century a backlash against spectacle led to the introduction of realism. Andre Antoine was one of the first directors to create a repertory theatre company with the vision of integrating reality as the unifying force in dramatic works. Shortly

after, Stanislavski broke further from the ranks. As a director he explored all possibilities to achieve a realistic production. Ultimately, in order to get the emotional depth of a theatrical work he realized that he needed to train his actors. Due largely to his efforts, the focus on the actor and acting returned, and with it literary meaning was once again merged coherently with staging design.

Acting Theory

In *The Poetics*, Aristotle (c. 335 BCE/1958) clearly outlined the essential ingredients for dramatic performances and his ideas remain powerfully resonant in today's international acting traditions. He stated:

So all the arts . . . produce their imitations by means of rhythm, speech and melody, using them separately or together. . . . Since those who make imitations represent men in action, these men must be superior or inferior, either better than those we know in life or worse, or of the same kind . . . that is why their works are called dramas, because they represent men "doing". (pp. 3-6)

He grounded his theory of imitation in the natural activities of child's play and the pleasure and learning gained during this activity. He claimed that poets must employ insight and clarity to represent men in action and they must determine the positions and attitudes of the actors in the play who will imitate the characters. Aristotle believed that gifted poets expressed powerful emotions only when they felt them. And what differentiated gifted poets from the ungifted was the ability to remain balanced and not get lost in the characters they portrayed. He also offered a warning, that actors must not become more important than poets; it is the balance of all these elements that make theatre vibrant and meaningful.

In *Hamlet*, Shakespeare (1623) offered a similar perspective. Hamlet demanded that his players "Suit the action to the word, the word to the action, with this special observance, that you o'erstep not the modesty of nature . . . to hold, as 'twere, the mirror up to nature" (*Hamlet*, Act III, Sc. I, lines 18-21). Both Aristotle and Shakespeare insisted that acting was a fusion of word and action that was rooted in the truths of nature. Performers were charged with the responsibility to engage their entire *self* in the portrayal of another; they were to give life to the character and the action of the play. Today, Tadashi Suzuki, one of Japan's leading theatre-makers, echoes the thoughts of Aristotle and Shakespeare. In *The Way of Acting* (1986), he stated: "The art of stage performance cannot be judged by how closely the actors can imitate or recreate ordinary, everyday life on the stage. An actor uses his words and gestures to try and convince his audience of something profoundly true. It is this attempt that should be judged" (p. 5).

These major concepts confirm the universality of acting in which actions are performed in a contextual relational field between the performers, the audience, and the socio-cultural experiences that have shaped them. To perform something profoundly true, to hold the mirror up to nature, to retain critical balance and yet maintain an ability to be emotionally engaged requires training and practice, and then it must be performed with others in the immediacy of the present moment.

Major Acting Theories of Today

Stanislavski

Konstantin Stanislavski's System remained dynamic throughout his life due to social and political constraints and his own personal search for creative clarity. Living in Russia he experienced European and Asian artistic traditions and saw popular shifts in theatre from nineteenth century histrionics to the realism and modernism of the twentieth century. He strove to codify the experience of creativity on stage into a common system which he himself warned never to use as a philosophy but merely as a handbook to bring the actor closer to the nature of creativity. He experimented with symbolism, verse, opera, western behaviorist psychology, eastern ideas on the mind-body continuum (including yoga), and trends in criticism in art and literature. He became the first Western practitioner of the twentieth century to articulate actor training, calling it the grammar of acting.

The elements of his actor training (concentration, imagination, and communication) were regarded as skills that needed to be learned and controlled. Concentration demanded a sharpening of the senses of sight, hearing, touch, smell, taste, and affect. He achieved this through a series of exercises to recreate specific sense experiences drawn from memory and imagination. Stanislavski believed it was important to energize imagination through exercises such as:

- visualization (i.e., imagine that you are a tree and see what type of tree you are, how thick is your bark, etc., a process that led to progressively more specific details evoked in the visualization);
- use of random words to spark the imagination and then connect them into a narrative (improvisational practices commonly used today in improvisational theatres);
- take familiar events and fantasize different outcomes;
- take objects and explore the 'what if' of these objects (i.e., what if this glass of water were poisoned and it is your last drink).

In his explorations on communication, regarded as the interaction between scene partners and between actors and their audience, he added the less tangible experience of subtext (the unspoken narrative operating concurrently with spoken dialogue).

Stanislavski's most pervasive belief, a holistic view that the mind and body represented a psychophysical continuum, became the foundation for his training philosophy and the conditions for performance. Both mind and body had to be in a state of relaxation in order to withstand the demands of the creative process. As a result, he suggested that actors practice the poses and breathing of yoga to build habits of relaxation, and that they remain essentially dynamic and improvisational during performance. He believed that the actors could then experience the sensation of existing fully within the immediate moment, a sensation which he referred to as 'I am,' which is commonly described today by actors as being in the moment. He advocated a recursive practice of exploring a sense of self followed by exercises in imagination, concentration, and communication that reinforced the actor's sense of self. This became the process in which an actor prepares.

According to Stanislavski, the second part of actor preparation was the construction of a role. It involved the above elements but they were now examined from the perspective of the script. There were a variety of ways to examine a role, such as scoring actions from intellectual, imaginative, and affective explorations, or relying on physicalization and active analysis. Stanislavski described affective cognition as an analysis of all the details of the play, including research into the history and social world of the play, and visualization of the character going through a typical day. Identifying the actions was considered the heart of Stanislavski's System and began with breaking the play down into segments (units of action, bits, or beats). Each segment described the circumstance of the character's situation and was identified by specific active verbs to express the segment of action. When taken together these scores of action told the story of the play and posed a series of problems, which the character must overcome. It was through the attempt to resolve these problems that conflict arose between characters; these became the source of dramatic tension. During the performance the actor placed full attention and concentration on carrying out these actions with the character's emotions arising naturally as a result. Stanislavski stated "If our preparatory work is right, the results will take care of themselves." In his system the actor must focus on the actions and not the results.

Stanislavski's rehearsal methods remained dynamic; however, he never lost sight of how best to support the actor's connection to the role being prepared. What remained consistent was his belief in the three basic drivers behind creativity: (1) 'mind' (for analysis and understanding), (2) 'will' (for control and physical preparedness), and (3) 'feeling' (fostering passionate and zestful relationships with the characters being created). Stanislavski's System continues to inform acting practices around the world. He paved the way for actors to perform what Hamlet requested, "Suit the action to the word, the word to the action."

Those that Followed Stanislavski: An Individualistic Approach to Acting

Although most twentieth century acting training methods draw from the influence of Stanislavski, many practitioners have added their own personal perspective. These perspectives range from extreme oppositional stances to more nuanced departures. The approaches can be understood from multiple points of view but for brevity's sake, we will categorize the theorists within two general groupings, individualistic and contextualistic.

The individualistic group tended to focus on the training of the actor, although these practitioners were equally aware that a relational context was always operational. For example, Vsevolod Meyerhold sought to train the brains and bodies of actors to be more theatrical. He devised biomechanical training principles that amplified gestural expressivity. Jerzy Grotowski developed a theatrical style that amplified the archetypal truths of the character. He integrated a psychophysical training that included extensive physical training.

Michael Chekhov developed a training that incorporated psychological gestures, imagination, and concentration practices with the goal of creating dramatic atmospheres or moods

for the characters. Chekhov focused on a clear sense of form shaped by the rhythmic flow of energy and the dramatic climaxes and accents inherent within each dramatic work. In an attempt to intensify the experience for his actors and his audience, repetition was practiced both in the training of his actors and in the performance of his productions.

Uta Hagen claimed that the actor is the closest figure to the audience; both are present while the art is being created. She differentiated external representational acting (actor to imitate or illustrate the character's behavior) from internal presentational acting (actor attempts to reveal human behavior through a use of self). Hagen's overarching belief was that through an understanding of self an understanding of the character being portrayed would emerge.

Lee Strasberg, Stella Adler, and Sanford Meisner were all Stanislavski trained; however, they went on to shape their own particular brand of acting training. Strasberg focused more on the psychological realism of the character, Adler on the sociological perspective, and Meisner on behavior. Although they had their own particular focus they were all considered founders of Method acting. This approach insisted on the actor justifying every word, action, and relationship. Method acting attended to the careful analysis of objectives, actions, and intentions. Moment-to-moment impulses were followed as a means of giving life to the actions and active listening supported the inter-relational actions within and between actors. This form of training enhanced the actor's unique personality since each actor was asked to draw from personal emotional, psychological, and imaginative realities that were to be revealed directly to an audience. As a result, each character resembled the actor and so the actor was frequently cast based on shared attributes with the character to be played. Method acting is perhaps the most widely used technique for film work. The camera captures the most intimate emotional shifts of the actor. The Method has spawned some of the great actors of the twentieth century: Brando, Dean, Hoffman, Deniro, Pacino, to name but a few.

Those that Followed Stanislavski: A Contextualistic Approach to Acting

Bertolt Brecht was a powerful force in modern theatre. He challenged theatrical norms by blending and contrasting comedy, high drama, and song together in a single play. He drew characters from a socio-political perspective and his actors portrayed these characters from this perspective. This required strong physical, emotional, and vocal training. He called this character work *gest* or *gestus* and contended that the power of *gestus* enhanced audience understanding of the play and its larger socio-political implications. He referred to this work as theatre of alienation, a process in which the audience was emotionally engaged yet prevented from personally identifying with the characters. Brecht, as playwright and director, wanted his performers and audience to question and explore.

Peter Brook was a strong proponent of ensemble productions and communal explorations. He claimed that truth in the theatre is always dynamic and encouraged his performers to actively seek the impulse inherent within the word, a process that he believed would join the truth of the performer and the playwright.

Those that Followed Stanislavski: East–West Integration

Eugenio Barba fundamentally rejected Stanislavski's System of acting training and focused his attention on the symbolic conventions of Eastern theatre. He examined the use of energy as a way to generate power and believed that mastery and total presence within a performer was achieved through an integrated mind-body-energy process. Focus on the spine, balance, weight, space-time relationship, and core expressions facilitated this integration and, after a long training process, his ensemble was able to perform productions that incorporated a fusion of Eastern and Western cultural traditions.

Tadashi Suzuki is a master at integrating the ancient traditions of Japanese theatre with modern Western practices. Following Eastern acting practices, Suzuki continues to train his performers with a focus on the physical expression of human existence. He advocates practices for strengthening the use of footwork and vocal range and insists on balance, containment, and transformation of yin (soft) and yang (strong) energy. He maintains strong communal practices in which his actors live and work together and are influenced by and participate in their surrounding community. Ann Bogart, one of America's most respected experimental theatre-makers, was deeply influenced by the work of Suzuki. She actively explores these same polarities of energy as she examines themes of violence, terror, disorientation, and paradox. Her training method, Viewpoints, is a series of exercises and staging devices that probe these complex themes. Like many, she incorporates the psychophysical actions of her performers as she examines the social structures around her.

Empirical Research Studies and Acting

Individualistic Research Studies

Individualistic research methods have provided greater understanding about the psychological aspects of actors. For example, Kogan claimed that performing artists were generally regarded as interpretive artists rather than creators; however, many interpretive artists described their experiences as highly creative. His research findings revealed performing artists as possessing innate talent and training, strong skills for memory retention, physical dexterity, and emotional self-expression. Further, he claimed that actors had stable internal attributions (they believed that they had control over the outcome of their performance) and external attributions for failure (not getting hired from an audition because they were not a good fit for the role). As a result Kogan's research suggested that actors did not have a depression profile even though they experienced great stress while maintaining a career as an actor and that working creatively in the public eye was considered a source of stress as well as inspiration. Daniel Nettle found similar psychological profiles for actors. He examined a group of professional actors who demonstrated higher levels of extroversion, openness to experience, agreeableness, and empathy as compared to a general population sample. Goldstein, Winner, and Wu found that actors actually had better theory of mind abilities but did not demonstrate higher levels of empathy. Gluck, Ernst, and Unger added to the psychological profile of actors.

They found that actors believed that imaginative assertiveness, cultural competence, intrinsic motivation, and having many ideas enhanced creativity.

Individualistic studies focusing on affective qualities have added further to our understanding about actors and performing artists. Feist found that actors were more emotional and sensitive than nonartists. This result was shared by Fuchs, Kumar, and Porter who found that performers had an ability to feel and express emotions honestly, as well as in unique ways that were effective in meeting the demands of both intra- and interpersonal situations. They suggested that performers had emotional creativity. A study conducted by Thomson, Keehn, and Gumpel found that performing artists were emotionally less variable compared to a control group which suggested that these artists possessed more emotional regulation. However, anger, sadness, and spirituality, along with higher scores on fantasy proneness and traumatic experiences, predicted elevated levels of dissociation in this population. Further, interpretive artists (actors, dancers, musicians, opera singers, directors) as compared to generators (writers, choreographers, composers, designers) had elevated levels of dissociation. This research team posited that interpreters may be able to submerge themselves within the role of a character, in part because of an increased ability to employ nonpathological dissociation, in particular, the ability to engage in heightened states of absorption that cause diffuse self-states and intense sensory-emotional imaginative experiences. Other research groups found a similar pattern of elevated dissociation in writers who, during the creation of their characters, experienced them as though they were independent agents. Dijkstra, Kashcak and van der Zwan demonstrated that assuming specific physical postures enhanced memory retrieval and evoked specific emotional states. Interestingly, this empirical finding supports the intuited psychophysical traditions of the East and West that were practiced from the earliest days of acting.

A slightly different line of investigative research focuses on boundary blurring versus boundary stability within the actor's personality, especially during the performance and the aftermath of portraying a character. According to Burgoyne, Poulin, and Rearden different acting techniques may lead to more boundary blurring with the potential increase of psychological distress if the actor is not able to regulate and discern self-other contextual shifts. They differentiate acting that is rooted in inside-out approaches (advocated by Stanislavski and his followers) from acting that is outside-in (more distancing practices to keep the character in the third person). The inside-out approach requires actors to personally connect emotionally to their characters; hence, a blurring of role/self may provoke a loss of control on stage or cause increased emotional distress after the performance. Although the inside-out approach may lend a performance more immediacy and potency, the actor is at risk for increased psychological distress. They suggest that educators, directors, and the actors themselves need to be aware of potential personality shifts and the adoption of the character's personality. This caution was substantiated by the work of Hannah, Domino, Hanson, and Hannah who found that actor's self-perceived personality profile did become similar to the character during the rehearsal and production period.

Based on this small sample of individualistic research studies, we can posit that:

- actors value creativity and imagination;
- have a strong sense of well-being, self-regulation, and intrinsic motivation;
- possess innate talent (physical dexterity, memory retention) and a capacity for training;
- endorse higher levels of nonpathological dissociation;
- have a stressful career;
- are more emotionally sensitive;
- possess greater theory of mind abilities as compared to empathic abilities;
- exhibit more extroversion, openness to experience, and agreeableness;
- may be vulnerable to boundary blurring.

Contextualistic Research Studies

Contextualistic researchers such as Sawyer claimed that any investigation into acting should include a study of group interactions (between performers, production teams, and the audience). Peak experiences for performers and audience became magical moments when reciprocal emotional contagion occurred. They suggested that actors have greater facility to relive emotional states and this freedom helped audiences experience their own emotional states. Kogan's research, later supported by Goldstein, suggested that performing artists are usually drawn to this profession early in life when they also have some family support. Other research teams have replicated this finding, claiming that creative achievement was facilitated by a confluence of varying intrapersonal and interpersonal factors (cognitive abilities, personality traits, intrinsic motivation, familial resources, societal factors, and cultural considerations). This socio-cultural contextual line of research reinforced the concept that actors are embedded within a relational field during their creative work and that early experiences supported their career choice and their ability to succeed in it.

Concluding Remarks

Although Eastern and Western traditions present stylistic and aesthetic differences, the training of the actor and the concepts of acting are more similar than contradictory. What crosses time, culture, and medium is the need to train the actor. Gestures and movement, speech and song, psychological insight, storytelling, and creative imagination are all skills that require long training to master and ongoing exploration to perform. Recent empirical research studies on acting demonstrated that actors are not depressed despite the reality that they maintain stressful careers. They were shown to be self-regulated even though they were emotionally more sensitive and engaged in more dissociative experiences. Perhaps their psychological stability was supported by the socio-cultural groups in which they participated and the early support they received for their interest and training in their career. These studies reiterated Aristotle's theories; acting arises from the innate human instinct to play and imitate in an effort to increase understanding and reduce anxiety.

Acting is a process even when it delivers a product. For the actor and the audience the process of acting is revealed in the ephemeral immediacy of the shared moment. Whether the moment is a failure or a success, performers and audience experience it. It is ultimately a poetic process of doing actions during the imaginative engagement of imitating or representing characters and situations. The magic inherent in acting is experiencing the spirit of the performers who have sought to master the integration of mind-body-energy-spirit. Words found across all cultures (such as prana, chi, soul, yugen) name this integrative and enlivened state, a state inherent in all imaginative works and in the great acting practices found across all cultures.

Acting traditions teach artists to find a balance between technique (techne) and content (story/poetics). The moment Thespis stepped out of the chorus and stated "I am Dionysius" was a revolutionary moment. He had the courage to embody another. Acting is dynamic and alive and it invites performer and spectator to engage. It reunites us to our humanity.

See also: Improvisation; Theater; Zen.

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Adaptation, Adaptiveness, and Creativity

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Glossary

Accommodation The act of modifying or adjusting the knowing structures in order to deal with discrepancies or conflicts to them.

Adaptation The act or state of adjusting to fit environmental conditions through conformity, agreement, or compliance; to acclimatize or apply experience to the use or selection of an environment to personal advantage; to modify or transform the environment to suit the individual.

Adaptiveness One's ability to adjust to conditions or environments, such as requirements of a given culture or context, or to change as needed to fit such conditions.

Assimilation The act of bringing in elements or aspects to the systems or knowing structures that conflict with those structures.

Continuum of adaptive creative behaviors A continuum of seven levels of creative behaviors that explains the shift in adaptation from individual-to-world to world-to-individual.

Culture The sum of ways of living, behaviors, and beliefs characteristic of a particular social or ethnic group as well as

the political, economic, and technological forces that impact that group in a particular place and time, usually transmitted from generation to generation.

Equilibration The act of restoring a balance when conflicts to the knowledge systems occur through the processes of assimilation and accommodation; the linking mechanism between adaptation and the mental organization of the individual; the mechanism by which the individual moves from one developmental stage to the next.

Mature creativity (Capital C Creativity, according to Mihaly Csikszentmihalyi). The products or performances of individuals who have mastered a field or fields at very high levels, normally associated with adulthood; creativity by extension or transformation of a field.

Mundane creativity (Creativity in the small, 'Little c,' or personal creativity). Creativity that is new to the individual or perhaps to peers, but does not result in products or performances that are rare or of value to the world.

Structure The mental organization(s) of the individual based on what has been previously assimilated and accommodated.

Depending on the situation, adaptation can hinder or support creativity. In some cases, adaptation means tightly conforming to a confining environment that stifles creativity. In other cases, it means creatively adjusting to the subtle nuances of a changing environment. Adaptation also occurs when individuals force the environment to change in response to their needs or efforts. Adaptation may even mean that individuals move out of one environment into another better suited to their abilities or preferences. In most cases, creative adaptation in our highly complex world involves most or all of these mutually shaping influences between person and environment.

The dynamic interplay between person and environment is one of the most important issues in analyses of creativity. Certainly, culture, the combination of tradition, values, customs, rules, behaviors, and beliefs, as well as the political, economic, and technological forces that impact a given group in a particular time and place need to be taken into account in adaptation and creativity. The focus of this article is on who does the adapting. On one hand, some definitions and theories related to creativity and adaptation focus on conforming to or fitting in to an environmental situation by the individual. Those who do not 'fit' into prevailing values and mores are considered weird, maladaptive, or even dangerous. For example, Elisabeth Rudowicz noted that Eastern or traditional cultures would consider creative products or ideas that counter values and child rearing practices of a given culture as unacceptable or dangerous. However, when adaptation is viewed as

modifying or transforming the environment, particularly when the created products or ideas are valued by a culture, the creator is considered the epitome of human development and health.

This article explores a wide range of issues and concepts relevant to creative adaptation. These include (a) definitions and theoretical perspectives on adaptation, adaptiveness, and culture, (b) research on adaptation and creativity, (c) facilitation of adaptation for creative individuals, and (d) a developmental continuum of creative behaviors in which there is a shift from individual adaptation to the environment to adaptation by the world to the individual. This developmental continuum accounts for creativity in both young children and eminent adults. Variables that influence development along the continuum include purpose, novelty, value, speed, and structure.

Definitions of Adaptation and Adaptiveness

The term 'adaptation' is derived from the Latin, meaning 'to fit.' The dictionary definitions for adapt are "the act of adjusting to environmental conditions"; or, "the modification of an organism or its parts that makes it more fit for existence under its environmental conditions." Adaptiveness in this article is one's ability to adjust to conditions or environments, such as requirements of a given culture or context, or to change as needed to fit such conditions. Mark Runco noted that

adaptation (and adaptiveness) rests on personal reactions, perhaps influenced by social relationships and socioeconomic influences, as well as dealing with tension, challenge, and adversity in life. While one person may see a problem or gap, another does not; or one person may be stressed and overwhelmed by adversity, another may find that same set of events challenging and exciting. In her longitudinal study of 30 000 disadvantaged young people from two distinct cohorts, Ingrid Schoon found that the particularities of the time period and historical context further shape adaptiveness, resilience to adversity, academic attainment, and creativity.

There are three distinct shades of meaning for adaptation. As described in the dictionary definition, the first and most common is adaptation as fitting in – conformity, agreement, compliance, or yielding to environment or situation. Essentially, this is modification of self to fit environment. For example, a new employee quickly adapts by talking about sports or pop music to ‘fit in.’ In this view of adaptation, individuals who do not conform to prevailing values, mores, and practices of a given culture or context often are considered maladaptive outsiders or even lunatics. Early definitions of creativity, in fact, focused on the pathology of creators. Such definitions portrayed creators as neurotic or mentally ill, partly because they were unable or unwilling to adapt to the styles and customs of the times, helping to explain crazy artist or mad scientist stereotypes. But groundbreaking, paradigm-shifting creators do not make their impact by conforming to the prevailing belief systems of their eras. On a smaller scale, a creative young person who does not conform to the prevailing fashions worn at school, or who does not hang out with the ‘in’ students is likewise often ostracized. This failure to adapt may or may not be a sign of mental instability. When a little child says, “Look how my shadow is glued to me!” this unusual and delightful use of words is hardly a sign of neurosis. Instead, it is a creative-adaptive attempt to understand the world. In like manner, the student who bucks the system when faced with another boring work sheet may be demonstrating a healthy sense of self.

A second definition of adaptation emphasizes the role of experience in successful orientation to an environment or situation. Adapting to the heat and humidity by resting in the afternoon when living in a tropical country is an example. One type of intelligence involves rapid ‘reading’ of an environment and selection of responses that provide the greatest benefit to the individual. For example, a politician who sizes up a crowd and delivers a speech tailored to that audience could be considered contextually creative because he or she successfully uses experience to adapt to a given situation.

Experience also can help individuals select environments best suited to their full development, or even reject a detrimental environment. Examples of this kind of adaptation include moving to a setting that is aesthetically invigorating, enrolling in a school that offers a program of deep interest, or leaving a job when it becomes debilitating or toxic. Such selection of an environment based on experience might prevent maladaptive situations where individuals do not feel they belong. It also may prevent high-potential people from feeling inferior and developing a poor sense of self based on an environmental mismatch.

A third definition of adaptation suggests something different; that is, the individual acts on the environment to modify,

change, translate, or transform it. For example, some creative employees make work environments more fulfilling and challenging by initiating innovative and interesting projects in otherwise barren, stifling offices. On a larger scale, some highly creative people modify their environments by developing profound ideas or products that affect many people for long time periods. For example, Thomas Edison’s inventions and Albert Einstein’s theories made high-impact, long-lasting transformations that continue to influence the present.

In considering the dynamics of creative adaptation and adaptiveness, the issue is directionality. Eminent adults must adapt to their environments, but they also encourage the world in which they function to adapt to their ideas and products. In contrast, children and adult novices concentrate on adapting to their environments, and exert little influence on those environments. Both of these forms of adaptation involve creative thought and action, but what is creativity?

Definitions of Creativity

The most common definition of creativity involves the production of something appropriate yet new or rare that is valued and accepted in the world. However, this definition applies only to creativity in eminent adults because children are unlikely to produce something truly new or valued by people other than their families or peers. Hence, this definition is not very helpful to those concerned with creativity in the classroom, nor does it apply to mundane creativity or personal creativity ‘creativity in the small’ – ‘Little c creativity,’ or even, as Ronald Beghetto and James Kaufman suggested, ‘mini-c creativity’ – the less than earth-shaking variety of creative products or ideas made by children and adults such as making an unusual meal, lovely garden, or delightful finger painting.

Creativity involves a paradox: an original, novel idea or product as well as its acceptability, appropriateness, and usefulness to a given group or society. Creative adaptiveness is the ability to adjust flexibly to conditions or environments in developing new ideas or products while adhering to what is approved of or permitted in a given cultural context. It requires, according to Elisabeth Rudowicz, commitment to the sociocultural system, not exceeding boundaries to be too foreign or perceived as dangerous to that context, more typically involving modification or improvements, rather than new inventions.

J. P. Guilford’s conception of divergent thinking is probably the second most common definition of creativity. Divergent thinking involves production of ideas from given information, with an emphasis on variety and quantity of output involving fluency, flexibility, originality, and elaboration. “How many uses can you think of for a cup?” is a typical classroom problem based on this definition. It appears to apply to both childhood and adulthood, but does not likely span the gap between children’s creativity and mature, eminent creativity and it relates more to problem solving.

Definitions of adaptation are influenced by differences between problem solving, its application as entrepreneurship in business, and creativity. Both creativity and problem solving share a common starting point – incongruity in a problem. Both also require knowledge, motivation, repetition, and

discovery of unique combinations. In addition, there are phases or stages in the problem-solving process. In entrepreneurship, an application of problem solving to business, Codrin Kruijne suggests three phases which continuously recycle:

1. perceiving the current state of the business in historical perspective and why things happen as they do, which requires monitoring of self and performance in the environment;
2. selecting among possible actions, which pressure the entrepreneur due to limited resources;
3. acting and monitoring to see if the action improved the product or situation, inspiring others to work towards the adaptation.

But problem solving (and entrepreneurship) and mature creativity are different in duration and effect, both externally and internally. Problem solving is generally a short-term process while creativity at higher levels is life-long. Creativity at high levels also focuses on a larger unit of analysis, more on a totality rather than a specific answer, and it usually involves a greater impact on the world. Additionally, in problem solving the problems are typically externally set, with the focus more on resolution. By contrast, mature creativity involves problem finding wherein both problems and innovative solutions are generated internally and intrinsically, although there certainly are both external stimuli and parameters.

Mature creativity involves a discontinuity with what was before, while problem solutions can be explained by more continuous, straightforward processes. For example, solving the problem of how to get kids to use more toothpaste might involve researching children's flavor preferences and making cherry-flavored toothpaste. Creativity, on the other hand, involves a shift in context, which allows the creator to see the world in a new way. In this process, the connections between the new and the old perspectives on the situation are not directly discernible. For example, in coming to understand the inner world of individuals, Freud created new perspectives with his concepts of id, ego, and superego. These new concepts produced a discontinuity with the knowledge that had prevailed previously in the field. Such discontinuities are consistent with Howard Gruber's conclusion that mature creativity involves the construction of a point of view while problem solving does not. Gruber came to this conclusion during his analyses of the works of highly creative individuals, Charles Darwin and Jean Piaget.

Mature creativity, then, involves both external transformation of a field and internal transformation of self. Adaptation is evident in both aspects. External transformation involves sensitivity to a context as well as awareness of the limitations of a field and the desire to work hard to transform it. This is primarily adaptation by external transformation although there are certainly internal aspects, such as the zeal to put forth effort. Internal transformation involves sensitivity to one's self and the openness and willingness to modify one's present ways of thinking in order to construct a unique point of view. Thus, mature creators adapt in both ways, modifying the environment to fit their schemes and theories and modifying themselves to be able to accommodate to the environment. This is not a meek or passive attempt to fit in. Rather, according to Howard Gruber, it involves the active construction of a way

of looking at the world. It is not always conscious, but it is dynamic and effortful. In both external and internal transformation, adapting means being tolerant of uncertainty or ambiguity outside and in, being willing to not have answers, to be wrong, to try alternatives.

Theoretical Perspectives Related to Adaptation

Returning to the three definitions of adaptation, early definitions of creativity focused largely on the fitting of individual to the environment, sometimes by equating mental instability with creativity. For example, Freud believed that creativity arises from attempts to sublimate libidinal or sexual impulses into more socially acceptable forms; in short, adapting to the values or mores of the times. For him, creativity and mental illness have identical origins, both arising from conflict within the unconscious. According to Freud, creative individuals blend productive abilities with neurotic tendencies.

The first theorist who suggested a direct relationship between creativity and adaptation, however, was Freud's disciple, Otto Rank. Rank broke with his mentor over the issue of sexual sublimation as the motivating force in behavior. Instead, Rank believed that motivation came from the dynamic tension between the wish to depend on and unite with others, and the wish to separate from others in order to assert one's individuality through the will. For Rank, the will is a life-shaping force that includes a sense of self and a sense of what the individual wishes to accomplish. As a positive force, it is the urge to create; as a negative force, it manifests itself in repression and control. If parents have a healthy regard for their children as individuals and grant them autonomy and the chance to assert their own will, children move toward a secure sense of self. This enables a child to establish independent individuality through force of will without feeling rejection from the parents. When the child is not accepted as separate and different, the will becomes a source of guilt instead of ego strength. Rank's definitions of three distinct personality types: adaptive, conflicted, and creative or artistic, clearly portray adaptation as fitting in to an environment and as counter to creativity.

Rank called the 'adapted type' the creativity-inhibiting personality of the 'average man.' Very early on, the child identifies with and adapts to the will of the parents and later, to the will of society, in order to avoid the pain of guilt. This form of adaptation produces harmony and reduces the potential for conflict, but it also works against creativity. Rank's 'conflicted type' is characterized by divisions in the personality. These divisions involve moral struggles against the compulsion of the outer world as well as inner conflicts between the will of the child and the will of the parent. The individual attempts to form personal goals, ideals, and standards, rather than those sanctioned by society, but remains conflicted, guilty, and unable to move to the third level of creativity and productivity. For Rank, the third and ideal personality type is the creator or artist. This is the ideally functioning person who has accepted and integrated two conflicting fears: the fear of being a separate individual and the fear of union and dependency. Acceptance and integration of these fears produces ideal mental development and healthy behavior wherein the creative impulse

comes from the desire for immortality. In Rank's theory, adaptation is antithetical to creativity because it exclusively involves fitting into the environment. Creativity requires the individual to resist adaptation through the will to create.

Psychologist Jean Piaget generated a constructivist-developmental theory that portrays intelligence as adaptation. His theory explains how individuals adapt by modifying their knowledge structures to fit the environment. Piaget also linked intelligence to creativity, calling early childhood the most creative period in life because young children construct their understandings of the world. According to Piaget, intelligence develops through the child's actions in and on the social and physical environment. Using the mechanism of reflective abstraction, the child projects new concepts to a higher plane of understanding and reorganizes them at that higher level, thereby creating ever-more-complex relationships among actions, objects, ideas, and social experiences. Piaget believed that this mechanism is the same in both child and eminent creator.

For Piaget, individuals adapt through the process of equilibration, actively assimilating concepts that relate to their idiosyncratic knowledge structures and accommodating new concepts that do not fit current structures by modifying those structures, thereby evolving through distinct levels or stages of organization. Through these processes, growth in understanding arises from environmental or internal stimuli that cause gaps, conflicts, or disturbances in current mental structures. These discrepancies provide the impetus for reorganization of the mental structures. Thus, individuals adapt to the environment by modifying themselves. Each equilibration leads toward higher and broader levels of understanding, hence stronger adaptation.

In Piaget's theory, the concept of discontinuity provides the first glimmerings of adaptation of environment to individual. Discontinuity occurs because the construction of relationships is not inherent in the elements themselves, but is brought about through mental action. It is the individual's own construction and imposition of orderly rules and patterns on environmental objects or events that make this adaptation of the environment to the individual. This is the case even if the same rule has been constructed for centuries by other learners. For example, the little boy who is arranging sticks from smallest to largest and generates the idea of putting all the ends against a baseline has constructed the rule for seriation discovered by every child who does so. This child has imposed order on the environment that is not inherent in the sticks themselves (a discontinuity) as he modifies his structures to create the rule for seriating. As in this example, Brian Sutton-Smith noted that play is essential to adaptive capacities, allowing for variability and experimentation not always available in everyday life wherein unexpected things happen when there are no rules inherent in the play.

Except for statements about early childhood, Piaget said little about creativity, with the exception of his three rules for being creative:

1. after becoming knowledgeable in a field, read widely around it, in order to cross-fertilize that field with new ideas;
2. have an adversary in mind, something against which you react;

3. believe in yourself and distrust influences from the outside.

From these rules, it appears that Piaget was going beyond merely adapting to the world to protecting the self from the world and even to shaping it.

Developmental psychologist David Feldman proposed another perspective on adaptation. Feldman claimed that universal cognitive development moves the individual toward competence with the general adaptive abilities that are needed for getting along in the world. From this viewpoint, adapting is finding a satisfying, useful way to live. This is similar to Piaget's notion of intelligence as adaptation. But Feldman also described nonuniversal development, which takes place in creative individuals and child prodigies. Not everyone attains this type of development. It requires specific instruction and the sufficient development within a field in order to reach very high levels. This domain-specific development can be thought of as talent that enables the individual to excel if the right niche is found.

In his seminal book, *Beyond Universals in Cognitive Development*, Feldman described a Universal-Unique continuum that portrays both how individuals move through levels of development in a given domain and how their creative products affect the world. There are five levels in this continuum: universal, cultural, domain specific, idiosyncratic, and unique. Universal development is the type of cognitive growth that emerges without instruction and across all cultures, such as learning to conserve number and substance. Cultural development is the result of growing up in a given context, such as celebrating Thanksgiving in the United States. Subcultural experiences, such as specific manners, dress, or habits of speech also fit here. Adults in the environment teach children this information by offering them encounters with cultural events, values, or practices, but without formal instruction. Domain-specific development requires instruction by skilled teachers whose pedagogical skills and familiarity with a field help the new learner become competent within that field. Learning to play the flute, use a computer, play chess, or ski are examples. Sometimes informal learning rather than formal instruction can introduce the child to key ideas in a domain, such as a book about plant genetics devoured by a child who is raising questions, as was the case with Roberto Burle Marx, a renaissance Brazilian best known for his work in tropical landscape. Idiosyncratic development occurs when a learner reaches high levels of accomplishment in a given domain. At this point, the individual may develop distinctive movements in skating, characteristic phrasing in piano-playing, or mastery of a surgical technique that is different from the repertoire of most other surgeons. Finally, at the unique level, the individual has mastered a field so completely and created such original products or performances that his or her influence on a field requires new learners to learn the field in its transformed state. A performance by pianist Vladimir Horowitz or dancer Judith Jamieson, or Einstein's theory of relativity are examples of accomplishments that emerge from the unique level of development. The more the influence of a unique accomplishment works its way back down the Universal-Unique Continuum towards cultural or even universal levels suggests its value to the world. At this level, Feldman emphasized adaptation by the world to the individual.

From yet another theoretical vantage point, psychologist Robert Sternberg provided an extensive and integrative definition of adaptation. His Triarchic Theory of Intelligence portrays integrative relationships among three subtheories: the componential, the experiential, and the contextual. The componential subtheory relates intelligence to three types of information-processing components within the mind of the individual: metacomponents (higher-order executive thought processes), performance components (lower-order processes that serve as tools for the metacomponents), and knowledge-acquisition components (enable the individual to learn how to do what the metacomponents and performance components eventually do).

The experiential subtheory connects intelligence to experience. Effectively dealing with novelty and automatically processing information (automaticity) are signs of intelligence. An individual who does things automatically efficiently conserves mental resources that can be allocated to dealing with novelty, such as focusing on phrasing, rather than the notes in a piano sonata. Conversely, a person who effectively deals with novelty can apply more intellectual resources to automatization. Thus, adaptation can improve through experience.

The contextual subtheory relates intelligence to a person's external world. People may choose to exercise their contextual intelligence in one or more of three ways. They may adapt to an existing environment, shape that environment to better suit their needs, or leave the environment in favor of one that better suits their abilities and aspirations. For example, if workers feel trapped in a confining work setting, they can adjust their own beliefs and behaviors to fit in with the system, they can unionize to force the system to adapt to their needs, or they can quit and seek more rewarding employment elsewhere. In Sternberg's theory, we begin to see intelligence and adaptation linked by these three emphases on context: fitting in to, modification or shaping of, and selection of an environment.

Intelligence and Creativity: A Convergence of Perspectives Around Issues of Adaptation to Novelty

In these theoretical approaches linking creativity and adaptation, discussion of intelligence is necessary. Theories of intelligence deal with the ability to adapt successfully to the environment and to solve problems related to one's particular setting. Art Costa, an expert on thinking strategies, describes intelligent behavior as what one does when one does not know the answers. Facing a new situation in the environment, what types of responses would be appropriate?

This is an important starting point for a comprehensive understanding of creative adaptation, as theories of intelligence have been evolving in an interesting direction in recent years. Theories developed by psychologists Howard Gardner and Robert Sternberg emphasize multiple abilities and modes of information processing, modified by cultural context. They also focus on modification of the environment to meet the individual's needs rather than merely the reverse: the individual adapting to the environment. It becomes evident that theories of intelligence and theories of creativity are converging. Recent theories of intelligence are moving toward including creativity because they are concerned not only with the individual's capacity to adapt to the world, but also the ability

to shape or transform it. Theorists now are recognizing the pivotal role of creativity in intelligent adaptation.

Moreover, older theories of intelligence focused on adaptation to the environment. In recent theories of creativity, the adaptation is mutual. The creative person must master a field sufficiently to be able to see the problems or gaps at the 'edges' of the field. As Howard Gruber explained, 'It is safe to say that no case of early achievement occurs without a long apprenticeship.' This is adaptation to the world. But when creative individuals extend or transform the domain in which they function, that world of endeavor adapts to the creator. For example, when Freud described the workings of the unconscious mind, he changed the way new psychology students learned the knowledge base in their field.

Such creative transformation of the world requires wisdom and an ethical commitment to its betterment, according to Don Ambrose and Tracy Cross, as well as Robert Sternberg. It also involves a transformation of self that enables the individual to grasp the edges of a field, and that provides the courage and will to construct a point of view. The most recent theories of intelligence incorporate creativity by acknowledging this shaping-of-the-world aspect of adaptation, but they do not address the transformation of self.

Research and Scholarship on Adaptation and Creativity: Style, Expertise, and Chance

Creative adaptation and adaptiveness are related to cognitive style, development of expertise, and chance factors, discussed in this order.

Creative-Adaptive Styles

The research literature connecting adaptation and creativity is meager with the exception of the work of Michael Kirton and colleagues. Kirton hypothesized that there are two distinct types of creative people. He developed a scale to distinguish cognitive style preference, the Kirton Adaption-Innovation Inventory (KAI). The pattern emerging from this research suggested that creative adapters and creative innovators are types of creative people with quite different cognitive styles, which can be disadvantageous or advantageous, depending on the context. Structure is a key to the style differences. Those who prefer more structure are adapters while those who prefer less are innovators. However, either too much or too little structure inhibits generation of new thought or action. Innovators prefer situations that allow them to do things differently while employing looser cognitive structure. Innovation has a meaning of breakthrough change, or breaking out of a paradigm into another structure. Adapters prefer structured situations. They are interested in refinements of existing products, processes, or ideas. Their focus is on redefining, elaborating, modifying, and improving a paradigm.

Kirton made clear that innovation is not the 'best' nor the highest form of creativity. The appropriateness of a given style is dependent on a specific context and a given situation. When faced with a difficult context that demands other than the preferred style, individuals must use coping behaviors to bridge the gap between their preferred style and what is

perceived as necessary to achieve goals. Excessive demand for a different cognitive style usually results in the individual wanting to leave the situation. Yet Geir Kaufmann argued that Kirton's theory does not distinguish between novelty on the stimulus side and on the response side. He differentiated between reactive and proactive creativity, based on the novelty of the problem and problem sensitivity, rather than just the personal style of the creator.

Creative Adaptation and Expertise

Bruce Shore, Gillian Resjkind, and Lannie Kanevesky used recent findings in cognitive research to illuminate linkages among various conceptions of giftedness, creativity, and expertise. As with Sternberg's experiential subtheory, this work relates to creative adaptation because the cognitive abilities and habits of experts usually make them much better adapters than are neophytes or novices. Experts have mastered the knowledge base and skills of a field; hence, the thought processes necessary for efficient problem solving, adaptation, and innovation have become automatic. By contrast, neophytes and novices, with some rudimentary knowledge of the field, have not developed automaticity nor the necessary knowledge and skills. Consequently, they are not efficient adapters within that field.

Of course, questions arise about the degree of automaticity an expert can muster when confronted with a profound paradigm shift in a field. Standard knowledge and practices could become hindrances that lock an expert into ineffective actions when a paradigm shift changes the operational rules of a profession. In most situations, however, the experts' large accumulation of knowledge and skills provide them with strong adaptive advantages including (a) problem-solving flexibility, (b) effective use of prior knowledge, (c) strong associative and interdisciplinary connection-making capacities, (d) the ability to develop and follow effective action plans, (e) the ability to understand and use the context of a problem, and (f) meta-cognitive strength, or the ability to monitor the effectiveness of one's own thought and actions.

At the same time, development of expertise is probably not sufficient for renaissance types of creativity. I analyzed two major trajectories in creative lives that form a continuum, the linear, focusing on development of expertise and the network type, connecting diverse fields. In my study of two creative brothers representing each of these trajectories, I noted the pulls from each end of the continuum, the interplay of circumstance and context relative to adaptation, and a somewhat different development of expertise in the network trajectory.

Creative Adaptation and the Element of Chance

Abraham Tannenbaum described a dynamic interplay between chance and ability in the fulfillment of one's potential. According to Tannenbaum, chance is one of five factors that combine to influence development. There is a static element of chance, which includes things the individual cannot control, such as the accidents of genetic inheritance, or birth into a family of privilege or deprivation. There also is a dynamic element of chance, which includes things the individual can influence. For instance, rather than merely accepting their lot in life, people

can actively and randomly explore new ideas or work processes. Although randomness may be inefficient, it can lead to 'lucky' breaks. Those who actively prepare their minds according to perceived trends in their environmental contexts are likely to be even more 'fortunate' than those who simply employ random activity. Those who are most fortunate, however, are the few who develop a facility for luck through highly individualized action. They develop unique perspectives from which to view problems and their environmental contexts. These perspectives enable them to encounter opportunities more frequently than those who lack unique, individualized vantage points.

Recent developments in the emerging science of complexity add new dimensions to the influence of chance on creative adaptation. Complexity theory involves interdisciplinary studies of complex adaptive systems. Of most interest to complexity theorists such as Stuart Kauffman and Doyne Farmer are the ways in which order spontaneously emerges from apparent chaos. Complex adaptive systems, such as human minds or international political and economic systems, can be strongly influenced by minor environmental fluctuations; yet these systems seem to settle into patterns of order that enable them to adapt and thrive in changing conditions. High-powered computers and mathematical analyses are helping these theorists discover meta-patterns in the activity of complex adaptive systems. Given the existence of these patterns, it is likely that pattern finding in the midst of apparent chaos enables individuals to survive and thrive in complex, changing conditions. If so, 'good fortune' may be more dependent on intuitive pattern perception than on the elements of chance, at least in some conditions.

Whether people are blessed with socioeconomic status or earn more opportunities through activity, preparation of mind, or development of useful perspectives and pattern-finding abilities, the element of chance can affect creative adaptation. Those who are more fortunate are more likely to adapt successfully to problems, or to force adaptations in the environment that better suit their needs and desires.

Assisting Adaptation: Facilitative Contexts and Environmental Support

According to Lev Vygotsky, a Russian psychologist, mediation is needed to help the individual become adaptive and creative. Vygotsky posited that caring individuals are needed to help young learners interpret new knowledge. The 'zone of proximal development' is the conceptual space in which such interventions are most effective, the discrepancy between the children's actual mental age and the problems they can solve with assistance. Vygotsky found that instruction leads development and assists in the ripening of knowledge structures. Therefore, adults play an important role in mediating the learning process by providing hints, guidance, and correction. Through interactions with the mediator, the child internalizes problem-solving processes, thereby becoming better adapted to dealing with problems in the environment. Ideally, as the child becomes more able to generalize and transfer what is learned, the adult becomes less of a guide and more an encourager.

Psychologist, Reuven Feuerstein, also stressed that mediation plays an important role in adaptation. Feuerstein noted that intelligence is dynamic and modifiable, not static. In efforts to help the Israeli army find ways to improve the intelligence of ‘retarded performers,’ he posited that direct intervention in an individual’s cognitive development through mediation by an adult optimizes the effectiveness and efficiency of that development. He also suggested that lack of mediation can result in retarded performance. The intelligent person is able to effectively gather needed information and use that information to solve problems, or to generate new information. Through the benefit of mediation, the individual becomes more open to experience and more adaptable to new situations.

Both Vygotsky and Feuerstein focused on the role of the adult in interpreting both the inner and the outer worlds for the child in order to assist in the adaptive process. For instance, when a parent says to her 3-year-old son, “You are really angry that Sammy took your truck. Could you think of another way of getting it back, instead of hitting him?” the description of the child’s feelings and experiences helps him adapt to both the specific situation and to other similar occurrences. Such early mediation appears to promote successful adaptation to the world, and may even promote creative development.

Mediation provided by caring others also may support the work of mature creative people. Gruber’s studies of highly creative individuals suggest that social support is essential for full development of creative ideas. For example, in his study of Charles Darwin, Gruber found that Darwin’s concerns about contradicting the social values of his time, as well as his desire for social support, inhibited completion of *The Development of Species* for some 20 years. This can be construed as a desire for mediation – the need to discuss and share with like-minded others, or with those more knowledgeable who can facilitate thinking. It may be that mediation early in life prepares the individual for adaptation to the environment while allowing the individual the internal freedom to modify that environment. Paradoxically, however, enough tension, adversity, and challenge need to be present to develop adaptive strategies. And at the same time, the creator must interpret the cultural and contextual boundaries and what might be accepted or rejected out-of-hand.

A Continuum of Adaptive Creative Behaviors

In the previous two sections, one emphasis has been on adaptation and the creative person, with particular focus on cognitive style. Another emphasis has addressed a contextual aspect – the facilitation needed to fully nurture both adaptation and creative development. In this section, we explore another continuum, one that addresses adaptation in context, as well as the creative process and product. Linkages are needed to connect childhood creative adaptation to the type of creativity seen in eminent adults. Another bridge is needed to explain the more mundane creativity found in the everyday lives of adults. I suggest that one way to build these bridges is to think of creativity as a range of adaptive behaviors along a continuum of seven developmental levels. This continuum can help explain the processes and progress of creativity itself.

The Common Element in the Continuum: Discontinuity

Common to all levels on this continuum is the notion of a discontinuity between what was before and the new. It is what Gregory Bateson, Bertrand Russell, and Alfred North Whitehead described as a ‘jump in logical types’ from the particular to the general, that results in a new context. Piaget defined this leap as ‘reflective abstraction,’ a process of reflection and putting events or thoughts into relationship, which leads to new understandings not inherent in the thoughts or events themselves.

In this Continuum of Adaptive, Creative Behaviors, the variables hinge on six aspects related to context, process, and product, as described in [Table 1](#).

The seven levels of the continuum of creative behaviors

At one end of the Continuum is Level 1, Learning something new: universal novelty. This type of creativity occurs in infants, children, and adults as they deal with newness in their world. At the opposite end of the continuum is Level 7, Creating by transforming a field. This level of creativity is found only in a few individuals. In between are levels that connect the universal creativity of childhood to eminent creativity.

Table 1 Variables in the continuum of adaptive creative behaviors

Aspect	Variable	Description
Context	Adaptation	Initially, creativity involves adaptation of the individual to the world. At the highest levels, it involves adaptation of the world to the individual. This shift occurs between Levels 4 and 5
Process	Purpose	The creator’s purpose shifts from mastery to extension, and finally to transformation
Process	Speed	Creativity is rapid in early levels, involves more time in each increasing level, and involves living a creative life at the highest levels in which one’s major focus is on creating, requiring many years of effort
Process	Structure	Initially, the mental structures are very incomplete and creativity involves construction of these structures. At the opposite end, the structures are very well-developed, and the individual sees gaps, lags, and conflicts – limits to the present level of understanding. Early levels of creativity involve simple structures, a single domain or scheme. Later creativity involves major structural reorganization and transformation. The goal is to push out the edges and to transform the structures, constructing a point of view
Product	Novelty	In the first level, creative products or ideas are new to the individual. They become rare compared to age-peers, offer new combinations of others’ ideas, and finally, are considered new and transformational to the world at the two highest levels
Product	Value	The creative product is of value initially to the self, then to others, and finally, to the world

Level 1: Learning something new/universal novelty

Individuals construct relationships new to themselves, but not new to the world; also mundane, mini, or little c creativity. All new learners of a field make the same constructions. *Examples*: conserving number; learning to push off the ice when skating the first time.

Level 2: Making connections rare compared to peers

Individuals develop products, ideas, or approaches that are unusual compared to peers but are not new to the world. *Examples*: a 4-year-old on a city walk focuses on a pile of broken glass. 'Look,' she says, "here is a city with all the buildings and busy people. And see this piece? This is a lonely child"; envisioning an onion to conceptualize the layers in Bronfenbrenner's ecological theory.

Level 3: Developing talents

Individuals connect to and develop skills in one or more domains, moving through a series of stages in which abilities are honed, accumulated knowledge of a field is learned, and craftsmanship developed, usually requiring expert teachers. Individuals experience compulsion to work hard in the area of interest, setting a variety of challenges to themselves. When heredity and environment inextricably combine, a child's products or abilities may approach adult levels in prodigious development. *Examples*: becoming good at athletics, art, mathematics, writing, or fixing cars; playing violin with the NY Philharmonic at age 10.

Level 4: Developing heuristics

Through instruction, individuals develop strategic ways of thinking in the domain, such as creative problem solving, critical thinking, and metacognition, wherein the preferred ways of working and habits of mind are identified and cultivated. This level probably develops simultaneously with Level 3, Developing Talents. *Examples*: using fantasy and imagery in writing; focusing on aesthetics to develop stronger awareness of beauty, harmony, and patterns.

Level 5: Producing information

Individuals discover and investigate their own real problems or burning questions related to areas of interest and developing knowledge, producing new information that is valued by self and others, although the scope is limited to an arena 'close to home.' The individual's views begin to be imposed on the world. Adaptation starts to shift from making self fit the world to changing the world a little by one's ideas and efforts. *Example*: a fourth grader logs weights, measurements, behaviors, and daily photographs of the changes in their husky's litter of puppies over 8 weeks, publishing their research in a children's magazine; an elderly citizen, moved by the plight of the homeless, rallies a community to help.

Level 6: Creating by extending a field

Individuals, having mastered a domain to be aware of gaps, problems, or pressing issues, add a new dimension or valuable information to that field, thereby extending that domain of endeavor, as well as constructing a partial point of view. *Examples*: developing a new technique for surgery; writing an award-winning dissertation.

Level 7: Creating by transforming a field

Individuals, labeled geniuses or renaissance persons by society, revolutionize a field or create new ones by combining different aspects of endeavor. At this level, the field, and possibly even the world, adapts to the creator by passing on the transformation to new learners, contributing to a paradigm shift. Both individuals' internal knowledge structures and the external environment in which they work are transformed, a unique point of view is constructed, and the product is highly valued. *Examples*: Piaget's equilibration theory; Roberto Burle Marx's contributions to tropical landscape design.

What most people consider creativity – production of something new or very rare to the world that is of value – is reserved for Levels 6 and 7 on the Continuum. Creativity at these levels is called 'mature' because it involves well-developed, extensive, and intricate knowledge systems representing mastery of a field typically requiring 10 years of effortful study and practice to reach such levels, according to Mihalyi Csizentmihalyi. In addition, this type of creativity involves the regular solving of problems, not a one-time occurrence, according to Howard Gruber. Ethics become very important at these levels. Creative products such as nuclear power or genetic engineering may be valuable when they are produced, but their long-term effects are unpredictable and potentially disastrous. Those with the most creative potential carry the greatest moral responsibility for the ultimate effects of their creative thought, as noted by Ambrose et al. and by Sternberg.

In this Continuum of Adaptive Creative Behaviors, the shift in adaptation occurs between Levels 4 and 5. Prior to this point, the individual has been adapting to the world. In Level 5, the world begins to adapt a bit to the individual. To make such a shift usually requires facilitation from knowledgeable and supportive adults, as well as the building of a knowledge and experience base. School and work settings that encourage autonomy, freshness of vision, and originality; the development of talents and multiple strategies for thinking; as well as purposeful, self-set effort help individuals make the shift and can lead to mature levels of creativity.

Conclusions and Issues

Creative adaptation involves highly complex dynamics that depend on a wide range of situational and cultural constraints. It involves both short- and long-term thought, action, and development. It brings forth transformations within the individual as well as modifications, or even paradigm shifts in the environmental context. It also involves a wide range of cognitive, emotional, and motivational elements. In short, virtually all human faculties are called into play during creative adaptation to environmental problems and opportunities. Ultimately, adaptation is one of the most important issues of relevance to the development of creativity.

Successful creative adaptation involves a number of paradoxes. Creators need to destroy existing structures while maintaining safety and harmony within the environmental and cultural context. They must make major transformations to their own cognitive structures while remaining resilient in the face of the inevitable attacks that accompany creative work.

They must perceive pressing and immediate problems and opportunities in the environment while staying focused on a long-term sense of purpose. This requires creative balancing of self in the environment, 'reading' the cultural and contextual requirements and demonstrating adaptiveness as well as developing original ideas. If one merely adapts to the will and the world of others, it is unlikely that highly creative products can result. If on the other hand, the distance between the world and the individual's created product or performance is too great, 'pearls may be cast before swine' and the world will not recognize the breakthroughs. Bucking prevailing paradigms or cultural norms is always difficult if not dangerous. Individuals have been relegated to mental institutions and even tortured or killed for such differences in perspective. Although such penalties were more prevalent in the past, anyone who has tried to get major research funding for a 'far out' idea faces the problem of critics who simply cannot escape their own world view.

It is the long-term development of the individual along the Continuum of Adaptive Creative Behaviors that enables the resolution of these paradoxes. The broader, more integrative cognitive structures and stronger sense of purpose one develops through progress along the Continuum help provide resilience and competence necessary for successful adaptation of both self-to-world and the world-to-self, even in the face of the difficulties imposed by creative work.

All of this raises one final issue relevant to considerations of creative adaptation. To what extent should the creative adaptation of one individual or group impinge on the opportunities for success of another individual or group? This question brings into play profound issues such as individual freedom, social Darwinism, class conflict, exploitation, cultural context, and the moral-ethical implications of creative products and processes. In a postindustrial era of rapid, unpredictable change our answers to this question may determine our chances for successful creative adaptation as a species.

See also: Collaboration; Conformity; Creative Environments, Conditions, and Settings; Cultural Diversity and Creativity; Domains of Creativity; Friendship and Creativity; Intelligence (as Related to Creativity).

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Advertising with Art: Creative Visuals

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Glossary

Advertising A paid, mediated form of communication from an identifiable source, designed to persuade the receiver to take some action, now or in the future.

Art Works embodying human expression, characterized primarily by the manner of their creation and/or execution, irrespective of the presence or absence of concepts, ideas, messages, or functions underlying them, conveyed by them, or achieved by them.

Introduction

What Is Advertising?

Numerous definitions of advertising exist. Some are broad, like the definition provided by James Laver who proposed that:

Advertising is as old as Humanity: indeed, much older; for what are the flaunting colours of the flowers but so many invitations to the bees to come and 'buy our product'. Everything is already there: the striking forms, the brilliant hues, even the 'conditioning of the customer'. . . . Advertising might be defined as any device which first arrests the attention of the passer-by and then induces him to accept a mutually advantageous exchange.

A more narrow definition was presented by Raymond Williams in his classic essay entitled 'Advertising: The Magic System' in which he described advertising as "the official art of capitalist society."

In the opening paragraph of his book *Ogilvy on Advertising*, advertising legend David Ogilvy, wrote:

I do not regard advertising as entertainment or art form, but as a medium of information. When I write an advertisement, I don't want you to tell me that you find it 'creative'. I want you to find it so interesting that you buy the product. When Aeschines spoke, they said, 'How well he speaks'. But when Demosthenes spoke, they said, 'Let us march against Philip'.

Leo Burnett, another advertising legend, describes advertising from a competitive standpoint as "selling corn flakes to people who are eating Cheerios."

When advertising and marketing experts were brought together by researchers Jef Richards and Catherine Curran and asked to collectively decide what advertising was, they arrived at the following definition:

Advertising is a paid, mediated form of communication from an identifiable source, designed to persuade the receiver to take some action, now or in the future.

Why Advertise?

Advertising has many different uses: to create and promote the image of a corporation, product, or brand, to make an announcement, to make a sale, or to support a cause. The primary goal of advertising is persuasion. It is extensively relied

upon to promote products and services, charitable causes, individuals like politicians and celebrities, and even ideas. As a marketing communications tool, advertising is a critical element of the integrated marketing communication mix.

Russell and Lane propose that advertising is an institution, not merely a means of disseminating information about a product. They argue that advertising impacts consumers, businesses, and society. Advertising provides information to consumers that allows them to discriminate between products. It allows businesses to bring new products to the attention of enough consumers so as to enable them to stay in business. In this manner, it fuels the economic engine of society.

The money businesses spend on advertising has increased dramatically in recent years. In 2007, spending on advertising has been estimated at over \$150 billion in the United States and \$385 billion worldwide, and the latter to exceed \$450 billion by 2010. However, marketers are faced with increasing challenges as well, including a squeeze on profitability, increased advertising clutter, and the complexities involved in communicating with diverse target audiences.

What Is the Role of Creativity in Contemporary Advertising?

Consumers are bombarded with images wherever they turn, via TV, the Internet, smartphones, billboards, magazines, and so on. It is difficult for marketers to compete for the attention of consumers under such conditions. Increased spending on advertising has resulted in increased advertising clutter and consequently a struggle by marketers to have their message seen and heard. Indeed, under these circumstances, the importance of creative solutions to cut through the clutter is becoming increasingly evident.

Creativity is considered a product of human intelligence characterized by originality, expressiveness, and imagination. Thus, creativity in advertising may engender original, expressive, and imaginative ads. These ads may be funny, clever, unique, or exciting, but any 'wow, I love that ad' response evoked in a consumer must also translate to a 'wow, I love that product' response. What differentiates creativity in advertising from other types of creativity is that it must be employed to meet marketing objectives. Thus, effective advertising results from the interplay between creativity and strategic consumer insight.

Technological developments are revealing new opportunities for enhancing creativity in advertising. Many historical

inventions, such as photography, the printing press, television, or computers, have revolutionized the landscape of advertising, but new technologies are constantly emerging, and arguably more frequently now than in the past. For instance, computerized design tools, morphing and digital special effects, digital video-editing, holograms, 3D effects, virtual reality, multimedia presentations, ink-jet personalization, public relations planning software, and interactive media are changing the face of how advertising is done. Indeed, one of the ways that advertising professionals facilitate their own creativity is by staying abreast of the newest technological developments. In their efforts to remain competitive, advertisers must attempt not only to stay abreast of these developments, but also to apply them creatively in the marketing of products.

The Visual Element in Advertising

The effectiveness of an ad is a function of what is said and how it is said. Several creative elements – the visual, the copy, the music – come together to create a successful advertisement. Although a lot of research has been done on these individual elements to determine what works and what does not work, there are no formulas for success and few ways to measure truly creative advertising ideas. According to a handbook published by Ogilvy and Mather, to get an ad right you need two things: (1) a simple, inspiring, insightful strategy and brief, and (2) the time in which to do the work right.

A great deal of literature has discussed how the different elements of advertising work. In this article, we focus on the visual element of advertising. Investigations regarding how the visual element can help enhance the effectiveness of the advertisement have been undertaken since marketers began to adopt full-scale marketing activities in the late nineteenth century. In this article, we will review some findings from this literature and then narrow our focus to a special category of visual images, namely, visual art.

Importance of Visual Images in Advertising: Evidence from Academic Research

Kosslyn et al. report that two-thirds of all stimuli reach the brain through the visual system, and it might be argued that although human thought is neither words nor visual images, it seems closer to the latter than the former. This finding is poignantly reflected in Cahners Advertising Performance Studies which find that 98% of the top scoring ads in advertising effectiveness contain some visual element, either a photograph or an illustration. This visual element occupies between 25% and 63% of the layout space. Of the top-scoring ads in this study, 65% had a visual that occupied between a quarter and three quarters of the advertisement.

Visual images are used to attract attention, stimulate curiosity, illustrate product features and benefits, create and develop a personality for a product, associate the product with certain symbols and lifestyles, and establish a brand's identity in the minds of the target audience. Research findings suggest that the content or what is depicted in a visual image is an obvious influence in the overall evaluation of the brand. For instance, advertisers use visual imagery to enhance or strengthen the

message about their product. When something neutral (the product) is paired with something that elicits a positive affective reaction (a visual), the positive qualities of the visual may be interpreted by the consumer as also belonging to the advertised product.

Eye-tracking studies have been used to show that consumers focus first on the dominant picture in a print ad before attending to verbal information. The attention a viewer pays is facilitated by (a) the size of the image, where larger pictures work better than small ones, (b) the color of the image, where a color image works better than one in black and white, and (c) the vividness of the image, where a greater number of colors works better to attract attention.

Rossiter and Percy divided visual communication in advertising into two categories of stimuli – static and dynamic. The three elements that determine static stimuli are picture size, exposure duration, and number of exposures. An increase in any of these variables has been shown to increase recognition, encoding of details, and development of denotative images among viewers. Although the attributes of static stimuli do not fit perfectly in measuring dynamic stimuli, this latter type also has resulted in high viewer response.

A 'picture-superiority effect' has been established in the literature. This implies that images in ads (a) facilitate memory of ad content, (b) favorably influence beliefs, attitudes, and behavioral intent, and (c) increase involvement with the product.

How the Visual Component of Advertising Works

It is relatively well established that visual images have an influence on the effectiveness of advertising and the evaluation of the products being advertised, but it is less clear how this influence is exerted. It has been suggested that the visual component of advertising performs two key functions – literal and symbolic. Literal visuals provide factual information about products or services (e.g., a photograph of the product itself), and symbolic visuals perform an indirect role to connect the images of products or services with the meanings that are appropriately assigned to them (e.g., a fluffy kitten to connote softness). Indeed, visual images can convey semantically meaningful concepts via their stylistic properties. These stylistic properties may result from a variety of different factors such as camera angle, depth of focus, color treatments, orientation of depicted products, and so on. The descriptive concepts thus conveyed may serve as central arguments of an advertisement, such that the stylistic properties are instrumental in the influence of the ad on consumers' perceptions of the advertised product.

A great deal of research appears to be based on the assumption of a relatively effortless comprehension of nonverbal ad elements. Mitchell and Olson illustrate that brand attitudes arise from a classical conditioning effect using a valenced visual image, rather than from a more elaborate interpretation of the image. Miniard et al. investigate the influence of emotional appeals on brand attitudes by utilizing affect-laden or emotion-filled images that they argue are devoid of product-relevant information. Hagtvedt and Patrick demonstrate that although the content of a visual image is a source of interpretable information, art images have a general influence on consumer evaluations, regardless of the specific content of the images.

Previous research has also demonstrated that perceptual fluency (or the ease with which an image is processed) results in enhanced consumer judgments.

Some research has relied on theoretical domains such as semiotics and rhetoric to explain how consumers extract information from a visual image. Semiotics refers to the communication of information via 'signs' that combine to form a meaningful 'text,' the interpretation of which includes the decoding of these signs according to culturally based decoding rules. A sign may be iconic and thus have a physical resemblance to its meaning (e.g., a photograph of the advertised product). Otherwise it may be symbolic and thus relate to its meaning by arbitrary convention. This type of sign is not an obvious, physical representation of its meaning. A sign may also be semantically related to its meaning via index (e.g., smoke as an index of fire).

Hagtvedt and Patrick assert that visual images are characterized by two key components: (1) content (*what* is depicted) and (2) manner (*how* it is depicted). These authors present a theoretical framework to understand the impact that visual images have on persuasion. This dual-process model proposes that when the content of an image is salient, the image is processed analytically as a product-relevant illustration, but when the manner is salient, the image is processed heuristically as an aesthetic stimulus. For instance, one might imagine two individuals looking at an ad for a beach resort in which the visual image in the ad is a painting of a woman on a beach. One individual looks at this image and sees a woman on the beach, while the other individual looks at the image and sees a painting. In other words, these two individuals look at the same image but focus on two different components of it. The first focuses on the content of the image (*what* is depicted) while the other focuses on the manner (*how* it is depicted). This differential focus may lead to vastly different influences on the consumers' perception of the beach resort. Thus, this dual process model represents a means by which to systematically disentangle the influence that the two components of content and manner have on consumer evaluations of advertising and products associated with the advertising images.

Individual Differences in Response to Visual Images

The effects of the visual element of the ad may be different depending on an individual's response to visual (vs. verbal) elements and/or the consumer's ability to generate vivid mental images. The visualizer/verbalizer cognitive style describes individual preferences for attending to and processing visual versus verbal information. In general, visualizers are characterized as those individuals who have high imagery ability and vivid daydreams, who like illustrations, diagrams, and charts, who prefer to be shown how to do something, and who tend to be more subjective about what they are learning. In contrast, verbalizers have lower imagery ability, like reading text or listening, prefer to read about how to do something, and tend to be more objective about what they are learning.

Several scales have been developed to measure dispositional imagery abilities. The Betts Questionnaire Upon Mental Imagery (QMI) is designed to assess individual differences in imagery vividness in regard to visual, auditory, gustatory, olfactory, and organic modalities. The Vividness of Visual Imagery

Questionnaire (VVIQ) assesses imagery abilities in regard to only visual images. Notably, dispositional differences in response to visual elements have been demonstrated to have a significant effect on creativity and information processing. Bone and Ellen demonstrate that participants' ability to imagine/visualize had an effect on (1) the reported vividness of the image of consuming the advertised brand and (2) the subjectively perceived ease of imagining experiencing the product. These two variables in turn had a significant impact on the attitudes toward the advertised brand.

Childers et al.'s Style-of-Processing Scale is an instrument that reflects consumers' relative tendency to process information visually or verbally. The processing style relied on may depend on both chronic differences and situational differences. Research has indicated that chronic differences in processing style have virtually the same effects on the processing of product information as does situationally primed differences. However, the latter type of differences suggest that both visual and verbal processing strategies exist independently as part of procedural knowledge and that their relative accessibility decides which processing style is relied on at any given moment.

Visual Art: A Special Case of Visuals in Advertising

Visual art is used extensively in advertising. Indeed, Hoffman reports that "reproductions of high-culture images reach more people more often through advertising than through any other medium." However, although the use of art is widespread in advertising, the various manners in which it may be used have not been systematically studied. It therefore seems instructive to provide an overview of how visual art is incorporated into advertising, as well as to pose questions about how this use of art influences consumers. Increased knowledge in this area should also assist advertisers in using art strategically and systematically rather than in an ad hoc manner based predominantly on intuition and experience.

Depending on definitions, one might argue that advertising is about selling, while art is about revealing; advertising is commerce, while art is culture. Advertising is usually intended to get a specific reaction from consumers, while works of art are often ambiguous, inviting multiple interpretations and meanings. Such suppositions notwithstanding, art has been used to influence people in specific ways throughout history.

Leaders like the Egyptian pharaohs, Roman emperors, and the popes used art for various purposes such as selling religion, promoting their own image and prestige, and enhancing their positions of power. Similarly, the Medici of Florence used art to promote a philosophy of enlightened humanism, as well as to impress their clients and business connections. In the current era, the use of art in such promotional endeavors is perhaps more prevalent than ever, for two main reasons: first, art is affordable and available to a larger number of people now than it was in earlier times and second, the popular use of imagery is facilitated by modern media and channels of distribution. Perhaps the difference between high art and popular culture has also gradually eroded in our consumption society, or perhaps it is a lingering distinction that still makes art useful in advertising. Either way, before we can speak sensibly about the effect of art in advertising, we must first specify what constitutes art in the current context.

What Is Art?

The notion of art as a special category is itself a relatively modern idea. For instance, not before the mid-eighteenth century did Abbé Batteux present the separate classification of fine arts made up of music, poetry, painting, sculpture, and dance. A distinguishing mark of these disciplines was that they had pleasure rather than utility as their goal. Today the notion of art as a separate category still remains, along with a belief that the perception of art differs from the perception of other objects. However, although a great deal of research has been focused on this perception, different definitions abound, and it seems doubtful that scholars will ever agree on any particular one. When speaking of art in connection with advertising, however, it seems appropriate to define art from the consumers' perspective: that art is that which is categorized by the viewers as such. Further, we will here restrict ourselves to visual art.

Even with this definition, it seems reasonable that differences in opinion will exist as to what distinguishes something as a work of art. On average, however, consumers do appear to possess some consistent views of what does or does not constitute art. Research conducted by the authors has indicated that the average viewer is able to recognize certain characteristics that distinguish artworks from other human creations. Indeed, consumers consistently report that art images are expressive, that the manner of creation or execution is itself a central feature of an artwork, while just trying to say something or express an emotion without a 'special' manner is not enough to constitute art. This manner tends to be characterized by the skill and creativity applied to the creation of the artworks. Based on these self-reports and on a thorough review of art history, the authors propose that art may be identified as works embodying human expression, characterized primarily by the manner of their creation and/or execution, irrespective of the presence or absence of concepts, ideas, messages, or functions underlying them, conveyed by them, or achieved by them. Therefore, typical conceptual works such as animals in formaldehyde, human feces in hermetically sealed cans, or even Marcel Duchamp's famous urinal 'Fountain' (considered in a survey by CNN to be the world's most influential piece of modern art) may not spontaneously be recognized as works of art, unless they have already been marketed as such. These works typically depend on a context, such as being placed in a gallery, for their impact, and the cultural implications of, for instance, an institutional theory of art would detract from the focus of the current discussion. Further, works generally recognized as art, whether they are presented in a gallery or not, seem more useful for advertising purposes.

The Influence of Art in Advertising

Some research provides an understanding of the role of products with a salient aesthetic purpose, but the amount of extant research that illuminates the influence of art in the current capacity is quite limited. There is a need to further develop our understanding of how art images differ from other visual stimuli, and to map out how the presence of art influences consumer perceptions of products and brands.

Research conducted by the authors establishes the phenomenon of *Art Infusion*, broadly defined as the general influence of

art on consumer perceptions and evaluations of products associated with the art. General properties of art, tied to a special kind of quest for excellence inherent in the creation of artworks, spill over onto the products with which the art is associated. These properties cause perceptions of luxury, sophistication, and high culture to be associated with the product in question, leading to enhanced product evaluation. Further, although visual images are usually found to affect viewers in an affectively congruent manner, the Art Infusion Effect does not depend on the content of the image and occurs whether the valence of emotion elicited by the artwork is negative or positive. This distinguishes visual art from other sensory stimuli used in advertising, such as music, in which the valence of the stimuli has a congruent impact on evaluations.

In further research, visual art is also shown to have a favorable impact on evaluations of brand extensions. First, the Art Infusion Effect leads to enhanced brand image. Second, appreciation of visual art appears to cause enhanced cognitive flexibility, thus increasing perceptions of fit between the brand extension and the parent brand category.

If the artworks used in advertising are to have their intended influence, it is important that they are recognized and respected as artworks by the target audience. Indeed, popular and easily recognizable artworks tend to be relied on for advertising purposes. A large proportion of the ads feature European works created between the early fifteenth century and the mid-nineteenth century. Works stemming from the Renaissance, from Neoclassicism, and from Romanticism are well represented. Although well-known masterpieces are typically used, a style that clearly reflects skill and creativity may also be enough to convey the intended properties of the artwork, even when the specific piece is unknown to the audience. Possible gender differences should also be noted when considering the responses of the target audiences for advertising with art. Factors such as education, social class, and personality have a greater impact than gender on aesthetic activity and aesthetic attitude in general. However, men and women exhibit different preferences for, for instance, different styles. While women seem to prefer impressionist and rococo styles, men seem to appreciate expressionism, cubism, pop art, and abstraction more than do women.

The Ambiguous Language of Visual Art

Recent research in the emerging field of neuroaesthetics aims to understand the biological underpinnings of the human fascination with art. It may be argued that there are limits to how rich the information stemming from neuroscientific research can be on its own, but it may provide interpretable evidence when analyzed in combination with other experimental research, as well as with qualitative studies with converging evidence from fields such as art theory, psychology, sociology, anthropology, and marketing. Artworks are often ambiguous in nature, and research in neuroscience has found that this ambiguity is one of the fundamental reasons why a work of art engages the brain in the first place. Although the general insights given by the experience of an artwork may constitute a particularly interesting aspect of that work, openness to interpretation allows the viewer's brain to 'complete' the artwork for itself, and thus the commonalities in artistic

expression will be found by each individual viewer in a unique way. Indeed, Dewey argues that when viewing an artwork a spectator may experience creative processes similar to the ones of the artist who created the work. Does the open ended nature which often characterizes great art therefore contribute positively to the impact that art has on advertised products? How does this fit with the conception among advertising professionals that the best commercials leave something to the viewer's imagination?

A Typology of the Use of Visual Art in Advertising

O'Barr provides a review of the history of art in advertising. He outlines some of the earliest uses of art like Cruikshank's 1820 illustrations used in posters for Warren's blacking company, or the famous 1887 Pears ad with the 'Bubbles' painting by John Everett Millais. Today the use of art in advertising is widespread, and in the section that follows we will attempt to provide a typology for how visual art is being used in advertising. There are several ways in which categories for the use of art in advertising may be specified. Here they are specified by type of artwork, by the advertising appeal, or by the application of the artwork.

With these guidelines in mind, we perused a great deal of literature containing advertising, including books and journal articles on the subject, as well as a full year's (2005–2006) issues of various magazines, including *Architectural Digest*, *Businessweek*, *Cosmopolitan*, *Fortune*, *GQ* (Gentlemen's Quarterly), *New Yorker*, *Newsweek*, *Readers' Digest*, *Time*, and *Vogue*. After thus collecting a large quantity of advertisements with art, we attempted to identify general categories for the current use of art in advertising.

Type of Artwork

Figurative versus abstract

The majority of advertisements with art seem to use figurative art, in other words art which represents physical objects, people, or elements of nature. This may be because the majority of nonexpert viewers prefer representational images to abstract works.

Classical versus modern

In this categorization, classical may be thought of as most styles ranging from the Classical Greek sculpture of Pheidias or Myron to the Neo-Classical paintings of Jacques-Louis David. Modern may be thought of as later movements such as Surrealism or Abstract Expressionism. Some movements, such as Impressionism, would represent a grey area, and classifications would have to be made on a piece by piece basis. In general, classical art seems to have found more popular use in advertising than modern art has, and Hetsroni and Tuka-chinsky argue that the use of Renaissance artworks has been particularly prevalent. Indeed, Leonardo da Vinci's 'Mona Lisa,' Michelangelo's 'David,' and Botticelli's 'The Birth of Venus' are among the most popular images of all.

Famous versus unknown

The level of fame of the artwork may depend on the function the artwork is intended to have. For instance, if recognition value is the goal, then fame is obviously desirable. However, sometimes other criteria may guide the choice of artwork, for

instance if the advertisers want one that fits particularly well with a slogan or tells a specific story. In this case, a work of art may even be commissioned for the occasion.

Advertising Appeal

Serious versus humorous

Many advertisements with art have a serious approach. The aim may for instance be to convey an air of high culture or timelessness. In this manner, Rodin's 'Thinker' lends the gravity of art and philosophy to an ad for Dewar's, implying that this whiskey is more sophisticated than other drinks. Ads for Courvoisier often display paintings of Napoleon Bonaparte, underscoring the idea that this is the 'Cognac of Napoleon,' thus evoking both an imperial heritage and the timeless allure of French culture.

On the other side of the spectrum are the ads which use art for the purpose of humor. One ad features a painting by Fra Angelico, where the angel Gabriel informs the Virgin Mary that she will bear forth a child. Mary responds: 'Thanks, but I already know.' It is an ad for Clear Blue pregnancy tests.

Art-inspired versus product-inspired

There are popular conceptions about art itself which advertisers may wish to exploit. In an ad for Tabu perfume, artist and model are caught in a sudden, passionate embrace, thus linking the perfume to the emotional freedom and creative personality of artists.

Other times, art enables an advertiser to say something about product attributes which would otherwise be difficult to formulate. In an ad for Sungard, a painting of Hercules is explicitly used to symbolize the power of their systems. This also matches perfectly with the slogan: 'Rely on our strength.'

Nudity

Nudity and sex are employed in a variety of advertising contexts, but there are circumstances under which such a use would be considered improper, especially in a relatively puritanical country such as the United States. Here art comes to the rescue. One can often 'get away with' nudity if it is used in the context of art. For instance, Michelangelo's 'David' is the classic protagonist where full-frontal male nudity is concerned. The bare breasts of the 'Venus de Milo' seem harmless, even in a family friendly commercial for Kellogg's brand corn flakes, while Rest Assured mattresses emphasize comfort and user-friendliness by displaying sexual scenes from the Kama Sutra.

Application of Artwork

Mere presence versus integrated presence

Often a work of art plays a somewhat passive role in an advertisement. An ad for Pulsar displays the painting 'Spring' by Botticelli, tying Pulsar watches to the golden age of the Renaissance.

Other times the artwork is not merely displayed alongside the product. In an ad for Ikea, a naked old lady sits on a chair on her lawn, sipping refreshments. 'The Birth of Venus' by Botticelli is painted on the house wall behind her, seeming almost modest in comparison. In a Levi's commercial, Michelangelo's 'David' wears a pair of torn Levi's jeans. In a Fiat ad, Leonardo's 'Mona Lisa' is driving the car.

Telling a story with the artwork versus creating an artwork for the story

Sometimes an artwork is used to resonate with or underscore a story told by the advertisement. In an ad for the St Regis, Degas' painting of dancers viewed from the orchestra implies that guests may enjoy refined entertainment here. In an ad for Mercedes-Benz, Whistler's mother is implied to drive off in a fancy car.

Other times, a work of art is specially made to fit the product or a specific story. An advertisement for Pears' soap may be said to have started this tradition, with the first museum-quality painting used in modern advertising. The painting was just barely altered in that a bar of Pears' soap was discreetly placed at the bottom of a scene with a child blowing soap bubbles. Following this, many companies have employed artists to custom make artworks for their advertising campaign. The most famous of all is perhaps the enduring Absolut Vodka campaign.

Mimicking the original artwork: reminding versus parodying

It may sometimes be difficult to make the distinction between an image that was created to remind us of an artwork and an image that was created to parody an artwork. For instance, in an ad for Tela paper napkins, Leonardo's 'Last Supper' is imitated by a photograph with 13 young women at the table, arranged in a similar manner as Jesus and the disciples of the original fresco. Is it an irreverent parody, or is it a stylish photograph inspired by a masterpiece? Perhaps the answer depends on the intent of the advertiser or on the interpretation of the viewers.

Sometimes, however, the distinction is clearer. An example of an ad reminding us of a specific artwork may be a commercial for Campari, where a picture very similar to the painting of the 'Bar at the Folies-Bergère' by Manet displays bottles of Campari, rather than the indistinct bottles of the original painting. Beneath the ad are written the words 'Campari. Reflection on art.' The ad is serious, and the picture with the bargirl is clearly meant to mirror the original painting in an elegant and respectable manner.

In an advertisement for Prince sauce, the Mona Lisa appears in two versions side by side. In the first, she is very similar to the original painting, except that she is now holding a jar of original Prince sauce. In the second, she is obese, and she is holding a jar of chunky Prince sauce. The distortion of the original painting clearly identifies this ad as a parody.

Symbolic connection versus substantive connection

An ad for Shell features 'The Birth of Venus' by Botticelli, simply because she is standing on a giant sea-shell. Here, the representation of the shell is the only connection between the advertisement and the artwork.

In a different approach, several ads for De Beers display paintings from their collection, conveying the idea that diamonds, like paintings, are unique works of art. The ownership of the paintings establishes an intimate connection between the firm and the artwork, as well as highlighting De Beers as a collector and sponsor of the arts in general.

Summary

Advertising has been defined as a paid, mediated form of communication from an identifiable source, designed to

persuade the receiver to take some action, now or in the future. Thus, although advertising has many uses, its primary goal is persuasion, and creativity in advertising is employed to meet marketing objectives. As advertising clutter increases, it becomes increasingly difficult for businesses to find creative solutions to effectively communicate with consumers. At the same time, technological developments reveal new opportunities that facilitate this process.

Research has revealed that most effective ads contain some form of visual element. This is perhaps not surprising, considering the centrality of the visual system for supplying stimuli to the brain. Researchers have relied on various theoretical domains to explain how consumers extract information from a visual image. The responses to visual images may also vary among individuals, depending on, for instance, dispositional imagery abilities or visual versus verbal processing tendencies.

Visual art represents a special form of visual in advertising. It has been used as a tool in this capacity throughout history. What primarily distinguishes art from other forms of visual communication is the manner in which it is created or executed. This manner is recognized by consumers, and research has demonstrated that the favorable perceptions associated with artistic manner may spill over onto consumer products that are advertised in connection with artworks. The current article concluded with a typology of the use of visual art in advertising.

See also: Art and Aesthetics; Design.

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Relevant Websites

- <http://www.aef.com/index.html> – Advertising Educational Foundation.
- <http://www.adcouncil.org/> – Ad Council.
- <http://www.adforum.com/> – Resource Center for the Global Advertising Community.

Aesthetics and Creativity

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Glossary

Aesthetics A set of principles for judging beauty or pleasingness.

Effectiveness The extent to which a product does what it was intended to do.

Elegance A property of a product that makes it pleasing, beautiful, admirable.

Experimental aesthetics Empirical investigation of the interaction of beauty, perception, and culture.

Functional creativity Novelty that carries out a specific task effectively.

Genesis A quality of a solution to a problem that makes the solution transferable to other situations.

Indicators Properties of a product that demonstrate its functional creativity.

Quasicreativity Ideas that possess genuine novelty but are poorly adapted to the constraints of reality.

Relativity A property of aesthetic judgments which results in them being specific to a particular society and/or era.

Schemata Mental representations of external objects.

Subjectivity A property of aesthetic judgments which results in them being specific to a particular person.

Universal aesthetic A set of indicators of beauty capable of being applied in all domains such as fine art, science, business, and production systems.

The Nature of Aesthetics

Aesthetics involves questions of beauty. It is frequently associated with fine art, music, poetry, and similar activities. However, as Daniel Berlyne pointed out, it is not confined to these areas, and aesthetic issues apply in a wider range of domains. It is also important to note that beauty need not simply refer to pleasingness to the senses. Rather, as Immanuel Kant argued, the ultimate beauty is found in truth and order, regardless of domain. This means that aesthetic concepts can also be applied in areas such as science, engineering, business, or administration, which are aesthetically pleasing in the Kantian sense when they reveal truth and order.

Aesthetics and Creativity

There is a considerable overlap between aesthetics and creativity. Indeed, in everyday discussions creativity is often treated as almost synonymous with beauty, and thus aesthetics, although scholarly definitions give more emphasis to novelty and effectiveness. This close link between creativity and aesthetics is seen not only in art, but also in nonartistic domains. An example is problem-solving, a core topic in discussions of creativity: Li Zuo, for instance, concluded that creative problem solving involves finding *beautiful* problems and *beautiful* solutions, which requires 'aesthetic sensibility.' On the basis of case studies of well-known creative individuals such as Alfred Einstein and Charles Darwin, Zuo argued that it is aesthetic considerations that guide creative problem solvers to a solution; the nascent solution is so beautiful that their 'aesthetic awareness' tells them that it must be right. To take another example, Sandra Kay concluded that creative people are driven to move from less beautiful to more beautiful understandings of the world, not just from less accurate or effective to more accurate and effective ones, that is, 'aesthetic sensibility' is a major motivating factor

in creativity. Thus, aesthetics offers an extension of the way in which issues such as intuition/incubation or intrinsic motivation are looked at in creativity theory.

It seems that creativity is, in a certain sense, a special case of aesthetics: beauty is necessary for creativity, but not everything that is beautiful is creative. Creativity goes beyond 'mere' beauty to include novelty and effectiveness. It is worth noting here that the beauty of a creative product need not involve socially desirable or morally admirable purposes or results – creativity may lead to undesirable or immoral results, but still be beautiful in the Kantian sense.

Very early in modern discussions Mel Rhodes suggested studying creativity in terms of 4 Ps: person, process, product, and press, and aesthetics can be looked at in this way too. It is possible, for instance, to speak of an aesthetic person, aesthetic faculties, aesthetic feelings, aesthetic attitudes and values, or an aesthetic response. The aesthetic person is particularly sensitive to beauty (aesthetic sensibility), and aesthetic feelings involve attitudes and emotions that are aroused by contact with beauty. The aesthetic faculties are the sensory and cognitive processes that enable a person to perceive and distinguish among stimuli and thus have the potential to experience beauty, and a person's aesthetic sense makes it possible to recognize beauty in perceived stimuli; an aesthetic response involves responding to a stimulus in terms of its beauty, not for instance its usefulness or price. Experimental aesthetics investigates properties of the person which are related to aesthetic attitudes and values (e.g., preference for symmetry/asymmetry, sense of color, or openness to novelty), of processes (e.g., differentiated perception of stimuli, use of aesthetic schemata in making judgments), and of products (e.g., compositional geometry of an artwork, elegance of an object or system). Research in aesthetics on the fourth P (press) involves issues such as the effects of education or training on aesthetic faculties, aesthetic sense, aesthetic attitudes and values, aesthetic awareness, aesthetic sensibility, or aesthetic judgments.

Aesthetic Judgments

The making of aesthetic judgments is a process based on beauty rather than on logic or similar considerations. The perceptionist view is that such judgments are directly determined by the properties of an object, event or experience, which enter the brain as sensory stimuli. Thus, according to a pure perceptionist model a sound that hurt a listener's ears would be adjudged not beautiful, since it is an unpleasant sensation. James Mill extended this by arguing that it is the associations that a stimulus activates that cause it to be judged pleasing or displeasing. In any case, the aesthetic properties of a stimulus are regarded as inherent in the stimulus itself.

The contrasting view to perceptionism is the cognitive argument that aesthetic judgments are a construction in the mind of the beholder. Certain properties activate previously learned aesthetics-related cognitive schemata stored in the mind of the beholder, and an object or experience is classified and evaluated according to these schemata. The beholder thus infers that something is aesthetically pleasing or displeasing on the basis of acquired categories of pleasingness/displeasingness. To take an example, the cognitive approach argues that an intrinsically unpleasant sound such as atonal music might not be regarded as ugly but as beautiful by a beholder who had learned that this particular sound is beautiful, for instance through training and experience in a particular culture at a particular time, let us say by studying music.

The cognitive schemata according to which aesthetic judgments are made contain the stored results of the beholder's earlier experience and training, and are thus dependent upon the particular experience of the individual (i.e., they are subjective) as well as upon what the society has taught the individual is aesthetically pleasing or displeasing through formal training or life experience in the culture or a combination of both (i.e., they are relativistic). This suggests, among other things, that expert observers may judge an object differently from inexperienced ones, for instance because the experts have been trained to see beauty in objects the inexperienced typically find ugly or repulsive, or to recognize and focus on aspects of objects that are not apparent to untrained observers such as transformation of traditional materials or accordance with a particular school or style. An example is Andres Serrano's 'Piss Christ' which consists of a crucifix submerged in a glass of the artist's own urine. Many laypeople might find this disgusting, some experts by contrast found it daring, paradigm-breaking and highly effective, and it won a visual arts award from the Southern Center for Contemporary Art.

There is evidence that the level of agreement on aesthetic judgments among beholders increases with age, apparently as the result of a movement toward increased use of cognitive judgments with increasing cognitive maturity (as against reacting directly to the raw sensory stimulus, as a small child would) and of the homogenization of people's cognitive schemata that results from shared experience during long years of living in the same environment.

A second issue is whether aesthetic judgments are a cognitive reaction or whether they are emotional (affective) in nature. Do beholders judge beauty on the basis of

information processed according to internal cognitive guidelines, or because of the way something makes them feel? In the former case an object would be judged positively if it were, let us say, well-constructed. In the latter case it would be judged aesthetically pleasing if it made the observer feel good, displeasing if it made the beholder feel bad.

Aesthetic Products

An aesthetic product excites admiration in the mind of a beholder. The qualities that produce the admiration can be purely aesthetic such as 'exquisiteness,' 'gloriousness,' or 'gracefulness,' but they may also be formalist (e.g., 'unity,' 'harmony,' or 'complexity'), or technical (e.g., 'high quality of construction,' 'skillfulness,' or 'professional finish'). These qualities can be closed in the sense that they are narrowly defined, or open (a wide variety of states might, for instance, elicit the aesthetic judgment 'exciting,' according to the point of view of the particular beholder). However, as the eighteenth century philosopher Frances Hutcheson wrote, aesthetic qualities involve a 'subjective fact,' not an 'objective' one. This refers back to two general problems in the area of aesthetics and creativity already mentioned above: subjectivity (aesthetic judgments depend upon the person making the judgment) and relativity (the judgments differ from society to society and even from age to age in a particular society as the society's norms change). In early nineteenth century England, for instance, the language in the works of Shakespeare was considered unaesthetic, and in 1818 Dr Thomas Bowdler published the *Family Shakespeare*, from which all offensive words had been removed. To modern tastes this seems almost sacrilegious.

In the light of the subjectivity and relativity of judgments of the aesthetic qualities of any particular object (i.e., what is beautiful for one beholder may be ugly for another, while judgments may vary across cultures and/or change over time), psychologists have attempted to work out how to make absolute aesthetic judgments, on which different observers agree and which are stable both geographically and temporally. This has largely involved psychological tests investigating either what characteristics of beholders themselves lead to their judgments (such as good taste, preference for complexity/simplicity, tolerance for ambiguity, or openness to the novel), or what characteristics of the object invoke positive aesthetic judgments (such as unity, elegance, order, symmetry, or good finish). Such instruments include the Aesthetic Judgment Ability Scale, the Barron-Welsh Art Scale, the Maier-Seashore Art Judgment Test, the Maitland Graves Design Judgment Test, and the Welsh Figure-Preference Test.

Form Versus Function in Aesthetics

Emphasis on beauty as the core of aesthetics raises the question of whether beauty alone is enough. The view that it is was stated very strongly by the nineteenth century French novelist, Theophile Gautier, who argued in the preface to his novel *Mademoiselle de Maupin* that nothing is truly beautiful unless it is useless. However, the philosopher Ludwig Wittgenstein

argued that, in real life, terms like 'right,' 'correct,' and 'precise,' that is, terms closer to the domain of practical usefulness than that of artistic beauty, are more likely to be used as aesthetic praise than 'beautiful.'

This raises the issue of beauty of form versus function in aesthetics. We have argued elsewhere that artistic creativity is a special variant of creativity because in artistic creativity form takes precedence over function (i.e., beauty on its own is sufficient), whereas in engineering and similar domains the position is reversed: It is difficult to imagine a bridge being aesthetically acclaimed if it were built at great cost to carry traffic across a river but turned out to be useless because of design flaws, even though it looked very beautiful. Thus, there is a tension between exquisiteness of form (a pure aesthetic criterion of beauty) and correctness of function (a technical criterion), although the two are not mutually exclusive; an object may be beautiful in both form and function. Nonetheless, the two may have differing priorities in different domains: Form dominates in fine art, function in engineering, manufacturing, business, and similar fields. Architecture seems to occupy an intermediate position as far as the balance of beauty and usefulness is concerned. The Sydney Opera House cannot carry out the function that those who commissioned and paid for it envisaged (the staging of large-scale opera productions before very large audiences). However, because the Opera House's form is beautiful this flaw is forgiven and, indeed, the structure has become an Australian icon.

Creative Products

A product's creativity is not objective like length or weight, which can be measured accurately with appropriate instruments and mean the same even when applied to different objects, but, like aesthetics, is a 'subjective fact' (see above) and is thus affected by subjectivity and relativity. Early in the modern creativity era Teresa Amabile, and later Mihalyi Csikszentmihalyi made this plain when they argued that 'socio-cultural validation' is needed for creativity – a product is creative when experts in a domain apply the term to it in order to express their approval, and judge that it is suitable to be incorporated into the field in which they are experts. In other words, the creativity of a product is in the eye of the beholder and is relative to what the society judges to be suitable for a particular field. Furthermore, as for instance Kay and Zuo pointed out, experts' judgments are affected by aesthetic awareness, which is at least in part learned and peculiar to a particular culture.

Creativity theory has long acknowledged that there is a difference between creativity in the sense of a novel work that is revered over the ages and in the sense of simple production of variability that is quickly forgotten, even if its novelty is effective in a particular context at a certain moment. A homely example of the latter would be the creativity of a home cook who made an unusual combination of ingredients to produce a new and pleasing taste effect which was praised at the time but was not recorded and was only vaguely remembered, even by the cook. One way of referring to these two kinds of creativity has been to label them 'little c' and 'big C' creativity. A related issue involves the question of the difference between children's creativity, especially young children, and that of

adults. Both groups may display divergent thinking, high levels of motivation, openness, ability to use certain tools (such as crayons), risk taking and similar processes and properties, and yet there are marked differences between what they produce. The application of concepts from aesthetics provides a way of describing the similarities and differences: the work of children may well display aesthetic sensibility, aesthetic awareness or aesthetic feelings, but it seldom leads to products that strike beholders as beautiful or as revealing truths about the world or delivering insights into the structure of things.

Useful Products

The problem that creativity is essentially an aesthetic judgment based on the subjective views of observers and the current tastes of the society has dogged creativity research from early in the modern era. Some writers such as Robert Albert have argued that defining the creativity of products is too subjective and too unstable (relative), and recommended concentrating instead on creative people and creative processes. However, early in the modern era David MacKinnon and more recently Susan Bailin have insisted that products are the 'bed-rock' of creativity, and are central to its study. Thus, what is needed is a systematic way of understanding what the properties of products are that make them pleasing to observers and lead to aesthetic judgments that different people agree on and that are stable across societies and over time.

It is notable that most discussions of aesthetics have involved fine art. Questions of the aesthetic properties of, let us say, engineering products, business solutions, manufacturing systems, or administrative procedures are far less frequently studied, although not entirely ignored. That aesthetic properties of such products are evident to observers was attested to by the rocket engineer Wernher von Braun, who stated that: "The eye is a fine architect. Believe it!" He meant that they are pleasing to the eye, and that this supports the inclusion of beauty, along with effectiveness and novelty, as a key criterion of creativity. In recent years, discussions of, for instance, engineering design have been broadened to give greater emphasis to aesthetic issues, and this broadening of view has been reflected in some official documents such as curriculum materials for technological design education.

The idea of functional (useful) novel products is probably most obvious when it is applied to daily-use objects such as an appliance or machine, or to an effective, complex system of some kind (such as a jet aircraft, or a business information system), or on the other hand to a process in the sense of a service, technique or method (a manufacturing process, a control process, a logistics service). However, paintings, musical compositions, poems or novels, or even systems of ideas as in, let us say, philosophy or mathematics, are also products that successfully perform tasks of their own kind, such as capturing the essence of beauty or order, or communicating a feeling to another person, or introducing a new way of going about tasks of this kind.

The question now arises: "Useful to whom?" In the Renaissance, the notion of *il divino artista*, who is above the rules that apply to other humans was widely accepted, for example, Benvenuto Cellini. Later, the same view received a powerful

boost during the heyday of romanticism, and was exemplified by such outstanding (but morally flawed) creators as Lord Byron and Richard Wagner. In related, more recent psychological discussions, creativity has frequently been looked at in an extremely individualistic way, and has been regarded as closely connected with self-actualization. Not infrequently, this self-actualization has been seen as requiring a fight against the surrounding society or 'defying the crowd.' Contrasting with this emphasis on the individual, however, is the idea that creativity should be useful to the society. In seventeenth century Europe, Francis Bacon and René Descartes, two leaders of the enlightenment, wrote that the main purpose of scientific creativity was to serve the common good. Robert Sternberg argued that creative products must be guided by wisdom and that wisdom necessarily involves striving for the common good. This raises the question of whether something destructive or evil can be regarded as aesthetically pleasing.

A Universal Aesthetic of Creativity

More than 250 years ago, William Hogarth attempted to develop a universal set of aesthetic criteria for judging the beauty of artistic products, and concluded that there are six central qualities: (1) harmony among the parts of a work; (2) variety in as many ways as possible; (3) uniformity, regularity or symmetry, which is only beautiful when it helps to preserve the harmony in (1); (4) simplicity or distinctness, which gives pleasure not in itself but by enabling a beholder to enjoy the work's variety; (5) intricacy, which makes it necessary for the beholder to think actively about the work; and (6) quantity or magnitude, which captures beholders' attention and produces admiration and awe. More recently, however, in a famous and frequently cited essay in the area of art criticism, Clement Greenberg argued that "each art form has its own system for the judgment of aesthetics." This issue of domain specificity versus generality has been discussed in a more general way by various writers such as John Baer and Jonathan Plucker. Arnold Ludwig showed that there are both similarities and differences across domains, largely deriving from the cognitive (relevant skills and knowledge), motivational (e.g., determination vs. inspiration), personal (e.g., openness for the new vs. application of the familiar) and other demands of the domain.

In the preface to his own novel, *Nigger of the Narcissus*, Josef Conrad suggested a taxonomy for distinguishing different forms of creativity that implies that aesthetics only applies to artistic creativity: He argued that writers, poets, artists and the like achieve creativity through production of *beautiful* objects, whereas philosophers do it through production of novel ideas, and scientists and engineers through production of novel facts. Indeed, aesthetic judgments based on beauty of form are typically regarded as applying mainly to fine art, literature, music, drama, dance, and similar artistic fields. However, recent discussions such as that of David Cropley, James Kaufman, and Arthur Cropley have asked whether a universal aesthetic can be developed which is capable of being applied to products in all domains, including not only fine art, music, or literature, but also science, medicine, engineering, and technology, or business and manufacturing.

Jerome Bruner gave some idea of what usefulness would involve by emphasizing 'relevance' and 'effectiveness,' and more recent writers have stated that products must be appropriate, correct, useful, or valuable. In other places we have argued that, although novelty seems intuitively to take precedence over usefulness in determining creativity, in the practical world the most important aspect of a useful product that excites admiration in the beholder is effectiveness. A product must be valuable, logical, useful, and understandable. To take a simple example, a bridge must get traffic across a river. If it does not do what the engineers were hired to build it for, it lacks effectiveness and is thus not creative, no matter how novel it is.

Even in artistic domains, effectiveness is important. Emile Zola displayed extraordinary imagination and poetic fantasy (novelty) in his novels, it is true, but without his mastery of the French language, painstaking research, and detailed drafting of plot his manuscripts may well have been surprising, even shocking, but would have lacked effectiveness and may well have produced no more than quasicreativity. Vincent Van Gogh lacked technical knowledge of how to paint, and had to return at the age of 32 to the Academy of Art in Antwerp, where he was taught to express his flair for color and light in an effective way. He did not have to learn how to generate novelty, but how to convey it effectively to others.

However, Einstein made a direct link between creativity and aesthetics by arguing that it is not difficult to find novel solutions to problems that achieve the desired effect. The difficult part is finding solutions that are beautiful (that is, aesthetically pleasing). Robert Grudin reinforced this idea when he referred to "the *grace* of great things [emphasis added]." These authors were, in fact referring to the beauty of products, that is, to their aesthetic properties. Aesthetically pleasing solutions are logical, harmonious, organic, and complex (labeled 'internal elegance' by Cropley et al.) as well as well-crafted, pleasing to observers, even beautiful (external elegance). Elegance thus involves a mixture of pure aesthetic, formalist, and technical properties. Such solutions not infrequently cause a more or less instantaneous shock of recognition when they occur, and provoke a "Why didn't I think of that?" reaction. Indeed, an elegant solution may look so simple and obvious – after the fact – that viewers may under-rate its creativity or denigrate it as banal.

A second additional criterion of aesthetic pleasingness in creative products is 'Genesis.' Generic novelty is not only useful in the situation for which it was generated, but can also be applied in other apparently unrelated situations. It may introduce a new way of conceptualizing an area, for instance by opening up new approaches to existing problems (germinality), or by demonstrating the existence of previously unnoticed problems (seminality). In other words a generic product reveals the fundamental truth and structure of a domain, that is, it is beautiful in the Kantian sense.

Conclusion

Recognizing the aesthetic elements of creativity expands the vocabulary and concepts that are available for studying it, casting new light on issues such as creative problem solving or motivation in creative individuals. However, although the

label 'creative' involves an aesthetic judgment, the idea of beauty is both subjective and relative, with the result that it is difficult to obtain agreement among different beholders on aesthetic properties. This means that the judgments of experts such as, let us say, art critics or teachers may disagree markedly from those of laypersons or schoolchildren, with consequent difficulties of communication. For a similar reason, experts from differing aesthetic cultures may make widely differing aesthetic judgments. A universal aesthetic of creativity would enable not only teachers, critics, and reviewers, but also practitioners such as artists, scientists, or engineers to express in a cohesive and systematic way the effect on them of the different kinds of performance that they regard as creative, perhaps making it possible for people who generate creativity in different domains such as the arts, science, fashion, design, architecture, engineering, manufacturing, and marketing to articulate in a common language (to themselves, to colleagues, to critics, to sponsors, to clients, to the general public, etc.) what they are seeking to do, or have done. It might even make it possible to compare, let us say, the Mona Lisa, directly with the Golden Gate Bridge, Einstein's theories of relativity, or an advertising campaign. We have suggested such a system by adding aesthetic criteria (elegance and genesis) to novelty and effectiveness in defining creativity.

See also: Architecture; The Dark Side of Creativity; Definitions of Creativity; Moral Issues in Creativity.

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Aging

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Introduction

In the year 2009 the artist Louise Bourgeois was 98 years old, a fact which added a special flavor to the media's reports about her, at least from a Swedish perspective. In one newspaper, for example, it was claimed quite a tragedy for Bourgeois as a human being, that she was still seeking her identity.

Another likewise illustrative example is the scientist Jan-Åke Gustafsson, who had said that he was expecting to quit his career in Sweden, upon turning 67 the following year. Instead he described how he had been welcomed to Houston, Texas, where he was fully engaged in the building of a large research center, planned to house 150–200 researchers.

Society's regulations, for example, mandatory retiring at a certain age, inevitably influence people's attitudes in general, and researchers are no exception. The scientific view on how getting older affects us, as far as creativity is concerned, has been a matter of dispute for more than half a century – boiling down to the key question whether we, as some believe, become less creative with age, and in some instances, wiser. Others assert that it is possible and indeed good for you to keep your creativity alive, and that it actually helps you to stay happy and 'alive and kicking' as senior citizens. For example, people with higher scores on a creativity measure have been found to have a more positive attitude toward aging compared to those with a low score.

The Definition of Creativity

This brings up the issue of how we define creativity. As is often the case, part of the answer depends on the perspective. Focusing on the creative product, we might on the one hand concentrate on major and long-lasting ('big C') contributions made by a person in their chosen field, or we could discuss 'little c,' implying contributions on a small scale to a person's well-being and to their near environment in time and space. Since obviously the large majority of people have not contributed on a grand scale to the culture or to our society, the present article would only concern a small minority, were we to restrict ourselves to the 'big C.' Instead we prefer to touch upon a slightly philosophical note, or at least an evolutionary one, where we agree with earlier scientists, for example, Lev Vygotskij, that every human being is equipped with a potential for creativity. This claim does not exclude that we fully understand and likewise adhere to another principle, namely that the individual's resources in a wider sense, ranging from individual differences to the environment in terms of family and society, exert positive or negative influences on the scope as well as the fulfilment of a person's creative potential.

Creativity, as we see it, should primarily be defined by the novelty of the products, not by the usefulness, value, or beauty. It is rather that the new product or idea has been developed in

dialogue with the reality it is intended to replace. Creativity is not an inherently good thing in the moral sense, but is used in the interests of a certain individual or group.

The Life Span Developmental Model of Creativity

Considering this definition, we think it is important to widen our search from the product perspective to other perspectives when we look for new research about creativity and aging. In the first edition of the *Encyclopedia of Creativity*, Becca Levy and Ellen Langer made a valuable summing-up of the controversy between the so-called Peak and Decline view on the one hand and the Life Span Developmental Model on the other. The decline model was formulated by Herbert Lehman in the middle of the last century. His view has had a long influence, as was thoroughly described and discussed by psychologist Martin Lindauer, in his book *Aging, Creativity, and Art*. According to Lindauer, the quantitative measurements of creative historical persons, that were done by Lehman, have had a major influence over our views on old age creativity. However, in agreement with Levy and Langer, Lindauer concluded that despite its advantages, the decline model has many deficiencies due to both methodological and conceptual difficulties, with regard to the creativity concept as well as the conception of aging. Instead Lindauer showed good arguments for the continuity (life-span development) model, or rather that creativity is manifested differently over the lifetime due to the different demands on younger and older individuals. The many creative accomplishments of very old and very famous artists are important counterarguments to the early decline model and to the ageism which exists in society.

Additional support of the life-span development model was earlier found by the authors. In one project we investigated children's creativity in cross-sectional the age groups. Here we found lows and highs depending on age group. In seven year olds, creativity was particularly low, possibly due to both developmental factors and to the fact that these children had recently begun regular school (which in those days was the year when the child reached seven years old) and were still in the process of adapting to school. This result makes it quite likely that there exists a more accurate model than the linear one for how creativity develops over the life span.

In another study creativity levels were compared between a youngsters' group, a group of middle-aged people, and an elderly group including both recently retired persons and older pensioners. Creativity, as measured in the testing, was present in around two-thirds of the youngsters' group. It was found in half of the middle-aged group of people, and a few percent below that in the retired group. One thing contributing to the relatively modest level of creativity in the middle-aged persons' group could be that these years are pretty stressful, occupied by several duties that draw from the resources

available to function creatively. In this comparison of several age groups it is noteworthy that rather many pensioners had signs of creativity when tested, although admittedly most were on the lower end of the scale. It is probable that this group, born during the first two decades in the previous century, had had scant acquaintance with research and psychologists' tests, as well as having undergone a more authoritarian upbringing. These circumstances may have contributed to their greater cautiousness and their need to perform correctly and adhere to the objective norm.

An important scholar we find relevant to mention in this connection is psychoanalyst George Vaillant. He has underlined the mysterious fact that creative old people are still able to play. He continued by discussing the intriguing psychodynamics involved in creativity as an adaptive ego operation, and that it is also an ego function beside conflict. Vaillant's standpoint was that we all have the capacity for creativity within us. But since he also claimed that the task of youth is to innovate and that the task of old age is to pass on what has been learnt, in his conclusions he implicitly seems more supportive of the Peak and Decline model – as indeed was Freud before him. One argument in response to Vaillant is that it takes creativity to be able to pass on what has been learnt, for example, when relating to younger generations or writing about one's life and acquired knowledge – in line with Lindauer's discussion about different demands on the creativity of younger and older individuals.

New Conceptions of the Brain and of Creativity in the Latter Part of Life

"Becoming very old is good – as long as I don't have to take the consequences!" Whether this is a real quote from Woody Allen or not, many of us probably agree with the sentiment. People seek longevity but want to keep their vital functions intact. For example: After a certain age, in the late summers you start to listen eagerly for crickets and you get very relieved when you hear one. Let us then hope that you have not mistaken your tinnitus for the crickets!

Indeed we cannot escape the fact that physical functions and vital organs in the body get worn and lose the capacity of the young. For instance our pulse maximum decreases when we get older and it cannot be improved by training. Another example is that older adults have more difficulty focusing their attention and ignoring distracting stimuli. Much decline in mental ability is however often not caused by aging *per se* but by specific diseases, such as dementia or depression.

A notable contribution in support of old age creativity was recently made by psychiatrist Gene Cohen. Acknowledging the great contribution regarding the general life span development made by Erik Homburger Erikson, Cohen stated that Erikson himself thought his work on aging was incomplete. Cohen therefore delineated a new model of psychological development in the latter part of life, to be described below in certain detail.

Building on new research findings about the brain, Cohen made some important statements about it: First that the brain continues to develop into old age due to new experiences and learning, and that actually new brain cells form in the adult

brain. Next, that the brain's biological basis for our emotional life also develops and gets more balanced with age; and finally that the brains' two hemispheres are more equally used by older adults.

It is of interest that older people in certain tasks use the two brain hemispheres more equally, which according to Cohen could contribute to make old people more creative. This has however in other research also been interpreted as a sign of compensation for loss of resources which leads to the activation of larger brain areas.

Empirical support for the importance of using both hemispheres for creativity has earlier been given in research showing that highly creative young adults used both their frontal lobes approximately equally during a creativity task, in contrast to low creative persons who mainly activated areas in their left frontal lobe. However, since we know of no study that has actually looked at the hemispheric activity when old people perform a creative task, Cohen's point needs more evidence. Recent brain research clearly speaks in favor of the preservation of old people's cognitive and relational competences, but it is uncertain if this fact implies creativity, or if it rather leads to better and wiser decisions in older persons.

It is an indisputable fact that it takes many years of hard work and experience to achieve excellence in a field, and the reported difficulties with distracting stimuli might actually simultaneously be an indication of creativity, since research has shown that creative persons are often typified by slight disinhibition in the brain. It seems likely that disinhibition in the brain is one of the ingredients in human curiosity. Being less inhibited and controlled sets loose our inquisitive and curious minds, and the urge to seek out new problems and unanswered questions is an obvious starting point and motivating force for creativity. A curious mind is an important ingredient in what Cohen calls the Inner Push – the fundamental need to grow and develop.

Four Developmental Subphases in the Mature Age

Regarding the development in later adulthood, Cohen formulated four different subphases in what Eriksson called the mature age, namely midlife reevaluation, liberation, summing up, and encore. In the *midlife reevaluation* phase which encompasses the forties and fifties, people come closer to the personal realization that they themselves will die. They do not any more have only the abstract thought that people eventually will pass away. This brings forth a sense of a quest, or in some instances, crises where new exploration is made and maybe a transition to new fields. Certain positive new qualities follow from this reevaluation, for instance more openness to new ideas or complexity in life, as well as greater respect for one's intuitive feelings.

Secondly, *liberation* phase, roughly covering the time between the late fifties to early seventies, people have a sense of "if not now, when?" and coupled with partial or full retirement this gives the feeling of greater personal freedom to act according to one's own needs. Referring to empirical studies, Cohen claimed that this phase includes a significant shift in personal identity and furthermore that the brain in this age period has the richest number and density of dendrites in the

hippocampus – the brain's 'memory centre' – and that new neurons form as well in the hippocampus. In combination, this gives both the push and the capacity to learn new skills and enter new challenges.

Interestingly, recent research has shown – albeit on laboratory rats – that lifelong intermittent environmental enrichment since infancy prevents the decline of recognition memory, reduces anxious behavior in a novel environment, and increases the number of newly generated neurons within the hippocampus during aging. Obviously, a mouse is not a man, but nevertheless the species share many biological characteristics, making the generalization quite feasible.

Cohen describes the third phase as the *summing up*, which we enter when approaching seventy, or sometimes several years later or earlier. Typically, people now need to find an overall meaning in their lives, and to pass on to others their accumulated knowledge and other resources. This can be accomplished by personal story-telling or even memoirs. Moreover this phase implies new pressures to look back and review one's life and, if possible, to bring closure to unfulfilled business – whether with other people or with important projects.

The last part in our lives, from the late seventies and onward, the *encore* phase in life, is a set of variations on a person's life themes, and the three preceding stages are now combined, motivating the person to sometimes engage in 'jumping the tracks,' according to Cohen. Even despite serious physical problems an old person can feel vitality and enjoyment, especially in close and significant relationships. To learn new things and to train your brain, are according to Cohen, the keys to vigor in the oldest age groups.

All the good advice given by Cohen to older people cannot possibly be recapitulated here, but we could not abstain from sharing his advice about keeping a dream journal. To be able to remember our dreams at night, as it seems, becomes less frequent with age – even if we can only present anecdotal support for this belief. We are inclined to agree with Cohen's assertion that dreams are sometimes creative. His own example of awakening from a dream is quite fascinating: He describes how he was dreaming a creativity equation formulated as: $c = me^2$, and interpreted it such that our creativity (c) equals our mass (m) of knowledge, multiplied by the effects of our experience (inner psychological combined with outer life experiences; e^2). Obviously, as he himself acknowledged, the equation is wish-fulfilling, and supports his thesis, namely that when we get more knowledge and experience we also get the resources to become more creative!

The Creative Person's Contact with the Inner Child

The authors must however point out that the matter is not settled there, and that Cohen's creativity equation needs further interpretation. Not just knowledge and experience are needed for us to be creative. Rather, much motivating power must be provided to serve as the necessary ignition fuel, to more or less keep the engine constantly working, to keep us daring and venturing to take risks against the odds. Looking in the rear view, it seems that when certain important aspects in our lives are fulfilled, maybe the drive, or inner push in

Cohen's words, tends to get weaker. We are convinced that the significance of the whole word '*me*' in the playful equation above should be considered as the most important factor!

Personality variables have been described by many scholars to play a decisive role for the creative accomplishments of a person, indeed more so than general intelligence above a certain level. High sensitivity and elevated anxiety levels have been recurrent in our own findings, together with a flexible defensive structure. This flexibility includes both childish as well as mature defensive signs, and moreover very often includes an ability to symbolically or metaphorically handle and elaborate on a disturbing reality.

It would seem that a child with both high sensitivity and high curiosity could be the parent of a creative veteran, so to speak. Early stressful life experiences are often harder to bear for a sensitive child but serve at the same time as fuel for his or her motivation. Difficult life events, given the proper environmental support and resources, can be the necessary fuel for the first creative accomplishments which from thereafter enforce and encourage further efforts in the same vein.

It is probably productive to start 'exercising' creativity from early childhood. Even if a curious mouse is not really creative, the enriched environment proved to have good effects for cognition and feeling in the old mice. For infant human beings as well, more varied environmental stimulation and opportunities to explore it freely, may have long-lasting effects on the later life. Studies have found that creative old people often put up less blocks against (experimental) threats of illness, and also have a more flexible and emotional view of themselves. If the individual learns early on to develop and use flexibility and imagination, this should give better possibilities to overcome obstacles and drawbacks during the life, and most probably a healthier life than if creativity was stifled.

A System's Perspective on Creativity

When viewing creativity over the life span, it is wise to broaden the perspective, as for example, done by Mihalyi Csikszentmihalyi, from the individual to the environment, and not least to the individual environment at their work. Since a large part of our time before we retire is spent at the workplace, to spread the present conditions existing at many workplaces should give opportunities for the seniors in society to keep their engagement high. This ought to be a benefit for various things, not just keeping the direct costs lower for illnesses and disease.

It seems to be never too late, if Cohen and Landauer are correct, to start practising your imaginative mind and begin looking in new directions. After a strained working life it appears to be a fact that people tend to feel several years younger after having retired. This of course is quite understandable but also says something less fortunate about the increasingly pressing conditions and conflicting demands at our workplaces. Too much emphasis on high productivity and maximization of growth is likely to cause a general decrease in the staff of precisely the thing that is sought after, namely the truly creative persons bringing forth high innovation.

If creativity depends on different resources from the environment as well as from the individual, then it would seem quite inevitable that when retiring from work people lose

many outer resources needed to continue their professional creative endeavor. However, given that the inner push still is there, the person may continue to explore and be curious, sometimes in other domains. Maybe the creativity changes from a 'big C' into creativity on a smaller scale, or, in fact, the opposite can occur too. The 'courage to create,' as it was once formulated by Rollo May, should be greater in the older age groups, since much has already been accomplished, and you have become more confident in your own ability to create. According to Csikszentmihalyi, creative wisdom needs a broader viewpoint and the combination of knowing and sensing, feeling and judging. Naturally, this often cannot be expected to bring public success, but instead deeply personal meaningfulness and connectedness to mankind and one's existence.

Conclusions

The creativity of older people, coupled with their wisdom, appears to be a much needed competence. In today's highly technological world, new ideas, paired with not yet developed wisdom in youthful 'folly,' can lead to immensely more fatal, as well as far-reaching, consequences than could ever have happened in man's evolutionary childhood. However, this fear that the young are too wild seems to have been in existence since ancient times – naturally we can do nothing else but to set our hope on the young who the world is bound to rely on.

Encounters between the young and the old are often lacking but are immensely important. Since creative people even in old age tend to view themselves as younger than their actual ages and to have access to the inner child, schools, for example, should seek help of older volunteers to a much greater extent than is currently the case. The old age groups are growing faster in numbers than the younger ones – at least in the European and North American societies – making it of plain socio-economic importance that stereotypical attitudes and ageism are diminished in the general view on aging, which otherwise will continue to generate self-fulfilling prophecies and perpetuate discrimination.

It is our belief that being creative is to be alive in a deeper sense of the word, and that it implies 'open doors' exist both toward the external world and to our own inner world. If the door to one's own deeper layers is bolted in denial, this may lead to blocks or to a manic proficiency, but not to really creative solutions to the challenges we meet at each new step in life. From a dynamic perspective it is acknowledged that the inner 'memory cosmos' developed during an individual's lifespan is for the large part unattainable. Still, important memories from the early years continue to color and ignite feelings and meaningfulness in latter years.

Each crucial occasion in the life of an individual involves actualization of past, often hidden experiences. As many can bear witness about, creative channels help us to cope and transcend losses. These inevitable losses may even trigger a creative response and the use of latent resources. To seek one's identity repeatedly in a creative process during the lifetime implies confronting deeply personal questions carried along from the early years. In essence these are questions about relationship versus separation, and failure versus mastery, and the final existential question about how to master the separation.

See also: Brain and Neuropsychology; Life Stages of Creativity.

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Relevant Websites

- <http://www.creativeaging.org/> – National Center for Creative Aging.
- http://hubpages.com/hub/Creativity_and_Aging_Wellness – Creativity & Aging: Seniors Benefit.

Altered and Transitional States

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Glossary

Altered states of consciousness An 'altered' conscious state can be defined as a pattern of phenomenological properties recognizable by an individual (or group), or by an external observer of that individual (or group), as representing a major difference in behavior and experience from an ordinary baseline pattern of waking consciousness. An 'altered state' involves changes in a number of those phenomenological properties such as emotions, intentions, perceptions, imagery, and other so-called 'subsystems' of consciousness. Both dreaming and nondreaming sleep differ from baseline consciousness, thus qualifying as 'altered states'; so do variants in wakefulness resulting from meditation, prayer, mediumistic activity, 'peak experiences' in nature, and other 'spiritual' experiences. Studying the phenomenology (or subjective experience) of an 'altered state' can be accomplished through observation, self-reports, interviews, or administration of such instruments as the Pekala scales.

Changes in consciousness Changes in patterns of phenomenological properties can be brought about by contemplative, sexual, athletic, recreational, and other pleasant behaviors as well as by unpleasant ordeals such as torture, starvation, and trauma, or alleged 'possession' by discarnate entities. Psychopathology provides additional examples, such as dissociative and mood disorders,

post-traumatic stress reactions, and psychotic episodes. Both pharmaceutical drugs and psychoactive plants may produce changes in one's phenomenology.

Consciousness The term 'consciousness' derives from the Latin *conscire*, to know with, or to be cognizant of something. Ordinary waking consciousness reflects the explicit knowledge of one's situation, along with such patterns of phenomenological properties as awareness, attention, intentionality, and one's sense of personal existence. In general, 'consciousness' can be described as a pattern of phenomenological properties (perceptions, cognitions, feelings, etc.) that characterize a human or other sentient organism at any given point in time.

Creative The term 'creative' can be applied to any act, idea, or product that changes or transforms an existing domain. A phenomenon is creative if it is novel and, in some manner, useful or appropriate for the situation in which it occurs.

Transitional states of consciousness Typically, a 'transitional conscious state' lasts for a brief period of time, mediating between two longer lasting patterns of phenomenological properties. Hypnagogic states are transitional because they mark the shift between a baseline state (wakefulness) and a long-lasting altered state (sleep). Other transitional states include daydreaming, reverie, napping, and hypnopompic states, the latter occurring when a person is awakening.

Creativity, Consciousness, and Culture

The terms by which people make sense of their world are social artifacts, products of historically situated interchanges among people. In the history of Western civilization, not all individuals have had equal opportunities for creative expression. For example, the creativity of women was rarely valued or encouraged; they were given few occasions to develop the skills (e.g., critical thinking) or life circumstances (e.g., solitude) on which creative work often depends.

Historical Overview

The paintings in the Lascaux Caves of southern France date back at least 17 000 years; the prone figure depicted there is often regarded as a shaman experiencing a changed state of consciousness. Because psychedelic (from the Greek words *psyche* and *deloun*, i.e., 'mind-manifesting') substances helped many shamans enter the 'spirit world,' they became a technology for the production of mythic narratives, theatrical performances, chants, songs, dances, and other products currently labeled creative. Traditional Siberian shamans still 'journey' to

the 'spirit world' with the aid of psychedelic mushrooms and/or rhythmic drumming.

Initiates of the Eleusinian Mysteries in ancient Greece probably used a potion containing a psychedelic fungus to fathom what the poet Pindar called "the end of life and its god-sent beginning." India's Vedic hymns sing the praises of *soma*, an intoxicant that was "all pervading, swift as thought"; psychedelic mushrooms may have been its active ingredient. In pre-Conquest Mesoamerica, the natives used their talents creatively in the service of their religious beliefs. Aztec poets and musicians rhapsodized about the 'dream flowers' that took them to another world. Wasson, writing in 1980, found similarities between the use of psychedelics in pre-Conquest Mexico and their use in ancient Greece; mind-altering plants adorn both the vases of Attica and the architecture of Mitla.

Cross-Cultural Comparisons

Societies have an assortment of terms to describe activities resembling what Western psychologists refer to as creativity; for example, the first hexagram (or *kuan*) of the Chinese 'Book of Changes' (or *I Jing*) is *Ch'ien*, the 'Creative Principle.'

Most Asian, African, and Native American traditions also used creative imagination to enrich and enhance everyday life; novel, original contributions were typically seen as gifts from deities or spirits who used humans as 'channels'. Yet in some of these societies an individual who produced something unprecedented (e.g., an unusual mask) was censured for breaking with tradition; talented craftspeople were valued, but individuals with a flair for novelty were chastised. When the church's power was dominant, Western cultures tended to consider 'channeling' as demonic; once 'enlightened' science and medicine prevailed, such forms of experience were cast in psychopathological terms. By contrast, traditional Eastern cultures such as Hinduism and Buddhism had intricate vocabularies to describe the spiritual aspects of changes in consciousness. Many tribal people go through the day in what Westerners would consider a well-organized hallucination, since the world they believe and live in bears very little resemblance to the lived experience of Westerners. In dreams and in waking visions, the Maya people asked their deities to appear before them, reflecting a tradition of visionary ecstasy that had bequeathed them an intense and often overwhelming universe. Pre-conquest Maya artists depicted an overlap between the world of everyday reality and the 'spirit world,' suggesting a baseline state of consciousness that was much more 'dreamlike' than that of their European conquerors. Freud's description of the conscious ego as the external boundary of an invisible matrix of volatile 'psychic energies' that feeds and informs it resembles the shamanic energetic model of the human body embedded in a community and environmental matrix. However, from the shaman's perspective the 'unconscious energies' of the Freudians were not blind and irrational, but keenly intelligent, originating in the earth itself rather than in the neurons of the brain.

Creativity and Psychedelic Substances

Psychedelic substances and other drugs affect consciousness by modifying the process of synaptic transmission in the brain. Excitatory and inhibitory connections between neurons are carried out by transfer of special biochemicals (neurotransmitters) across the synaptic gap between neurons. Drugs can affect synaptic transmission in a variety of ways, such as blocking the production or reception of a neurotransmitter or mocking a neurotransmitter, thus effectively increasing its activity level. The phenomenological pattern that a drug evokes depends upon which particular neurotransmitters it affects and how. In the case of psychedelics, the result seems to be a disruption of logical analysis and the automatic reality-checking functions of the brain, probably connected to the ability of these drugs to block serotonin transmission. In psychotherapy, psychedelics can produce a depatterning influence that breaks up the individual's habitual experiences of the world, tending to increase the individual's suggestibility and susceptibility to reprogramming.

There have been several anecdotal accounts by creative individuals in Europe, Canada, and the United States claiming that their creative behavior has been positively affected by ingestion of psychedelics. They include neurologist S. Weir Mitchell, British writer Aldous Huxley, US naval technician John Busby, actors Cary Grant and Rita Moreno, and the

Canadian architect Kyo Izumi. Both Kary Mullis and Francis Crick attributed their Nobel Prize-winning discoveries (e.g., a deoxyribonucleic acid (DNA) detection method; the double helix structure of DNA) to experiences with D-lysergic acid diethylamide (LSD), at least in part.

The 'Model Psychosis' Assumption

Some early researchers reported that LSD users gave highly imaginative, although bizarre, responses to Rorschach inkblots. In summarizing his observations of LSD users in 1976, the psychoanalyst Silvano Arieti found that the use of 'primary process mechanisms' was enhanced, but that the 'secondary processing' required to put the imagery to creative use was impaired. These studies and related research, conducted with both artists and nonartists and with both laboratory subjects and 'street users,' identified many dysfunctional results of informal psychedelic drug usage but no conclusive data supporting the notion that psychedelics could produce a 'model psychosis.' In 1988, T. E. Oxman and colleagues reported a content analysis of 66 autobiographical accounts of schizophrenia, psychedelic drug experience, and mystical experience, as well as 28 autobiographical accounts of personal experiences in ordinary consciousness. Finding that 84% of the samples could be categorized correctly on the basis of word frequencies, they concluded that there is a 'clear dissimilarity' among changed states of consciousness, especially between psychosis and psychedelic drug states. This contradicts the 'model psychosis' perspective and its assumptions about congruences between schizophrenia and patterns of phenomenological properties evoked by such drugs as LSD, mescaline, and psilocybin. Creativity, of course, is only one of several instances of psychedelic phenomena, but one that often can accelerate the incubation phase of the creative process.

Creativity Research with Unselected Subjects

A number of studies were conducted with unselected subjects, primarily college students, in the 1960s and 1970s in an attempt to determine the relationship between psychedelics and creative behavior. For example, to study the effects of LSD on creativity test scores, a test battery (also administered to a control group) was given before LSD ingestion, and alternative forms of the same tests were administered 2 h afterwards. It was observed that most of the comparisons on the creativity tests favored the LSD group; on the other hand, that group did poorly on tests requiring visual attention. In another study, one-third of subjects were administered a high dose of LSD, one-third a low dose, and one-third an amphetamine. A test battery was administered to each group prior to drug ingestion and again at intervals of 2 weeks and 6 months after the third session. The low LSD and amphetamine groups obtained similar scores, but the high LSD group bought more musical records, spent more time in museums, and attended more musical events; neither LSD group demonstrated higher scores on creativity tests. Another study dispensed psilocybin to volunteers, most of whom were able to complete a creativity test and a test for brain damage before the session, as well as 90 and 270 min after drug ingestion. A significant inverse relationship between the scores on the two tests was reported.

These and similar studies cannot be considered conclusive, since they differed in many ways; however, it appears that volunteers cannot expect their creative behavior to be enhanced by psychedelic ingestion alone.

Creativity Research with Selected Subjects

In the 1960s, LSD was administered to 50 well-known artists at the Max Planck Institute in Munich. The results varied, but the artists concurred that the experience was of value, and the ensuing work was displayed in a Frankfurt gallery. In a study on the effects of mescaline and LSD on four US graphic artists, a panel of art critics judged the paintings to have greater aesthetic value than the artists' usual work, noting that the lines were bolder and the use of color more vivid. A similar study giving LSD to American actors, artists, musicians, and writers resulted in judgments by a professor of art history that the LSD paintings were more imaginative, especially in color, line, and texture, though the technique was poorer.

A study of professional workers in architecture, engineering, commercial art, furniture design, mathematics, and physics showed that mescaline ingestion resulted in a statistically significant increase in creativity test scores, with enhanced fluency of ideas, visualization, and field independence. Interview and questionnaire data suggested that about half the group had accomplished a great deal more during the mescaline session than would have characterized their ordinary workday. All subjects reported positive reactions to mescaline, but a larger number of subjects were unable to concentrate on their projects because they were diverted by the experience itself.

Cross-Cultural Considerations

The potent red mescal bean, *Sophora secundiflora*, has been found with the remains of the extinct bison and the tools and weapons of early North American hunters. Many of the chants and poems used in spiritual ceremonies make great demands on the practitioner; the Yakut shaman in Siberia, for one, has a poetic vocabulary of some 12 000 words for use in *Amanita muscaria* mushroom rites, as compared to 4000 in the ordinary language of the community. The Zuni rain priests of New Mexico have a special language with which they converse with spirit birds once they have ingested the mind-altering *Datura meteloides*. For native people, these substances are not taken trivially, for momentary pleasures or 'cheap thrills.' To maintain these standards, native groups require a precise amount of time for the preparation of psychedelic concoctions, and the mixture of ingredients must be exact. Even then, there may be an initial period of bodily discomfort, physical pain, or vomiting, followed by encounters with the malevolent entities thought to inhabit these realms.

Paradoxically, psychedelics foster creative behavior among native people by *reinforcing* the cultural myths and traditions. The *ayahuasca*-ingesting Siona shamans of the Amazon do not experience random images; rather, their experience is an ordering of the induced visions into culturally meaningful symbols and experiences. On the other hand, psychedelics often stimulate creativity among specialists in industrialized societies by *deconditioning* them to their cultural traditions; in contrast to

tribal shamans, their images are likely to tap into their personal rather than their social *imaginario*.

Creativity and Reverie

The term 'reverie' is defined in various ways, but it is usually said to be 'dreamlike' in that it is involuntary, fanciful, and imaginal, although it does not occur during nighttime sleep.

Creativity and Hypnagogia and Hypnopompia

Investigators of intuition have reported an association with hypnagogic (from the Greek *Hypnos*, or sleep, and *agogeus*, or leading into) reverie, the thoughts and images occurring during the onset of sleep. There is a similar association between intuition and hypnopompic (from the Greek *Hypnos*, or sleep, and *pompe*, or leading out of) reverie, which occurs as one awakens from sleep. These transitional states, referred to as hypnagogia and hypnopompia, resemble dreams in that both are marked by 'primary process' thinking and contain visual, auditory, and/or kinesthetic imagery. However, material from these twilight states is not typically characterized by narration, as with dreams. Hypnagogic imagery may render more obvious those images involved in scientific creative activity. Indeed, hypnagogic images seem to have been a critical factor in chemist Friedrich August Kekulé's conceptualization of the structural formula of the benzene molecule. Ludwig van Beethoven reported obtaining inspiration for a composition in 1821 while napping in his carriage en route to Vienna. William Blake claimed that images of spiritual beings started coming to him as a child and served as the basis for many of his later drawings. Thomas Edison often stretched out on his workshop couch; during these 'half-waking' episodes, he claimed that he was 'flooded' by creative images. Mary Shelley reported that her classic tale, *Frankenstein*, came to her as a series of hypnagogic images the evening after her group of friends agreed to compete for the best original Gothic horror tale (Shelley won).

Creativity and Daydreaming

Autobiographies and biographies reveal a number of prominent individuals who seemed to utilize various types of daydreaming for creative purposes. Isaac Newton claimed to have solved many vexing problems in physics when his attention was waylaid by private musings. The composer Claude Debussy used to gaze at the river Seine and its playful reflections of the sun to establish an atmosphere for his creativity. The writer Friedrich Schiller kept rotten apples in his desk drawer, claiming the aroma helped evoke creative reverie, while the philosopher John Dewey observed that creative conceptions frequently occur when people "are relaxed to the point of reverie." Jerome Singer and associates found evidence in both children and adults of frequent daydreaming among those whose written or dictated stories were rated by judges as the most original and creative. Singer's team also reported that, during passive, effortless indulgence of a wish in fantasy, eye movements were significantly less frequent than when subjects actively tried to suppress the fantasy or to speed up their thoughts. This essentially passive and uncritical condition is typical of some types of creativity.

Cross-Cultural Comparisons

The way a culture conceptualizes creativity automatically restricts it to some social practices and processes and denies it to others. During the heyday of Maoist thought in China, creativity was a matter of teamwork, and no individual artisan was allowed to sign a painting, claim authorship for an orchestral piece, or register credit for an invention. For spiritual reasons, the composers of Indian ragas did not affix their names to their works, and in the Benin culture, the African deity Olokun is thought to influence artists through dreams and reverie. There are any number of societies in which specialists are encouraged to put aside their rational problem-solving modes of thought in order for divinities to work through them.

Creativity, Meditation, and Hypnosis

There are psychophysiological markers for hypnagogia, hypnopompia, and napping. In the case of meditation, a number of studies have identified markers such as reduced respiration rate and volume of air breathed, reduced oxygen consumption and carbon dioxide elimination, and reduced blood lactate. In these studies, heart rate and the skin's electrical conductance decreased, but the frequency of alpha (and sometimes that of theta) brain waves increased. All of this suggests reduced energy metabolism, autonomic nervous system arousal, cortical energy metabolism, autonomic nervous system arousal, and cortical arousal. Additional research indicated that reduced arousal during meditation is due to its rest and relaxation aspects rather than to the specific meditation practice employed. However, it is probably more accurate to speak of "meditative states of consciousness" than to hypothesize a single "meditative state," because different practices may emphasize rapid breathing and active movement rather than counting breaths, repeating phrases, focusing on a mandala, or witnessing one's thoughts.

Creativity and Hypnosis

The term 'hypnosis' is used to refer to a variety of structured, goal-oriented procedures in which the suggestibility and/or motivation of an individual or a group is enhanced by another person (or persons), or by oneself. These procedures attempt to blur, focus, and/or amplify attention and/or mentation (e.g., imagination and intention), leading to the accomplishment of specified behaviors or experiences that reflect expectations and role enactments on the part of the 'hypnotized' individuals or groups who attend (often with little awareness) not only to their own personal needs but to the interpersonal or situational cues that shape their responses. Other research data emphasize the part that attention plays in hypnosis, enhancing the salience of the suggested task or experience. Both these bodies of hypnosis literature stress the interaction of several variables, suggesting that there are great individual differences in hypnotic responsiveness; some excellent participants are fantasy-prone, others dissociate easily, and still others are highly motivated to be 'hypnotized.' Both hypnotic susceptibility and creativity are fairly stable personality traits, as measured by several standardized tests. The research on

hypnosis and creative phenomena has shown that fantasy and absorptive experiences are concomitants of various changes in consciousness, including those due to hypnosis; they occur spontaneously in the context of a creative act; and they are often experienced by creative subjects who, as a group, seem more adept than their less creative peers at shifting cognitively from a higher to a lower level of psychic functioning – from a more active to a more passive condition. In addition, the ability to tolerate unusual experiences and become absorbed in a variety of experiences correlates highly with hypnotic susceptibility. Time distortion in hypnosis has been used to facilitate the expressive arts and creative writing. Benefits from hypnotically enhanced rehearsals have been reported by actors and performing artists.

Because of the link between hypnosis and creativity, practitioners need to know with what degree of facility a hypnotized subject can produce pseudo-memories. Even the increase in memories later found to be accurate is often accompanied by an increase in memories found to be inaccurate. These pseudo-memories attest to the subjects' creativity, but are often used inappropriately in psychotherapy.

Creativity and Meditation

The term 'meditation' (from the Latin *meditatio*, or thinking over) refers to a variety of practices that are used to self-regulate one's attention. All meditative practices attempt to bring the mediator into the 'here and now,' breaking through habitual patterns of behaving and experiencing. The case for increased creativity during meditation rests on a practice's ability to assist the mediator to break through socially ingrained patterns of perceiving and conceptualizing the world. If the linear, cause-and-effect way of thinking can be transcended, creativity may result. Creativity may be further enhanced by adopting a more circular way of thinking in which the focus is on relationships, possibilities, and recursive patterns rather than on linear causality and single-outcome events.

The research on meditation and creativity has produced mixed results. One group of researchers found no relationship between creativity test scores and experience in meditation. Another group reported significant increases in creativity scoring among practitioners of transcendental meditation (TM) and among Zen meditators. One of the latter studies focused on students of Zen koans, finding that they were able to eliminate prior approaches interfering with problem solving and enhance the unification of contradictory events.

Patricia Carrington has reported several cases of students whose grades have improved, whose emotions have stabilized, and whose artistic productions have flourished following their initiation of a meditation practice. At the same time, in a comparison of a group of teachers of TM with a group of nonmeditators, the former did no better than the latter on most measures, worse on a few measures, and better on one measure – an open-ended task requiring them to make up a story. It seems that meditation may enhance the free flow of associations and open up new ideas for a mediator, but an abundance of meditation (probably the case with the group of teachers) may interfere with a person's logical problem-solving capacity. A meta-analysis of all existing studies of TM and 'self-actualization'

concluded that the magnitude of the effects was not due to expectation, motivation, or relaxation, but to TM practice itself.

Cross-Cultural Comparisons

Eastern and Western meditative practices have a long history; they have been viewed as spiritual exercises – means for attaining the special kind of awareness that can be arrived at in concert with other life practices. In contemporary industrialized societies, however, meditation tends to be oriented toward practical goals, with no ties to a specific belief system. The advantage is that one is free to use meditation outside a spiritual context, combining it with other methods of self-development and health-oriented or psychotherapeutic treatment. The disadvantage is that one may not attain the peace of mind of the unitive ‘bliss’ claimed by members of traditional schools of meditation.

The history of hypnosis is more recent. In the middle of the nineteenth century, James Braid introduced the term ‘neurohypnotism’ or ‘nervous sleep’ (from the Greek *hypnosis*, or sleep). However, it can be claimed that the roots of hypnosis reach back to tribal rites and the practices of shamans. Hypnotic-like procedures were used in the court of the Pharaoh Khufu in 3766 BCE; priests in the healing temples of Asclepius induced their clients into ‘temple sleep,’ and the ancient Druids chanted over their clients until the desired effect was obtained. Herbs were used to enhance verbal suggestion by native shamans in pre-Columbian Central and South America. It is, nonetheless, incorrect to label these procedures ‘hypnosis’ simply because they drew upon similar procedures such as suggestion, repetitive stimuli, and expectations of the client. People, groups, and cultures are ‘creative’ during those periods of time when they exhibit activities that are innovative for that specific group in ways considered valuable by a society. These novel concepts, objects, and behaviors (e.g., a scientific discovery, a mathematical theorem, a philosophical insight, an artistic masterpiece) can be considered creative, although one social group might arrive at a consensus different from that of another group.

Possible Mechanisms

Art involves the controlled structuring of a medium or material to communicate as vividly as possible the artist’s personal vision of experience. If art resonates with a larger public, it has succeeded in filling some gaps in social knowledge or in resolving cultural contradictions. Artists also are attempting to supply missing information or material in a culture’s legacy. The same can be said for creative individuals who work with ideas, institutions, and other people. But none of this labor is done in a vacuum; there are neurophysiological predispositions that interact with social and psychological variables in the development of a product, process, person, or press that is eventually deemed creative.

Neurophysiological Mechanisms

There are several perceptual mechanisms ordinarily driven by sensory input during one’s baseline state of consciousness

that are decoupled, totally or partially, from sensory input during many alterations in consciousness. A total decoupling takes place during dreaming, while partial decouplings take place in hypnagogic or hypnopompic states, daydreaming, meditation, and some drug-induced or hypnosis-induced conditions. Transitions from such states represent a fertile ground for the development of creative ideas, because the perceptual mechanisms automatically linked to organizing the sensory inputs would still occur, occasionally constructing novel and useful images from fragments of internal neural noise and loosely guided consultations with memory. Language allows the abstract images and relationships to be translated into a communicable form. There is a direct relationship between perceptual processes and creative thought. The decoupling of normal sensory input during alternative states of consciousness should be viewed as distinct from restricting sensory input in an individual’s normal waking state in order to prevent interference with controlled manipulation of perceptual codes.

Psychosocial Mechanisms

The forms in which creative experiences are expressed cannot be separated from the person and the culture of which he or she is a part. Cross-cultural research has demonstrated that patterns of expectation within a particular culture have an *a priori* influence on creative experiences.

The effects of psychedelics upon creativity depend on more than their neurophysiological effects, which are produced by an interaction between pharmacological drug factors (type or dose), long-term psychosocial factors (culture, personality, attitudes, knowledge, beliefs, prior experience), immediate psychosocial factors (mood, expectations, group ambience), and situational factors (setting, instructions, implicit and explicit demands). For example, anthropologists who have observed the effects of *ayahuasca* among indigenous people in the Amazon comment that these differ, sometimes strikingly, according to the environmental and ceremonial background against which the drug is taken, the ingredients used in its preparation, the amount of it imbibed, and the expectancies on the part of the intoxicated.

Research Perspectives

The formal study of creativity dates back only to J. P. Guilford’s 1950 presidential address to the American Psychological Association, in which he urged his colleagues to pursue this overlooked area. After the connection between changed states of consciousness and divergent thinking was made, and investigations of the link among drugs, hypnosis, and creativity ensued, studies of additional altered and transitional states followed. Several studies examining the performance of scientists on lateral thinking tests found that highly creative scientists did not use lateral thinking more often than less creative scientists on these tests.

Learning from the past

A seminal research project was undertaken during the 1970s by R. K. Siegel. He conducted a systematic study of visual

images produced by a variety of drugs, focusing on such varied dimensions of these images as color, movement, action, and form. Siegel's subjects were trained to use an image classification system prior to the drug sessions. There were baseline and placebo sessions for comparative purposes. With regard to reported images, the amphetamine (a stimulant) and phenobarbital (a sedative) sessions did not differ from placebo sessions. However, the sessions with mescaline, LSD, psilocybin, and a synthetic compound based on the active ingredients in marijuana produced similar images. In the psychedelic drug sessions, for example, complex images did not appear until well after there was a shift to lattice tunnel forms; memory images emerged in the later stages of the appearance of complex imagery. Noting that hypnagogic and hypnopompic images were accompanied by theta and low-frequency alpha brain waves, other researchers used biofeedback to teach subjects how to enter these states. There was an expected increase in the subjects' awareness of internal imagery and dream recall. What was unexpected was that most of their subjects reported an increase in 'integrative experiences' and 'feelings of well-being.' These positive changes were amenable to intuition, insight, and creativity.

Several questions regarding the research on hypnosis and creativity remain unanswered because of the absence of robust findings due to methodological differences in the studies, the varied hypnotic responsiveness of the subjects, and the fact that creativity has been measured in disparate ways. Even when similar tests are used, they are administered differently, and the tests themselves admittedly assess a single instance or aspect of creativity. It may be that restrictions in awareness increase the priming of associative networks (outside of one's awareness) by reducing cognitive interference. As a result, new associations are made, giving rise to creative insights. Imagination or fantasy provides a continuous backdrop to mentation outside of awareness, and hypnosis may increase its accessibility. Heart rate probably reflects shifts of attention from external to internal events, making it a potentially revealing way to assess the oscillation of attention from an external focus of concern toward the internal events they trigger, a process which is one aspect of creativity. A significant relationship has been reported between heartbeat rate variability and subjects' creativity scores, as more creative persons tended to show higher cardiac variability. The psychophysiological studies of Zen meditators and yogic meditators revealed basic differences: members of the former group demonstrated 'openness' to external stimuli but were not distracted by them, whereas members of the latter group demonstrated 'detachment' from external stimuli. In the light of this diversity, it is important that the type of meditation studied be identified in the assessment of research reports, as well as the length of time the subjects had been meditating. Further, it is common for meditation to blend into sleep during an experiment; hence, the images reported may be the result of hypnagogia and hypnopompia and not meditation itself. The application of chaos theory to the study of creativity has produced several insights, among them a description of how chaotic activity patterns in the brain can reconcile convergent and divergent problem-solving processes, and how 'chaotic attractors' can utilize the brain's neural networks to combine images and thoughts that would escape detection during wakefulness.

Planning for the future

Future research might identify the extent to which individual differences in the recall of content from changes in consciousness might relate to instances of insightful creative thought, as well as to individual differences in attention and perceptual organization. Such data could provide a better grasp of the degree to which information processing in altered or transitional states actually constitutes a major source of creative productivity. Mental constructions occurring during such states can be useful only insofar as they are remembered and can then be evaluated for application and worth. It may be that the degree to which decoupled automatic perceptual processes contribute to creative output has far more to do with facility in higher level cognitive processes such as memory storage, retrieval, search, and comparison than in individual differences in the perceptual organization processes themselves.

One common view of why individuals who manifest some of the streams of schizophrenic-like thought might be viewed as creative is that deficiencies in the normal involuntary perceptual organization processes lead to an increased likelihood of an atypical representation of a perceptual event. In other words, it may be the anomalous organization of sensory input coupled with sufficiently appropriate higher order processes to evaluate the potential value of a mental construction that lead to creative output. However, creativity attributable to looseness in perceptual organization in the presence of stimuli is very different from creativity attributable to perceptual organization processes decoupled from normal sensory inputs. An increased frequency of transitions from transitional states of consciousness, as might be reasonably expected to occur in association with certain psychotic disorders, combined with unimpaired, or even superior, mechanisms of perceptual organization, thus represents a potential alternative route for contributing to creative thought by those individuals who are disposed toward cognitive disorders. Moreover, the relative weakness or looseness in organization processes, and the ability to exploit involuntary organizational processes decoupled from sensory input, may be distinct individual difference variables, both of which might relate to creativity in the general population.

In this regard, what Richards has dubbed 'everyday creativity' is an overlooked phenomenon in a field which all too often emphasizes the exotic, the dramatic, and the spectacular. It is quite likely that creative work draws more upon the ordinary waking state with its intact subsystems of consciousness than upon altered and transitional states. Drugs can be ingested, meditation can be practiced, hypnosis can be utilized, and the contents of reverie can be recorded, but everyday behaviors and experiences can also provide inspiration for what later may become a novel approach to a long-delayed home repair, an improved golf stroke, a new recipe for a family dinner, a breakthrough in a troubled relationship, an ingenious logistical plan to divert restaurant leftovers to homeless people, a challenging educational technology, or any one of many other achievements. The need for creative approaches at all social levels has never been greater; their development and application need to reflect the concepts of 'origin' and 'making,' which so appropriately grounded the Latin word *creare*.

See also: Brain and Neuropsychology; Chaos Theory and Creativity; Cross-Cultural Differences in Creativity; Dreams and Creativity; Everyday Creativity; Incubation; Women and Creativity; Zen.

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Analogies

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Glossary

Analogical thinking Applying structured knowledge from one domain to help in understanding, explaining phenomena or developing ideas in another domain.

Mapping The process of determining the correspondences between the source and target domains in analogical thinking.

One-to-one correspondence The principle that objects and relations in a given domain are mapped to one and only one corresponding object in the other domain in an analogy.

Parallel connectivity The principle that objects in matching relations also must correspond to one another.

Retrieval The process of bringing known information to mind, specifically the source analog in the case of analogical thinking.

Source The more familiar domain that serves as the base of knowledge to be applied to the less familiar domain in analogical thinking.

Structure-mapping theory The account that states that analogy is characterized by aligning the source and target domains to find their common relational structure.

Systematicity The principle that matching relations that are connected to higher order relations are preferred over those that are more isolated.

Target The less familiar domain about which a reasoner learns more from applying knowledge from a familiar domain.

Introduction

An important cognitive process that underlies creativity in many fields of endeavor is analogical thinking. In an informal sense, analogical thinking can be described as using what you know about one topic to understand another topic, that is, making advances in X by noting that X is in some way like Y. More formally, however, analogy is the application of structured knowledge from one domain, called the source or base domain, to another, called the target domain. Analogy can help in understanding or reasoning about a topic, in generating new products or ideas, in making inferences about what ought to be true about a topic, in communicating ideas, and in persuading others.

The emphasis on structured knowledge in this definition of analogy is important, because it relates to the component processes that make up analogical thought, including retrieval of a source domain, mapping the connections between the source and target domains, evaluating the goodness of a proposed analogy, and projecting inferences from the source to the target. The structure of the source and target domains can be described in terms of objects, simple relations between objects, and higher-order relations or relations between relations. When objects, relations and higher-order relations match across two topics or domains, we have an analogy, and the quality of the analogy is determined by the nature and extent of the match.

Most readers will be familiar with the types of analogical reasoning problems found on various tests of abilities and achievement that take the form of $a:b::c:?$. Problem solvers must determine what item is related to c in the same way that b is related to a. For example, the problem $dog:puppy::cat:?$ would be correctly completed with kitten because kitten bears the same relationship to cat (younger) as puppy does to dog. Note that it is the specific relation that matters, and that there

is a single best answer. Although tabbies might provide a partial match, for example, because dogs and puppies are of the same species and cats and tabbies are of the same species, the link between tabbies and cats does not capture the more specific 'younger than' relation that characterizes dog and puppy. These reasoning problems do possess the essence of finding a common relation across two sets of objects or domains, but analogy and its application to creativity is much richer than these types of $a:b::c:?$ reasoning problems for which there is a single best answer. Most particularly, analogy is useful in solving open-ended problems that do not have single, clear-cut answers and in working with complex domains of knowledge for which the relations of interest may not be as obvious.

Examples of analogy in a wide range of creative endeavors abound, and these examples can serve to illustrate the rich potential of analogy as well as its basic operation. Analogies have been noted to play a prominent role in science, as in the case of Rutherford's use of a solar system as a model for how the hydrogen atom was structured, Darwin's connection between agricultural breeding programs to select for desirable traits in species and the process of natural selection, and Kepler's use of both light and magnetism as sources for reasoning about why planets more distant from the Sun move slower than those closer to the Sun, among others. A classic case in literature is Robbins, Laurents, Bernstein, and Sondheim's adaptation of Shakespeare's *Romeo and Juliet* to the context of a 1950s New York City gang conflict in *West Side Story*. In technology and invention we have Edison's development of an electric light distribution system patterned after the gas distribution system of the day, the Wright brothers' efforts to craft a workable flying machine by analogizing from how a person turns on a bicycle and from thinking of a propeller as a rotating wing, and Georges de Mestral's reliance on the structure of burrs to inspire an idea for a new type of fastener, Velcro. In politics and social influence we have the analogy between Iraq invading Kuwait

in 1990 and Germany overrunning European countries in 1938 and 1939, a connection that may have galvanized US public opinion in favor of military intervention against Iraq. Note that the analogies mentioned in this paragraph vary tremendously in the conceptual distance between the source and target domains, with some being quite distant (e.g., solar system and atom) and others being quite close (e.g., sets of lovers from opposing groups). They also differ in purpose, including explanation, discovery, idea generation, invention, and persuasion. As considered in the section 'Modes of inquiry,' there may also be connections between analogical distance and purpose.

A detailed consideration of some of these real-world instances of the creative use of analogy can help to reveal the key building blocks. In the case of the analogy between the structure of a solar system and the structure of an atom, for example, the solar system is the source domain, about which much was known, and the atom is the target domain, about which chemists of the day were quite uncertain. We can identify matching objects across the domains, such as planets mapped to electrons and the sun mapped to the nucleus. We can also identify matching relations between objects, such as planets orbit the sun mapped to electrons orbit the nucleus. In addition, higher-order causal relations may be involved, such as a causal attractive force that keeps the planets and electrons in orbit. Knowing that gravity is a causal force in a planetary system can reasonably lead to the inference that a comparable causal force is operative at the atomic level, though on a different scale, and the projecting of that inference can thus underlie theoretical development as well as the search for particular types of empirical evidence about atomic structure. Independently of the validity of the mapping, the analogy itself served as an impetus for scientific advances as research progressed on its implications and possible inferences.

Similarly, Juliet and Maria, Romeo and Tony, and Juliet's balcony and Maria's fire escape are among the many matching objects in the deliberate crafting of *West Side Story* as an analogy to *Romeo and Juliet*. Romeo loves Juliet and Tony loves Maria are among the matching relations, as is the connection between the Montagues feuding with the Capulets and the Jets at odds with the Sharks. A higher-order relation is that the dynamic tension created by the conflicting lower-level relations of love and feuding leads to secretive behaviors by the main characters.

The creative power of analogies derives, at least in part, from the fact that good analogies connect the familiar and novel domains at very deep levels, not merely at the surface. Consider the solar system/atom analogy. It means that, just as planets orbit around a more massive central body, the sun, electrons may orbit around a more massive central body, the nucleus. But the nucleus and electrons do not resemble the sun and planets in any superficial way. The nucleus of an atom does not appear yellow to the naked eye like the sun, nor does it have a high surface temperature. The electrons are not as big as planets. What matters is that there are corresponding objects that bear particular corresponding relations to one another. Likewise, New York City of the 1950s did not have to resemble Verona of centuries earlier, and Maria did not have to look or dress like Juliet. What mattered is that two young people were in love, but were also connected to larger groups that were

in conflict with one another. The same type of conflict that drove the story of those star-crossed lovers of Verona drove the story of the more modern lovers.

A Theoretical Model and Set of Processes

As noted earlier, analogical thinking involves set of process, including retrieval, mapping, evaluation and projecting of inferences. In many instances, when people use analogy to create, understand or solve problems in a target domain, they must first retrieve from memory information about a source domain that might be helpful. Thus it is of interest to try to determine what factors determine the likelihood of an analog being retrieved from memory. Having retrieved the source domain, the next step would be to map the corresponding objects and relations in the source and target domains to one another. This is not a trivial problem, because in domains of any degree of complexity there may be many possible mappings between the objects and relations. Consider the attempted persuasive analogy of likening the situation surrounding Iraq's 1990 invasion of Kuwait to events leading up to World War II. The analogical argument in favor of US intervention mapped Iraq to Germany, Saddam Hussein to Hitler, and Kuwait to one or more invaded European countries. The argument was that, rather than pursuing a policy of appeasement as in the initial British response to Germany's invasion of Czechoslovakia, the United States should intervene militarily and stop Iraq before it achieved too much dominance. The object mappings in that case would include Britain of the late 1930s mapped to the United States of the 1990s, since those countries were the ones most dominant in the determination to either appease or intervene; that is, it was the actions of appeasement or intervention by Great Britain that were most relevant in the earlier situation and the potential intervention by the United States that was most relevant in the Gulf War situation. In that case, George Bush, as leader of the United States, would map to either Chamberlain or Churchill as leaders of Great Britain, making for a close relational match. However, the greatest surface-level object similarity would be between the United States of the 1930s and the United States of the 1990s since it is the same country. But that would also mean mapping George Bush as president of the United States, and Franklin Roosevelt as then president of the United States. So, the best relational mapping seems at odds with the best surface level mapping of objects. This conflict between deep and surface similarity can complicate the processing involved in analogical thought.

A particularly influential framework for describing and explaining analogical thought is Dedre Gentner's structure-mapping theory. The core process in that theory is mapping, or matching a familiar source with a less familiar target. The thinker has to find correspondences between the source and target by aligning them and projecting inferences from the source to the target. The alignment process takes into account matches at the level of objects, simple relations and higher-order relations, and ultimately reveals the common relational structure across the source and target.

The alignment process seeks structural consistency, guided by the principles of one-to-one correspondence and parallel connectivity. In one-to-one correspondence, each object or relation in the source domain maps to one and only one object

or relation in the target domain. Consider again the analogy between *Romeo and Juliet* and *West Side Story*. Although the analogy was used by the creators to develop the scenario for *West Side Story*, we can use it here to illustrate the operation of one-to-one correspondence in the comprehension of the analogy and how a viewer might obtain a richer understanding of the stories. Any given character in one of the stories could be put into correspondence with any given character in the other, but in the most sensible interpretation, Romeo maps to Tony and not Bernardo or any of the other male characters. Juliet maps to Maria and not to any of the other female characters. Similarly, using the World War II/Gulf War analogy, a coherent representation, honoring one-to-one correspondence requires George Bush to map to either Churchill or Roosevelt, but not to both at the same time.

In parallel connectivity, the objects involved in relational matches must also match to one another. For example, the relation love each other might map across both stories and the objects participating in that relation, Romeo and Juliet in the one case and Tony and Maria in the other also match. Even though Maria may love her brother or father, neither of them is part of the mapping involved in that particular love each other relation. Likewise, if the United States maps to Britain, Bush should map to Chamberlain or Churchill as part of the leader relation. If the United States maps to itself, Bush should map to Roosevelt as part of that leader relation. According to the structure-mapping theory, people may entertain all possible mappings between objects and relations, but they end up with a single structurally consistent interpretation that honors one-to-one correspondence and parallel connectivity. Interestingly, people asked to think about the World War II/Gulf War connection tend to end up with one of two arrangements. If they match the United States to Britain, they match Bush to Churchill. If they match the United States to itself, they match Bush to Roosevelt.

Having aligned the structures of the source and target, a reasoner can then project inferences from the source to the target. For example, if a reader knows the story of *Romeo and Juliet* well, and knows that the conflict between their love and their families' hatred led them to secretive and risky behavior, and the reader only knows that Tony and Maria are in a corresponding situation, the reader might reasonably project the inference that Tony and Maria will also engage in such actions. Generally, projecting of inferences and generating a preferred interpretation will be influenced by systematicity. That is, in projecting inferences and selecting the mappings to retain, those that are part of bigger causal structures will be preferred over those that are more isolated.

An additional process associated with analogy is analogical abstraction. This involves extracting and storing the abstract structure or schema of what is in common across a source and target or across multiple problems or situations. Consider again the analogy between *Romeo and Juliet* and *West Side Story*. A more abstract way of capturing what the stories have in common is that two individuals love each other but are members of groups that are opposed to one another. This characterization carries none of the specifics of either story, but does represent the conflicting forces that are at work. Such abstractions can be extremely powerful as sources of creative inspiration. A writer might determine for example to set a similarly structured story in the Middle East, in the United States

during the Civil War, in the heat of the Civil Rights movement or any of a huge number of situations in which two individuals might develop a special bond that puts them at risk because of animosities between the groups of which they are a part.

Modes of Inquiry

There are four major modes of inquiry that have been used in coming to understand the nature of analogical thinking. These include case study/anecdotal accounts, laboratory studies, *in vivo* studies, and computational modeling. All of the examples in the introductory section of this article fall into the case study/anecdotal category of investigation. Some are richly detailed, elaborate accounts of specific creative accomplishments, whereas others are shorter reports. Because creative individuals in a number of fields, such as science and invention, leave behind extensive notes regarding their progress on specific problems, it is possible to reconstruct their thought processes, at least to some extent, and draw conclusions about their reliance on a given source domain in understanding or explaining a target domain. Such approaches carry with them a level of uncertainty, in part because the individual's account is retrospective, possibly written well after the major creative accomplishment, raising the possibility that the memory of what actually occurred is inaccurate. In addition, even with contemporaneous notes, creative individuals may not always have a clear sense of all the factors that influenced their thinking. Nevertheless, case studies and anecdotes provide one window into the richness that characterizes analogical thought, particularly in high level, real-world types of creative activities.

In contrast, in laboratory studies, participants (often college students enrolled in psychology classes) are presented with relatively simple, highly constrained problems to solve. Experimenters obtain a variety of measures designed to give insight into the thought processes at work. The participants are not generally experts in any particular domain, such as science or technology, and the problems are typically less complex and open-ended than those faced by experts in those domains. The problems are generally ones that can be solved in the timeframe of a single experimental session, perhaps an hour or so. Because the tasks and situations are somewhat artificial it is possible to question their ecological validity, but what laboratory studies lack in realism is made up for by the precision and certainty with which conclusions can be drawn. Experimenters typically manipulate one or a small set of variables across the situation, and by keeping all other factors constant are able to attribute findings just to those variables.

The laboratory approach can be illustrated with one of the most well known set of experiments on analogical thought, conducted by Mary Gick and Keith Holyoak. In their studies, participants were asked to solve simple problems, such as the tumor problem. The gist of that problem is that a patient has a cancerous tumor that can be destroyed if enough radiation can be brought to bear on it, but a directed dose of radiation sufficient to destroy the tumor would also destroy healthy tissue on its way to the tumor. One possible solution, deemed the correct one, is that multiple, lower intensity sources of radiation can be directed at the tumor from different directions, all converging on the tumor as a focal point, thereby bringing enough

radiation to destroy the tumor but not harming healthy tissue along any of the separate paths. Note that this problem has a single best answer, which experimenters use in determining whether or not people correctly solve the problem.

Participants are unlikely to solve the problem spontaneously, but are more likely to do so if they first solve a problem with an analogous structure. In that related problem, a general has enough troops to overtake a fortress but the troops cannot all reach the fortress along a single path. When participants see the solution of sending smaller numbers of troops along multiple paths, all converging on the fortress, they are more likely to solve the tumor problem by analogy to the general problem. Interestingly, even so, only about 30% solve the tumor problem, unless they are explicitly told to think back to the prior problem. In other words, they have a potential source analog in memory, but do not often spontaneously retrieve it to apply to the new situation. So, the results highlight the importance of distinguishing between, long term memory storage of source analogs, retrieval of those analogs, and mapping of information from the analogs to a new situation.

Other laboratory research on analogy is typically designed to examine separate processes and the factors that influence them, or to test the competing assumptions of theoretical models of analogical thought. This includes research on the factors that determine the likelihood of retrieving particular source analogs, the evaluation of the strength or goodness of the analogy, and the projection of inferences from the source to the target domain. Some of this work reveals the intertwined importance of the distinction between the surface similarity of objects across domains and the deeper structural similarity of shared relations, and the distinction between retrieval and evaluation processes. People seem more likely to bring to mind potential source analogs that are similar in superficial ways to a target probe item, but they evaluate the match as better and the inferential value as greater when there is a similar higher-order causal structure to the target as opposed to superficial similarity. A vitally important implication is that the ideas that come to mind most readily as possible source analogs to help with a current problem are not necessarily the best ones for helping to make progress on the problem.

In vivo studies are designed to have the ecological validity associated with high-level, real-world creative activities in combination with the more direct observation that is characteristic of laboratory studies. The studies generally involve detailed observations of the activities of groups of experts working together on complex creative tasks in domains such as science and technology. A classic example is Kevin Dunbar's observations of molecular biology lab meetings as the groups went about their ordinary research business. The groups were clearly working on real-world creative tasks of great complexity, but by videotaping multiple lab meetings over an extended period of time, carefully coding the tapes for instances of analogical reasoning and other thought processes, and relating those observations to discoveries made, it is possible to develop a more certain picture of thought than would be available just from the scientists retrospective accounts.

Observations of these lab groups lead to important distinctions between near and distant analogies and between different purposes in using analogies. Distant analogies that recruit ideas from source domains that are conceptually very different

from the target (e.g., as in the case of the solar system/atom analogy) are quite rare in the day to day activities of working lab groups. Instead, near analogies, that recruit knowledge from domains that are conceptually very close (e.g., using knowledge about one virus to understand or generate hypotheses about another virus) are the more common mode of thought. Furthermore, the distant analogies that are used seem not to be used in making discoveries, developing an understanding of something, or generating new hypotheses. Instead they serve a more communicative goal of explaining something. If these findings turn out to be general ones that hold true across many areas of science, they would raise questions about how much previous anecdotal accounts of distant analogies really support their causal role in discovery. Perhaps, for example, Rutherford's use of the solar system was a communication device to explain an idea, not the source by which he came upon the idea. More generally, comparing anecdotal accounts to the findings of *in vivo* approaches shows that advances in understanding creative activities are more likely to come from using evidence from multiple methods than from the application of one type of method to the exclusion of others.

Research using the *in vivo* approach can also help to reveal differences between different types of creative endeavors. Observations of design engineers who had the task of developing completely new features for the product that was being designed have shown that they use distant analogies as commonly as near analogies. In addition, although engineers, like biologists, use distant analogies to explain things, they also use them for problem solving, a function much more linked to the creative process itself and not just an after the fact account of the process. Thus, the use of the *in vivo* method has helped to draw attention to the idea that the use of various processes and their value in those endeavors depends on the type of creative task involved.

In the computational modeling approach to understanding analogy, theorists attempt to simulate the findings of laboratory studies on analogical thinking using computer models built around particular assumptions. The advantage of this approach is that it requires modelers to be very specific about the processes and constraints they believe to be relevant. Without that specificity, writing the code to execute the steps would not be possible.

Two major classes of computer models are symbolic and connectionist approaches. The best known symbolic model is the Structure Mapping Engine (SME) that implements assumptions of Structure-mapping Theory. SME uses a predicate calculus and represents knowledge in the form of objects (role fillers, such as Bush, Churchill, Romeo, Tony, and so on), attributes (properties of individual role fillers), first-order relations (predicates with two role fillers, such as president-of (Bush, US), and higher-order relations (predicates that have at least one first-order relation as a role filler). In mapping across the source and target, SME proceeds in stages from local-to-global. In the first stage, all identical predicates and their role fillers are matched, which may result in multiple matches for a given element (e.g., Churchill from the source could match Bush or Hussein from the target because they are all role fillers of the predicate leader). In the second stage, kernels are formed from consistent matches (e.g., the match of Churchill and Bush is consistent with a match between the

Great Britain and the United States, since they are leaders of those respective countries, and those matches would become part of the same kernel). In the third stage, kernels are merged to form the largest structures that are structurally consistent and preserve one-to-one correspondence. Structures that include correspondences involving higher-order relations are preferred over those that do not. The model captures the notion, alluded to earlier, of a preference for higher-order relations in evaluating matches and projecting inferences.

A model of analogy that is inspired by connectionist approaches to cognition is ACME (Analogical Mapping by Constraint Satisfaction), which seeks to implement the assumptions of multiconstraint theory. Like SME, it does use symbolic representations of the source and target analogs, but unlike SME that focuses primarily on structural constraints as noted above, ACME considers interacting constraints of similarity, structure, and purpose in determining the best mapping between the source and the target. Similarity refers to the semantic relations between predicates or objects. For example invade (as in the case of Iraq invading Kuwait) is clearly more similar to occupy (as in the case of Germany occupying Austria) than to leader-of (as in the case of Churchill as leader of Great Britain), thus favoring a match between the former over the latter. The predicates need not be identical to be matched, rather matching is based on the degree of similarity, represented by a numeric code. Likewise, a relationship to the goals of the thinker can be represented numerically, thereby capturing purpose as a constraint on which mappings will be favored. Using excitatory and inhibitory links to represent constraints, and parallel constraint satisfaction to simultaneously or interactively satisfy the three types of constraints, the model seeks the optimal mapping between the source and target domains. ACME has successfully simulated a wide variety of human experimental findings, including the types of connections human research participants see in analogy problems.

Application

Analogy has been a key ingredient in proposals for improving creative functioning, though what counts as analogical thinking in such proposals may be less formal than is true for scientific approaches to the study of analogy. Most widely noted of the applied approaches is the advocacy for the use of different types of analogy as part of synectics, developed by William Gordon. Rather than a single form of analogy, synectics argues for different forms that might meet different purposes or goals. Direct analogy is perhaps closest to the nature of analogy as described earlier in this article. In direct analogy, the thinker applies knowledge, facts or other ingredients from some other source. That source can be ideas borrowed from nature. By considering how living things solve related problems, one might adapt that approach to one's current problem situation. De Mestral's realization that formed the basis for Velcro can certainly be described as a direct analogy. By observing that burrs attach to clothing and can be detached and reattached repeatedly because of a structure comprised of a large number of tiny hooks, he was able to

conceive of a durable, easy to use fastener as an alternative to zippers or buttons. The hooks and eyes as objects, and the relation of hook into, make this an analogy.

In personal analogy, the thinker identifies with the problem or at least a component of the problem, putting himself or herself into the problem, role-playing some part. For instance, in considering the operation of some mechanical invention, the thinker might imagine being one of the parts of the device, and moving the way the part does. In symbolic analogy, there is also identification but with phrases, images, and objects. In fantasy analogy, real world constraints are released and the thinker can consider how the situation would be if what is now impossible were to be possible.

It is clear that analogical thinking has brought about important creative advances in many domains, and thus it is certainly appropriate to suggest that people can behave more creatively if they adopt analogy as a technique. However, there are some important caveats. The first is that it is not always clear how one can retrieve from memory the correct analogy that will be most helpful. It is easy to see the role of a particular analogy in retrospect. For example, the possible match between the structure of a solar system and the structure of an atom is quite clear once the connection has been pointed out and described. But how did the analogy come about to begin with, and how was the source retrieved, as opposed to any of a wide variety of source domains that might have been retrieved that would have been less helpful. In a related way, what makes a good analogy may not necessarily be the same as what makes a source domain likely to be retrieved for consideration. In addition, as noted above it is not always clear that analogies play a causal role in discoveries. Perhaps the solar system was only invoked as an explanatory device to convey the basic idea to others, rather than the source of inspiration for what the structure of the atom must be like to begin with.

A second caveat is that, because they are structured sets of relations, there is a potential that interfering ideas can be brought along with useful ones in an analogy. One example can be seen in Edison's application of the structure of the gas distribution system of his day to the problem of electric distribution for powering his light bulb. Without a system of bringing electricity into homes, most people would not have much use for a light bulb. The analogy was complete and structured, including a central source, conduits for distributing the electricity, and devices to make it accessible in the home. Just as in gas distribution there would need to be some device for measuring usage at each residence, which led to even more invention to meet that need. However, the fact that the gas mains were underground led Edison to the idea of having electrical cables underground, a much more complicated and costly venture than having them above ground. Thus, the notion of structural consistency in the mapping between domains that makes analogies compelling can be the very factor that leads to the inclusion of attributes from the source that are problematic in the target domain.

A final caveat is that analogies are starting points, not end points or magical solutions to problems. Having determined to create a musical by analogy to *Romeo and Juliet* was just the first step in the creative labor that went into the final product of *West Side Story*. Characters needed to be generated

and fleshed out, scenes constructed, songs written, choreography laid out and so on. To take a different example from invention, de Mestral got the idea for Velcro by direct analogy from the structure of burrs, but it took him several years of effort to bring the invention to fruition. This is not to say that analogy is not helpful. It most certainly is. The point is simply to put its role in the creative process into perspective.

See also: Creativity in Science; Group Creativity; Knowledge; Metaphors; Problem Solving.

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- <http://en.wikipedia.org/wiki/Analogy> – Analogy wiki.
- <http://www.newworldencyclopedia.org/entry/Analogy> – Definition of analogy.

Architecture

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Glossary

Bauhaus ('House of building' in German) Name of an avant garde design, crafts and fine arts school, founded in Germany in 1919 by Walter Gropius. Until its closure in 1933 the school operated in Weimar, then Dessau, and finally in Berlin, and had a profound impact on modern architecture, design and art.

Beaux arts Short for Ecole Supérieure des Beaux-Arts ('Higher school of fine arts' in French). The school was founded in Paris in 1648 and became independent in 1863. Beaux Arts schools were established throughout France, the rest of Europe, and later also America. They keyed on classical arts – Greek and Roman architecture, and studying and imitating the Great Masters and the classical orders.

Computer aided design/computer aided architectural design (CAD/CAAD) Computational tools that support designing with various kinds of software.

Deconstructivist architecture A movement within postmodern architecture as of the late 1980s. It is characterized by fragmentation, manipulation of a structure's surface or skin, nonrectilinear shapes that serve to distort and dislocate some of the elements of architecture, such as structure and envelope. The theoretical underpinnings of deconstructivism were largely influenced by the philosophy of Jacques Derrida.

Performatism A contemporary interpretation of performance in architecture, embedded in digital design,

which aims to incorporate functionalist and image-based approaches to form making and conception.

Postmodern architecture A movement and style within the postmodern culture that flourished in the 1970s and 1980s. It came into being largely in reaction against the starkness and uncompromising modernism of the International Style. Postmodern architecture is characterized by the combination of modern forms and materials with a highly conscious use of motifs and conventions from earlier periods including decoration, which was not accepted by the Modern Movement.

Self-unself-conscious design Terms coined by Christopher Alexander. A self-conscious process occurs in a culture undergoing rapid changes that bring about random designed forms because designers are unable to respond to change systematically. Unself-conscious design occurs in a stable culture where occasional and slow changes cause only minor adjustments to robust, failsafe designed forms.

Starchitect A star architect, who produces exclusive, so called 'signature buildings.'

Vkhutemas (Acronym for 'Higher Art and Technical Studios' in Russian) Name of an avant garde art and technical school founded in 1920 in Moscow. It was dissolved in 1930 but was nonetheless responsible for one of the great revolutions in the history of art (constructivism).

Introduction

The history of designing buildings goes back several millennia. It is reasonable to assume that for a long time huts, and later buildings, mostly of modest size, were made to respond to basic needs of shelter. However, social life, which had taken place primarily in the open, eventually also required accommodation in buildings as well. The first known building of a monumental size that is believed to have been the brainchild of an appointed architect is the Pyramid of Djoser in Egypt, designed by Imhotep between 2630 and 2611 BC. Until the modern era, the history of architecture is told through mostly large-scale buildings with symbolic significance erected to house religious, government, cultural, and social functions. The rulers who commissioned them also had palaces designed and built for themselves, to serve as status symbols as much as living quarters. In modern times other building types emerged that acquired architectural prestige (diverse additional cultural centers, commercial edifices, transportation hubs, educational institutions, and more). Residential buildings, other than houses for the very rich, were not considered worthy of architectural attention until rather late in the modern era.

Outstanding buildings do not spring into being by chance, as arbitrary triumphs of creative architects. Exceptional buildings embody ideas that had ripened within a culture or micro-culture and were translated into built form; in return, exceptional works of architecture often extend such ideas and promote further development of architectural theory. Thus the history of architecture is largely a history of ideas; both general ones, which define historic styles, and individual ones that are responsible for outstanding buildings.

The two major aspects that guide the design of any building are function and form. Every building must serve the purpose for which it is being built, and it must have a physical form, which impacts upon both its users and those who perceive it from the outside as part of the environment. The evaluation of form and function is well aligned with the two most prominent measures of creativity: originality and practicality. In the behavioral sciences creativity is often measured as the sum of originality (novelty) and practicality (usefulness) of the outcome of a design undertaking. Although design of any kind is considered to be a creative activity, there are of course designs which are more creative than others, and it is these that are most interesting for this article. The article will touch upon ideas in architecture, and will stress the form-function issue.

It ends with a section on architectural education which is greatly concerned with questions relating to ideas, form, function, and creativity.

Leading Ideas: Self-Conscious Architectural Design

In 'Notes on the synthesis of form' Christopher Alexander, a leading design theorist in the 1960s and throughout the 1980s, distinguishes between 'self-conscious design' (Alexander's original term), as practiced in the modern era by professional designers, and 'unself-conscious design,' which was practiced by people who conceived buildings and other needed structures mainly before design became a formal professional activity in its own right. Unself-conscious design is responsible, well into the modern era, for what is referred to as traditional, vernacular or indigenous architecture, and is highly localized. In 'The appearance of the form' John Habraken recounts how, in the twentieth century, a house was built for a priest in a small Dutch village. The carpenter who was charged with constructing it received the following instruction: "... the priest needed, unlike other folk, a room to study and receive visitors." This was all the information he needed; as for the rest, the carpenter had a very precise mental model of a house in that community, to which he merely had to add the extra room. The mental model addresses the 'style' of the building as well as all other design issues: the size, the room layout, building materials, and so on. In vernacular architecture buildings of the same type resemble each other; examples of the past are followed, and there is no drive to change anything unless it is absolutely necessary. The beauty of such architecture comes from its perfect adaptation to its surroundings and its function, as was cogently shown by Bernard Rudofsky in the MOMA exhibition and catalogue 'Architecture without architects.'

In addition to the general cultural context in which it is embedded, more recent self-conscious design must also be understood in light of a narrower micro-culture to which a designer subscribes. Tradition is no longer enough of a moderating factor, and several approaches or design styles may be concurrently acceptable. Designers seek to belong to professional communities and to that end they subscribe to a micro-culture that best accommodates their values, beliefs and taste. This is a dynamic state, of course: cultures and micro-cultures do not stand still, nor necessarily do one's affiliations. Both traditional cultures and contemporary micro-cultures constrain design in terms of shapes, forms, patterns, and their combinations. There are explicit and implicit rules that designers are expected to follow regarding the spatial world within which they play out their designs. 'Playing by the rules' is in fact one's ticket to membership in a particular micro-culture, or design style. However, the most creative architects are known for their breakthroughs in which the rules are, at least, extended.

Striving for Novelty and Leading Ideas

Contemporary design is highly self-conscious. Architects strive to innovate within the culture or micro-culture to which they subscribe. To be considered creative, architects have to try to

push the boundaries of what is acceptable. In other words, they try to distance themselves from the typical in favor of a new and surprising design solution. More often than not, novelty rests on a 'leading idea' which drives the design. A leading idea in architectural design may be related to any one of different aspects of a building: spatial organization, building performance, the forms used to enclose spaces, façade composition, building materials, structural system, and so on.

Self-consciousness in design and the leading ideas that epitomize it are not restricted to contemporary times, of course. The Italian Renaissance architect Filippo Brunelleschi earned his fame mostly by devising a way to build the largest dome of his time, that of the Duomo of Florence, Santa Maria del Fiore. His creative contribution was the structural system of the building. The contemporary architect Santiago Calatrava also built his reputation on the ingenuity of his structures, many of them bridges. In both cases the structural solutions are responsible for the striking architectural quality of the ensuing buildings. In contrast the Swiss architect Le Corbusier, considered one of the greatest architects of the twentieth century, designed the residential building Unité d'Habitation in Marseille, France (1955), where the innovative feature was the spatial organization of the building. In this 12-storey building, which includes commercial and community facilities along an inner 'street' at mid-height, corridors run every third floor, leading to two-level apartments that span, on one of the levels, the entire width of the building. A very well known example of creative architecture due to novel building forms is the Guggenheim Museum in Bilbao, Spain, by Frank Gehry, completed in 1997, which, like other Gehry buildings, is composed of bold large curvilinear forms. Somewhat less known is the fact that the building also boasts an unusual application of a cladding material – sheets of titanium. A building that owes its fame entirely to the novel building material chosen for its enclosure is the Beinecke Rare Book Library at Yale University, designed in 1963 by Gordon Bunshaft of the firm of Skidmore, Owings, and Merrill. All exterior walls of the building are made of translucent marble, which transmits subdued lighting and provides much needed protection from direct light which would have harmed the rare manuscripts the building houses.

What the above examples have in common is the fact that all of them offered entirely new solutions to at least one major architectural aspect. These architects did not follow precedents and succeeded in making a significant breakthrough by offering an entirely new way of treating that particular aspect. In terms of problem solving, it may be claimed that the novelty of the architectural solutions in these cases stemmed from a conscious breach of the habitual problem space (design space, in this case) in which the architects searched for a solution. Despite their novelty, however, even exceptional works of architecture continue to be embedded in their cultural circumstances, and are identified by a style or movement they belong to (which, in extreme cases, they help create).

Styles and Paradigmatic Shifts

Styles and micro-cultures are based on overarching ideas over which there is a consensus within the relevant communities at a given period. Such ideas are encompassed in theories,

expressed in writing, often in the form of treatises. The earliest treatise still referred to today is by Vitruvius, a Roman architect and theorist who lived in the first century BC. His writings were rediscovered in the Renaissance and have had a lasting impact on architectural thinking and practice. Fil Hearn compiled the most important treatises throughout history and demonstrated the key role they played in shaping important works of architecture. Architectural styles are rooted in shared formal theories and the appearance of each style is accompanied by corresponding treatises.

The twentieth century saw the rise of three major styles: modernism, postmodernism, and deconstructivism. The modern movement was born at the turn of the nineteenth century. It strove to free buildings from formal historic compositional principles and excessive decoration, and to make them more suitable to the new lifestyles of a more egalitarian society that recognized everyone's right to live and work in improved built environments. With the social motivation, formal design principles were also widely accepted, including regularity rather than axial symmetry as an organizing principle, the breaking of large masses into smaller volumes that form three-dimensional compositions, and the removal of decoration in favor of surface composition of facades as the main aesthetic appeal of a building. In the 1920s two new design education programs were launched, at the Bauhaus in Germany and the Vkhutemas in Moscow. In both schools the new ideas of modern architecture underpinned the curriculum, in contrast with the prevailing neo-classical approach that was the rule in Beaux Arts schools throughout Europe and North America (for further discussion on this topic please see 'Architectural Education' below).

Following an exhibition at the MOMA in New York in 1932 the ensuing style was dubbed 'International Style,' a term advanced by Henry-Russell Hitchcock and Philip Johnson, who were the exhibition curators. Although the style was born in Europe and crossed the ocean to North America, today one of the largest concentrations of International Style buildings (some 4000) is to be found in Tel Aviv, Israel; the area in which they are concentrated is called White City as these buildings are predominantly white. The style was brought there by the many immigrants from Europe who arrived in Palestine in the 1930s and 1940s. In 2003 UNESCO proclaimed The White City of Tel Aviv a World Cultural Heritage site.

Postmodern architecture emerged as part of a wider cultural shift. It was mainly a stylistic tour de force, which rejected the austerity of modernism and embraced, once again, historicist and decorative connotations. Postmodernism was permissive rather than purist. For the first time the envelope of a building no longer had to express the volumes and spaces it enclosed and acquired an independent status of its own. Therefore, the modernist slogan 'form follows function' lost its currency during the postmodern era.

In the late 1980s a further stylistic development within the postmodern culture brought about deconstructive architecture, which was heavily influenced by the writings of the French philosopher Jacques Derrida who coined the term 'deconstruction.' The term refers to the close analysis and breaking up of texts into fragments that are not necessarily seen as coexisting harmoniously. In architecture, deconstructive work is characterized by

fragmentation of building volumes to the point of tension among them, non-rectilinear shapes, often with sharp angles, and a dismissal of any formal commitment to building typology, which was important to modernist architects. In architecture deconstructivism (also known as deconstruction) is also akin to constructivism, a movement in art and architecture in Russia that was active from 1919 until 1934. The constructivists were part of the modern movement, but had a more radical and innovative approach to the treatment of shape and form.

Architects who pioneered these styles forged and developed the ideas that defined the styles, along with theorists and historians whose writings helped lay the foundation for the movements' theoretical underpinnings. Needless to say, there have always been voices that proclaimed other ideas, away from the mainstream. When postmodernism reigned, a smaller movement called regionalism advanced different ideas: in opposition to the universalism of postmodernism they preached localism: respect for local culture, building traditions, and so on. The deconstructionist era also saw, in parallel, a growing concern for the environment which was finally embodied in a movement for sustainable architecture, now also referred to as 'green architecture,' which emphasizes the measurable performance of buildings (but not in opposition to spatial excellence). At present no major style reigns in architecture (unless digital design is treated as a style; see 'The Digital Shift' below). This does not preclude new theories from influencing both practice and discourse about architecture. An example is the books by the architect Rem Koolhaas that have had more impact than the buildings he designed.

The Form-Function Dichotomy

The dictum 'form follows function' is attributed to Louis Sullivan, a prominent American architect who was active when steel first became a primary building material late in the nineteenth century, used for the construction of building frames. Steel frames, along with the introduction of the elevator, made it possible to build taller buildings and Sullivan is known as a pioneer of skyscraper design. This building type, completely new at the time, with the new design issues it brought with it, emphasized a renewed interest in functional aspects of architectural design. The turn of the century was a time in which many social and technological changes took place that encouraged a willingness to break away from conventions that had dominated in architectural design until that time. The new attitude was the background to the growth of the modern movement which, not surprisingly, endorsed 'form follows function' to the point of turning it into a slogan. Form and function were always conceived as two complementary but dichotomous parameters that define architecture. This is not to say that form or function are, or can be, mutually exclusive: both are musts in architecture. The relative weight attached to one or the other places a work of architecture within a defined category from an historic perspective and, within a given cultural context, it helps classify works of architecture as well as architects. Form and function also represent the two facets of creativity: originality and practicality. With few exceptions, originality is expressed mainly in the treatment of form, whereas the way a building functions is obviously chiefly related to practicality.

Modern architecture was heavily committed to thorough functional analyses and incorporation of ensuing requirements in any design program. Building types were defined and investigated, and a rich technical literature was developed to guide architects in providing appropriate responses to predefined programmatic needs. Form was expected to follow closely the allocation of space that resulted from a functional analysis. Consequently, the building form was expected to express its function and its typological affinity; that is, a school had to look like a school, and a city hall like a city hall.

During the 1960s a concentrated effort was made to introduce systematic, scientifically-based design methods into architecture. A number of international conferences related to methods were held, most of them in the United Kingdom, as part of what came to be known as the 'design methods movement.' Many of the methods in question were adapted from engineering and management, and their goal was to optimize design outcomes by ensuring that all relevant issues would be addressed properly. The methods that were developed were prescriptive in nature, specifying design steps and their sequence. Two decades later it became clear that despite the efforts invested in design methods, they had failed to have an impact on either practice or education. There was more than one reason for this failure. First, the methods were very laborious and technical, and architects felt that they crippled their creative initiatives. Second, high hopes for automated processes in which computers would play a decisive role had left designers disappointed: computational technologies were far from capable of delivering the desired results. Third, and possibly the most important reason for the failure of 'methods' was the fact that with the advent of postmodernism, satisfying functional design requirements had lost its priority in favor of articulating form, or more specifically, the independent design of a building's envelope, into which spaces were fitted that accommodated the building's program. Exciting façades became so important that Robert Venturi and Denise Scott Brown, prominent architects and contributors to post-modern architectural discourse, wrote 'Learning from Las Vegas,' in which they talked about the acceptability of even the most simplistic box-like buildings, provided a well-designed façade was attached to them like a billboard or very large advertisement. The consequences of this theory are discernible today in places like Times Square in Manhattan.

Today the approach to function and form is more balanced. However, the term 'performance' has replaced function in discourse. The change of term signifies commitment to a higher-level scrutiny of building requirements, which is made possible with state of the art computational tools.

The Digital Shift

Computers have permeated design as they have pervaded almost every other area of life. The use of computers in design goes back to the 1960s, notably with the landmark system Sketchpad developed by Ivan Sutherland at MIT. By the 1980s CAD (computer aided design) and CAAD (computer aided architectural design) became established research fields, taught in schools of architecture, and making their way into practice. Early computational tools were seen as supporting

design in several ways, from drafting and the creation of fast and lively renderings, to flexible instantiations of designed objects through parametric control over design constraints. Specific programs were written for various building performance aspects, for example, the determination of window sizes and shading requirements for best climatic performance.

Digital design technologies have made enormous progress since then, and many will agree with Branko Kolarevic who wrote in 2003 that "Digital technologies are changing architectural practices in ways that few were able to anticipate just a decade ago." Today's advanced digital design systems have generative capabilities and they are able to create and transform non-Euclidean geometric spaces and transform them in the blink of an eye. Frei Otto designed the roof of the Olympic stadium built for the Munich games in 1972. The structure, considered very innovative for its time, consisted of large sweeping curvilinear canopies. During the design process Otto had to model the forms he was designing manually with elastic fabrics (allegedly he used ladies' stockings), as there was no way to represent their geometry accurately otherwise. Today structures like this are easy to model digitally. Moreover, up to a certain size complex forms can be manufactured with no need for any intermediary representation other than the digital model, which is fed into a CAM (computer aided manufacturing) system. CAD-CAM systems are already ubiquitous at high-end industries such as airplane and car production plants.

One of the immediate impacts that these new capabilities are having on architecture is the ability to break away from the straight line in favor of an 'emancipated' world of rounded and curvilinear forms. This includes many varieties of spatial expression, some of which are sometimes referred to as 'biomorphic.' The term suggests a trend to emulate natural forms that, at different scales, are by and large composed of non-Euclidian, curvilinear shapes and forms. This world of forms had been lost to architecture until now because it was not possible to represent and specify them properly, as in the case of the Munich Stadium. Now that this has become possible, architects are at liberty to explore a whole new array of spatial forms, and some of them, especially young architects and students of architecture, are happy to immerse themselves in this new and challenging universe.

Since buildings are usually large and to date must be constructed, or at least assembled in situ and not manufactured like cars or other artifacts, it is still very difficult and expensive to build structures which are neither regular nor modular, and may not include any repetitive elements. The building industry thus faces a serious challenge that will determine the pace at which biomorphic structures will turn from exciting digital projects into buildings in the real world.

Digital design is largely preoccupied with form, but it also advances the designer's ability to model and therefore predict and control the building's performance. Alternative values and tradeoffs can be tried out quickly and inexpensively in order to arrive at an optimal or balanced performance. The centrality of the issue of performance has led to a branch of digital design known as 'performalism.' Performalists stress the need to advance digital design not only in terms of forms and their production, but also in terms of the way they respond to needs, both needs of their own technical systems ('clever buildings') and the needs of the people who inhabit and use them.

The options that digital design opens up are vast and potentially revolutionary, and at present it is impossible to anticipate where they will lead. How will people relate to complex forms of such different geometries? How will structures relate to one another? Today they are treated rather as discrete objects, whereas there is generally a preference for thinking of buildings within contexts, primarily urban contexts, where continuity and coherence of a broader urban fabric are sought and open urban space is planned to complement buildings with equal heed and prudence. What would such an open space be like if the buildings that abut it were all composed of forms that were convex and curved onto themselves and usually turned a concave and possibly alienating face to what surrounds them? How will people inhabit and furnish curvilinear spaces should they be severely constrained in size, in contrast to vast spaces in the mostly virtual designs that can be experienced today? Will new building materials make it possible to manufacture structures and maybe allow them to be transformed routinely throughout the life-cycle of the building? What will such a cycle be? And how would regulatory forces adapt themselves to the new realities?

But most importantly, the new technologies pose questions regarding the very act of design, and the role of the architect. The new systems are imbued with intelligence that allows them to generate form, transform and evaluate it, often surprising the designer who, having provided a certain information set, may receive unexpected outcomes. The architect will most probably continue to make the decisions, but what decisions? Is he or she to choose from among proposals obtained digitally, adjusting the input more or less randomly so as to come closer to satisfying constraints or requirements? Who will determine the constraints and requirements, or the goals? In other words, conventional artificial intelligence as it is known today will no longer suffice; it may become necessary to talk about a higher digital intelligence, and digital creativity, at least as far as design is concerned. Such intelligence and creativity will have to be pitted against the architect's creativity and intelligence. The old question regarding the nature of the partnership between the designer and the computer in the design process has never been as acute as it is today. It is hard to predict what architecture and architectural practice will be like a decade or two from now, but it is certain that the digital shift which is occurring as these lines are written will have a profound and irreversible impact on built form and its production as they have been known and practiced until the present.

Starchitects and Other Practitioners

Although architectural design, and design in general, are creative activities by definition, not all works of architecture are equally creative, nor are all architects uniform in their creativity. In a paper published in 1962 Donald MacKinnon presented a study of personality correlates of American architects, in which he found that there were significant personality differences between more and less creative architects (creativity correlated positively with for instance higher levels of affective intelligence, openness to experience, freedom from petty restraints and impoverishing inhibitions, aesthetic sensitivity, cognitive flexibility, independence in thought and action,

high level of energy, unquestioning commitment to creative endeavor, and unceasing striving for creative solutions to ever more difficult architectural problems).

In a book published in 1998, the sociologist Garry Stevens looked at architectural practice and found it necessary to distinguish between architecture as a field and architecture as a profession. The profession is the more mundane of the two; it represents the business of designing buildings for clients to fulfill defined purposes. In their capacity of architects working in the profession, architects provide design services to clients, be they owners, users, or representatives of public or private organizations. It is a business-oriented activity in which architects try of course to excel, while being highly client-minded and constrained by the client's directives. Expertise is much valued in the architectural profession, and there are firms that develop special expertise in a particular building type, for example, hospitals.

The architectural field transcends ordinary practice. It is more concerned with innovation and with a cultural discourse through writings and built form. Architects who operate in the field of architecture are privileged; they see themselves, and others regard them, as practicing at a higher level than other professional architects. They are status oriented and instead of being client-minded they are eminence-minded. They hope to produce landmarks, rather than buildings that 'just' serve their users well. Clients turn to architects of this kind when they are interested in a product that would serve as a status symbol, and are willing to compromise some of their control over the building program and design decisions. They are also willing to pay higher fees, in addition to higher construction costs.

Stevens calls the architects in this group 'the favored circle.' Those at the top of the list are known to us as 'starchitects': they become cultural heroes, even celebrities, and their iconic buildings – 'signature architecture' – are included in lists of attractions to be visited by tourists. A well known case in point is the Guggenheim Museum in Bilbao, Spain, completed in 1997, by Frank Gehry. The building is said to have done wonders for Bilbao, then an industrial city with a decaying economy, by bringing in an average of close to one million tourists each year (about eight times the number before the building was built). The project costs were overwhelming (over 200 million dollars), but the city gained hundreds of new jobs, hundreds of thousands of overnight-stays annually, along with other business that tourism generates.

Starchitects are definitely among the most creative of architects. Their creativity rests primarily on exceptional originality, whereas in terms of practicality they do not necessarily achieve better results than other good architects. In fact, sometimes there are serious functional flaws in their buildings (the Sydney Opera House by Jorn Utzon, completed in 1973, is an example). But striking, original forms are received with so much admiration by the public at large that functional flaws are often met with forgiveness. In this respect, architecture occupies possibly a unique position as far as the balance of novelty and effectiveness in creativity is concerned, and in that it is closer to the visual arts. The Sydney Opera House cannot carry out the function that those who commissioned and paid for it envisaged (the staging of large-scale opera productions). However, because it looks beautiful this flaw is forgiven (by contrast, it is impossible to imagine public acclaim being given

to, let us say, a bridge that was built at great cost to carry traffic across a river but turned out to be useless because of engineering flaws, even though it looked beautiful). Thus, to some extent architecture is less bound by the insistence on function in the literature on definitions of creativity.

Architectural Education

The history of university-level professional education in architecture is relatively short. Before World War I, the great majority of schools of architecture in the western world were modeled after the French Ecole Supérieure des Beaux Arts, which was founded in the seventeenth century by the Académie Royale d'Architecture. Its main purpose was to serve the needs of French aristocracy. Throughout its long existence, Beaux Arts education promoted the value of historical precedents and the primacy of the great classical traditions. The Beaux Arts educational system was extremely influential and many a school in Europe and beyond followed its tradition and were hence identified as Beaux Arts schools (to distinguish them from schools of other 'denominations'). Leading nineteenth-century American architects went to Paris to study at the Ecole des Beaux Arts. A Beaux Arts diploma was in good currency in the United States well into the twentieth century. Creativity was not a prime goal of standard Beaux Arts education (with exceptions in the last years of its existence); the fostering of creativity and innovation had to await a later major cultural shift. European Beaux Arts schools of architecture were widespread until the 1960s, alongside other types of schools, notably the 'Polytechnic' institutes and schools that reflected the ideology of the Modern Movement. In France the Beaux Arts system was abandoned only after the events of 1968.

An alternative model of architectural education was launched in the 1920s in Europe in two avant-garde institutions, the Bauhaus in Germany and the Vkhutemas in Russia. In both institutions architecture was a unit alongside other units devoted to the arts and to crafts. The foundation of the new schools resulted from novel cultural attitudes and from reforms in education prevalent in contemporary arts, design, and architecture in the aftermaths of World War I and the Russian Revolution. These reforms, which rejected classicism, were strongly motivated by a social and political agenda and by a wish to empower the arts, the crafts, and design through the use of industrial and technological advances. Experimentation and creative initiative were central to the educational philosophy of the Bauhaus and the Vkhutemas, as opposed to the conservative approach of the academies, embodied in Beaux Arts education. Although the avant-garde Bauhaus and Vkhutemas were shut down prematurely due to the political circumstances of the 1930s in Europe, they exerted a lasting influence on architecture and architectural (and design) education. In fact, the term Bauhaus has become an emblem of the modern movement in design and architecture, still in wide use today (and often erroneously replacing International Style).

The second half of the twentieth century has seen a phenomenal growth in higher education, for which the university has become the prime vehicle. Many new universities were founded around the globe. The great majority of schools of architecture, whose number has surged proportionally, operate today as academic departments within universities, sometimes independently but often in partnership with other departments (e.g., planning, construction, environmental studies, engineering, or art). Despite the many differences among schools of architecture and their institutional contexts, almost all of them share similar goals and the programs they offer are based on training principles that were, to a significant extent, inherited from the Beaux Arts and the Bauhaus-Vkhutemas traditions. The omnipresent design studio, central to the curriculum of every school of architecture, is a direct descendant of the Beaux Arts' atelier. Striving for originality and innovation and the legitimization of exploration and search by trial and error have been handed down from the Bauhaus and Vkhutemas, and today creativity is the single most valued capacity students are expected to demonstrate. A similar development is now being seen in technological design education, as well as in other areas such as entrepreneurship education, where creativity is receiving much greater attention as a goal of teaching (as against for instance, mastery of techniques or tools). Accordingly, the role of the studio teacher has evolved: from studio 'master' (or 'mistress'; until a few decades ago, however, architecture was a predominantly masculine occupation and most teachers were men) to what is sometimes referred to as 'coach.' Needless to say, new curricular components have been and continue to be added to professional education to catch up with technological and scientific developments, notably computational options and new building materials, as well as dynamic social and environmental sensitivities and awareness.

See also: Definitions of Creativity; Design.

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Art and Aesthetics

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Glossary

Collative variables As per Berlyne, are complexity, novelty, surprise, and absurdity.

Concinnity Skillfully put together, well made.

Hedonic Pleasure.

Heterogamous Having different origins, having unlike 'genes.'

Schema Generalized diagram, plan, or scheme.

Semantic Meaningful, as in the meaning of a sentence.

Simulacra Unreal or superficial likeness, an image, or representation.

Syntactic Structural, as in the grammar of a sentence.

Veridical Truthful, corresponding to facts, actual.

Introduction

The 2005 *Compact Oxford English Dictionary* defines art as the expression of creative skill in a visual form such as painting or sculpture (or, for that matter, also music, dance, drama, and literature). Aesthetics is defined as a branch of philosophy and a set of principles concerned with the nature of beauty, especially in art which deals with questions of beauty and artistic taste.

Gustav Fechner's 1876 publication of his *Psychophysics* as the first scientific study of aesthetics began at the point when art styles were still anchored in Renaissance thinking, although radical changes were beginning to manifest themselves. Aristotle's criteria that had defined good art for two millennia as beauty, order, proportion, unity, symmetry, and concinnity, would become virtually obsolete by the end of the twentieth century. Thus, no research on art, aesthetics, and creativity can be considered adequate without taking into consideration the aesthetic theories that have arisen from the artists and art critics, psychologists, and philosophers in the last 100 years.

As a philosophical domain, aesthetics lends itself poorly to the types of quantification that characterize the social sciences. This presents serious problems for the field of cognitive science where Daniel Berlyne placed aesthetics as the empirical study of aesthetic enjoyment and preferences. Redefined as 'Empirical Aesthetics' by Berlyne, aesthetics retains its philosophical foundations although it now includes attention to sampling procedures, research design, and statistical analysis of data. The concomitant hypotheses derive from psychologists, psychobiologists, cognitive developmentalists, anthropologists, information theorists, semioticians, and the philosophical aestheticians themselves.

Over the course of the last 100 years, both art and therefore the field of aesthetics have been completely revolutionized, and since both philosophical and psychological aesthetics must be based on contemporary aesthetic experience, it is necessary to review the changing positions of the visual arts of our time.

Traditional Versus Modern Theories of Aesthetics

The Tradition from the Greeks and Aristotle

The Greeks had no term for 'artist' and no concept of the artist as conceived today. The artist was regarded as a craftsman or

artisan, and the arts were assessed only in relation to the purpose for which they were made. Painting and poetry were 'pleasure giving' arts creating simulacra of real things. The arts were regarded as handicrafts to serve purposes that were approved by society, and the criteria with which to judge such products were concreteness and craftsmanship. The artist's goal was to produce a representation of the ideal in the context of Plato's theory of ideas – to improve on and perfect nature by eliminating imperfections in order to arrive at an ideally beautiful figure according to the 'idea' of the beautiful in the mind's eye. It is evident that the most important goals of the arts in ancient Greece were to mold fashions that would conform with the ideals of the state. The Aristotelian criteria of good art, namely, beauty, symmetry, concinnity, determinate bounds, and above all order and unity in diversity, indicate that the desired response in the observer was to achieve a greater sense of inner equilibrium and balance. The viewer's aesthetic response was an acknowledgment of artistic success – art as spiritual ideal to emulate.

Innovation as Twentieth Century Beacon

The Greek concept of beauty as described by Aristotle remained dominant in Western art and aesthetics until the late nineteenth and early twentieth centuries when the idea of art as a novel and original creation with autonomous criteria specific to art itself became established. This view emancipated the work of art from subjugation to all forms of instrumental purposes, although the Freudian theory of sublimation by means of which libidinal and aggressive impulses are transformed into socially acceptable products bears some resemblance to the Greek aesthetic ideal of the 'improvement of nature.'

Neither the Greeks nor the 2000 years of artists after them entertained a concept of innovation as an ultimate 'good.' However, by the early twentieth century innovation had begun to replace beauty as the criterion of creative worth, and between the First and Second World Wars the Dadaists and Surrealists were particularly determined to burn all bridges behind them. The scientific explosion in knowledge had changed the twentieth century mentality, resulting in a dynamic avidity for the new, the unexplored, and the challenging. Little feeling was left for the traditional or the spiritual. The mood was analytic and

reductive. Ironically, at the same time, there was a need to turn to personal sources as the raw material of artistic creation as the Surrealists did. This tendency continued into the late twentieth century as is evident in Conceptual Art, Body Art, Performance Art, and Happenings.

Innovation and the Avant-Garde

The avant-garde is by definition art that is ahead of its time and is shocking, disturbing, and therefore viewed as socially and aesthetically objectionable. The specific aim of the avant-garde is to undermine the existing order and to replace it by another. It attempts to do this by contradiction, challenge, confrontation, and self-assertion. The avant-garde first defines its distance from the establishment and tries with all its resources to make itself felt as a force aiming to redefine the limits of art. The new art continues to assert itself irrespective of the degree of success or opposition. The criteria for significance are difficult to establish. The novelty and abrasiveness of the avant-garde could never meet the standards of beauty that were the primary conditions of traditional aesthetics, but its own novelty made it readily recognizable as innovation.

Although innovation does not guarantee either quality or significance, it is clear that art cannot be significant unless it is new. However, in order to be recognized as art, the avant-garde product must be seen in context; it is only novel and significant by virtue of the contrast it creates. Confrontation is not always its goal. Sometimes the goal may be to simply direct perception.

Conceptual Art

Conceptualism is the most important of the avant-garde movements to make a radical difference in the evolution of modern art and aesthetics. It came into being when Marcel Duchamp chose a ready-made bottle rack to serve as a work of art. Duchamp's act was conceptual: he deliberately chose an object that had no aesthetic qualities of any kind. This act occurred in 1913, and although the impact of his gesture was immediately felt, 'conceptual art' as such did not become a widespread movement until the 1960s. Duchamp's action opened up the field of art to a multiplicity of gestures that have changed the nature of art – and also the concept of aesthetics.

In America, Joseph Kosuth produced a manifesto for conceptual art describing conceptualism as an inquiry into the foundations of the concept of art stating that "All art after Duchamp is conceptual because art only exists conceptually." Kosuth maintained that if philosophy (and religion) is finished, it is possible that art's viability may be connected to its ability to exist as a pure, self-conscious endeavor, and that art may exist in the future as a kind of philosophy by analogy.

By the 1970s Gregory Battcock maintained that there were no aesthetic criteria for judging conceptual works. The conceptual art framework should be judged by how effectively it changes cultural values, that is, for the ideas that it motivates. Aesthetic theories, as they modulate practice, become the fuel for social significance and a potential for change.

For the most part, however, avant-garde art consists of objects recognizable as art – painting, sculpture, music, dance, or performance – but the aims are different from

those of traditional art in ways that identify avant-garde art as instances of confrontation, challenge, and transformation.

Current Conceptualizations of Creativity

Defined as the raw material of the self, art emerges through the interaction of two levels of ideation: primary and secondary processes. A primary process gives the artist access to the self as raw material – to personal raw drives and desires, libido, and aggression. A secondary process is the transformative level. Colin Martindale identified primary process as essential to creation, changing, however, the terminology to 'primordial thinking' in order to differentiate his theoretical position from that of Freud. Primordial thinking is free associative and undirected thought, thus increasing the probability of novel combinations. 'Primordial thought,' however, says nothing about its deeper 'primordial process' sources. Martindale's term 'secondary process thought' described conceptual thought and according to Martindale, 'It cannot produce novel ideas.' The final artistic product is therefore the result of unsolicited, urgently felt decisions made at the level of primary process and the intentional decisions made at the level of ongoing transformational activity by secondary processes. The primary ideation pumps in new drive material or, as primordial thought, contributes novel associations (in Martindale's terms). Thus, all aesthetic decisions are continually being made by the secondary process as the ongoing input of raw material keeps streaming in at the primordial level, directing the content of the creative process. During the working process, the perceptual – the aesthetic – function provides the crucial contact between what the world will accept and the creator's personal strivings that must be incorporated to effect a work of self-expression in symbolic form. The final emergent qualities of conscious thought direct the execution of the work into a style that is either adapted to the social order or is transgressive of it depending on whether constraints in the personality of the artist have steered him or her toward change and disruption or toward social compliance. In twentieth and twenty-first centuries, artists have felt impelled to create a 'difference' (innovation) and to create transgressive work in order to make an impact on the audience. Thus, the spirit of audacity and rebellion appears to characterize much of the last 100 years of creative work.

Experimental Research on Aesthetics

Daniel Berlyne began the experimental study of aesthetics in the 1960s where Fechner had left off in the late nineteenth century. Berlyne presupposed a basically Darwinian, neutral, monistic theory about psycho-physical relationships between mind, consciousness, and the brain. As a scientist Berlyne was looking for the biological basis of behavior – for variables that lead to arousal of the nervous system. Arousal has been identified as the psycho-physiological energy dimension mediated by activity of the reticular system. Berlyne's psycho-biological theory of aesthetics postulated that the hedonic tone of the stimulus is determined by its arousal potential. The latter is a function of three (and often four) variables as follows: psycho-physical (intensity, saturation, pitch, and brightness),

logical (meaning or signal value), and collative (complexity, novelty, surprise, and absurdity) qualities. The fourth is contributed by nonfocal stimuli. Of the four, the collative variables were seen as contributing by far the largest share to arousal. Like Gustav Fechner before him, Berlyne found that arousal is most pleasant in the middle ranges of stimulation. He also incorporated information theory and therefore described a work of art as an assemblage of elements, that is, information. He was able to show that the pattern of the semantic and syntactic information contained in the artwork could be used to define style. He also made use of multidimensional scaling to obtain indices of stylistic similarity. Berlyne's importance to the field of aesthetics cannot be overestimated. However, he overlooked the reality of the organism as a dynamic and essential component in the response process to aesthetic stimuli.

Berlyne rejuvenated a field that had fallen into virtual oblivion since Fechner's death. He gave it form, substance, and leadership. Aesthetics prospers now as an active field of psychological research largely due to Berlyne's efforts. However, his approach combining information theory with behaviorism may not have been the most appropriate for a study of the effects of the creative process. The behaviorist viewpoint excludes experience and subjective interpretation.

Berlyne's findings have come under increasing attack by Martindale and other researchers in the field of cognitive psychology. Martindale suspected that the arousal system may not be a necessary factor in explaining hedonic responses. Martindale pointed out that formal collative and psycho-physical aspects of the work of art are the ones that people tend to ignore in their search for meaning. Martindale believes that the laws governing aesthetic pleasure are quite similar to the laws governing perception and cognitive processes.

The major drawback to a serious study of art and aesthetics by psychologists has been the absence of a coherent philosophical position of what needs to be studied. Since psychologists have limited their aesthetic research study to the aesthetic response, it means that the study of art as art has been excluded. This makes sense if one focuses on psychology as a study of behavior (the subject's response), as Martindale insisted. But the study is presumably of art and aesthetics, thus, the need to study art as art. This shortsightedness of study is not limited to psychology. University art and philosophy departments have been in the same league. For this reason, questions dealing with the significance of art have been few. To the extent that questions dealing with the significance of art as art and concerns about its importance in a postmodern society have been investigated, it is artists and philosophers rather than psychologists who have done so. But, research by psychologists on cognition and perception as factors in the aesthetic experience has produced some interesting results.

Cognitive Versus Perceptual Theories of Aesthetic Experience

Art as Feeling

Art defined as a significant symbolization and conceptualization of feeling in perceptible forms offers the viewer access to the most basic mode of artistic understanding. The immediate

response is prior to understanding. Feeling must precede in order that the viewer arrive at some understanding of meaning in all areas of human perception. The importance of aesthetic experience has been underscored by stating that what is gained from it is a more basic yet richer form of knowledge than the knowledge typically 'associated with scientific rationality.' The first intuitions of 'knowledge' are affective.

Art as Cognition

In contrast, cognitive theories of art define the aesthetic response in cognitive terms as an inquiry into the 'whole' in order to discover how the parts contribute to the force and integrity of the entire structure. Significance, in this respect, is something that impresses the viewer with its abstract rather than its empathic qualities.

For example, how does one evaluate a work presented by the musician John Cage entitled *4'33"* that consisted of four minutes and thirty-three seconds of silence? Certainly *4'33"* is a novel gesture but how does it qualify as art – that is, as an aesthetic object? For some, it would not qualify at all since it is entirely empty and since it has no qualities we can perceive except the ambient sounds of silence. Nor does it express any feeling; but the thought it provokes is to make the listener think about what music is and is not. In sum, Cage's *4'33"* does fall into the category of avant-garde art by its express intent to call into question what music is, to shock expectations, to change perceptions, and most important, to rethink our own definitions of art. Thus, although *4'33"* does not call out the aesthetic response, it is a major innovative work of twentieth century music.

The preceding issues of feeling and cognition are crucial to an understanding and appreciation of contemporary art and aesthetics. Martindale held that a plausible theory of aesthetics would evolve from what we already knew about cognition and the determinants of hedonic tone, that is, from continuing research in the fields of perception and cognition.

The present status of the research on hedonic response does not allow us to determine conclusively whether a genuine aesthetic response of pleasure derives primarily from the formal qualities of the work of art or from an affective response to the stimulation. Research findings are divided.

Martindale postulated that aesthetic pleasure is related to the net activation of a set of cognitive units. In other words, apprehension of a work of art will activate cognitive units in sensory, gnostic (pertaining to or having knowledge), semantic, and episodic analyzers. The pleasure engendered by the work will be a monotonic function of degree of activation. He underscored the fact that this cognitive model explains only disinterested pleasure. In cases where the arousal system becomes active, it will take over the determination of pleasure or displeasure. Martindale maintained that stronger cognitive units code more prototypical and more frequently encountered stimuli. Whereas sensory and perceptual details would be ignored or quickly forgotten, more abstract concepts would be remembered. In other words, meanings or typicality are more important than psychophysical or collative variables in determining preference. The one exception may be the artists who by profession are trained to be more interested in formal issues and collative variables, that is, in the tricks of their trade.

In 1962, D. W. Gottschalk attempted to deal with the problem of what makes an aesthetic response different from mundane reality processing, by comparing the reactions of naive and experienced (artists) subjects to a work of art. The artist viewers clearly showed a more sustained and critical evaluation, thus reflecting a different interaction with the object.

There is no reason to assume, however, that cognition was the dominant factor in releasing their pleasurable response, although it may have added to the pleasure by virtue of the challenge that synthetic activity presents. R. B. Zajonc clearly indicated that human thinking begins in an intimate association with emotions and feelings which is never lost. Moreover, almost all human activity serves not one but a multiplicity of motives at the same time. It would be difficult to imagine that an aesthetic response would not maintain this intimate contact with emotions in response to a freely chosen complex activity such as looking at art.

Cognitive theories maintain that the perceiver brings together hypotheses, inferences, probabilistic weighting of cues, affective subtleties and associations in response to aesthetic stimuli. Perceptual theories assume that association is the primary mechanism of response. Schema theories (hypotheses, concepts, and categories) belong to the cognitive camp. They place emphasis on constructs as means of explaining the different responses to aesthetic objects. Schemata are essentially information-confirming procedures in which the individual checks a hypothesis aroused by central cognitive and motivational processes against information from the environment. Schemata are relatively stable mental structures.

Julian Hochberg, a veteran researcher in this area, has postulated that internalized mental structures are integral to the perception of pictures. His position was that features of the perceived object indicate what schema would be appropriate to the picture being viewed. The schema is determined by the viewer's prior aesthetic experience or training as well as by idiosyncratic characteristics. The schema gives the viewer a way of storing the results of peripheral inquiries and terminating them when the schema is sufficiently filled out for the task being pursued.

In short, neither the schema nor the perception view of aesthetic experience is able to account for the interactive nature of human behavior in aesthetic experiencing. The more recent contributions are those of information processing. This position regards perception of artwork as inseparable from memory and the representation of information in memory. This makes the response infinitely more complex and unpredictable.

According to R. W. Neperud, the importance of stored information as a factor in directing human attention serves to support the view that the visual and verbal structures that an individual possesses are important constituents, along with the artwork, as to what will be perceived. Thus the emotional bias of visual information may affect not only attention to that material, but also influence, independent of the subject's awareness, the direction of the central processing system.

In short, stimulus and stored information may interact to determine the interpretation of the stimulus, or art. It is evident that an informational processing view must take attentive behavior into consideration, as this is unquestionably an essential dimension of aesthetics. Berlyne's work in the psychobiology of

aesthetics was conclusive enough for Berlyne to sum up his position by stating that:

there are ample grounds for believing that the variables to which information theory has drawn attention have a great deal to do with the motivational aspects of aesthetic form.

Aesthetic experiencing is clearly very complex, and both cognition and affect may be shown to interact in intricate ways. Such experiencing is colored by sources of information about art, by individual habits of information processing, by affect, by past experience, by personal values and prejudices associated with class status, by information about prototypical categories (such as structural properties, subject matter, and constantly evolving artistic forms), and by cognitive structures that provide bases for perceiving the object.

Affect as Primary Variable

Francois Molnar's extensive research led him to propose a science for visual art in which affect plays a crucial part. He made two assumptions as a result of reviewing the field of visual art research. (1) The aesthetic effect is an affective response, a reaction to a stimulus from the outside world, passing through sensory channels. (2) There are no works of art without sensory input. (Note Marcel Duchamp's *Bottle Rack* leading to Joseph Kossuth's "All art after Duchamp is conceptual because art only exists conceptually." The avant-garde strikes again.) An affective response does not exclude the cognitive element. According to Molnar, the first stage of the aesthetic response begins at the retina with the retinal cells responding to the formal properties of the object. The retinal cells act as filters and as feature detectors. This describes the processing of neural information. Molnar adds that sensory information is processed at the cortex only if it is accompanied by influences from subcortical areas. Meaning does not yet exist at the level where the aesthetic response begins. Aesthetic pleasure seems to be independent, at least at the start, of the cognitive system. The aesthetic effect begins at the level of the early sensorial information process.

Molnar believed that one of the most efficient experimental methods to test this theory was to study eye movements because the primary sensory system and the motor system are closely linked. Molnar maintained that the eye does not necessarily seek out the region of semantically rich information. During a fixation, the observer is unaware of the momentary content of the vision. It is therefore not possible to talk about the primacy of cognition in exploration.

The research by cognitive psychologists focusing on cognition versus affect has centered on how individuals attend to, make sense of, and value particular visual phenomena. It has not attempted to look at qualities that define 'art.' The cognitive research can identify preferences for stimuli as well as the contextual variables that affect them. However, this adds little to our understanding of what makes a work of art the profound experience that it is, alive and palpitating to our senses through the centuries, revealing the predominating rhythm of its period. Clearly, affect cannot be ignored and the affective components have been highly underestimated in discussions of art.

The Philosopher's View of Aesthetics

When contemporary philosophers think about art they do not put the emphasis on hedonics. They are concerned with the problems of art in a postmodern society with many opposing views ranging from the dogmatic belief that art cannot be defined to Arthur Danto's statement that art works have at least one necessary condition: that they be enfranchised by art theories. His superb book *'Philosophizing Art'* does a lot to show the way, including his essay "Art and the Discourse of Nations," with "Art is a language in which nations convey so much to one another, that one has to ask how they would do this if art did not exist."

One of the most important and controversial current conceptions of the philosophy of art and aesthetics is George Dickie's 'Institutional Theory of Art' – that is, art in modern Western Culture is what the social group of interested and knowledgeable people (the art world as a social institution) says it is. Yes, his theory is more nuanced and complex than simply "Art is what the art world says it is"; but when you look at the social institution of the art world – the museums, magazines, critics, dealers, collectors, and artists – it is their collective voice (certainly not unanimous but the sound of many voices in conflicted concert) that determines in any time what is considered to be art and therefore worthy of 'aesthetic experience.' As far as the aesthetic evaluation of a given object is concerned, Dickie says the object may be evaluated as good or ordinary or bad, but it is the art world that decides whether to keep it or dump it.

But for those who are more interested in the source of art as a human instinct, Denis Dutton's *'The Art Instinct'* relates art to our evolutionary beginnings in Africa during the Pleistocene Age. Ellen Dissanayake continues the evolutionary anthropological research approach, noting that since the arts and ritual ceremonies have been with us forever, the question becomes why do humans have an irrepensible penchant for making things special, weird, strange, sometimes ugly or extraordinary as for example in ceremonies. In short – why do people 'artify'? She notes that 'artification' has both an adaptive and a functional use, inevitably tending to bring individuals together and thus creating social accord and cooperation. In short, literature and the other arts are devices of orientation. They are vital to personal development, to the integration of individual identities within a cultural order, and to the imaginative adjustment of the individual to the whole larger world in which he or she lives. As Colin Martindale quoted Gregory Feist, "It might perhaps be said that in humans art takes the place of instinct."

Yet, art is there, and "What is it a picture of?" is always a question. The philosopher R. R. Wartofsky said:

The radical epistemological conclusion is that there is no intrinsic, veridical, or 'correct' mode of representation that is not itself a product of the social and historical choices of norms of visual representations. Truth in perception is bound to canons of the veridicality of representation; these, in turn, have a history and are rooted in our social practice and in our own activities of picturing and representing. Thus, it is we who create the very norms of veridicality by our pictorial practice. Such norms are not arbitrary, though they are conventional; they are not biological but historical. Pictures are heuristic and didactic artifacts. They teach us to see; they guide our vision in such a way that the seen world becomes the 'world scene'.

However, Wartofsky's position runs counter to positions taken by psychologists, for example, Hochberg and Molnar, who grounded seeing in the biology of the eye.

Another important concern to philosophers as well as artists is how viewers interpret art. Sidney Finkelstein maintained that all scientific approaches to vision which reduce it to those properties that are shared by all viewers may be distorting the phenomenon they propose to be investigating. Accordingly, the individuality of seeing is irrevocable, and the artist in the process of creating in a highly idiosyncratic and dynamic way makes the individuating decisions. Moreover, it is not clear how and when such decisions and choices are made, but it appears they are made by the intentionality of the artist. This liberty is taken intentionally in the service of expressiveness, and the result is more effective than it would have been had the schema been 'correctly' followed.

This dynamic aspect of looking and seeing is equally applicable to the viewer. It has been shown that the 'scan path' or repeated pattern of eye fixations is particular to a given individual. That is, sense and meaning will vary according to individuals and their histories – their mental 'fixes' and the conditions of artistic representation. Modern visual culture is far from appreciating the many "trans-local and trans-temporal characteristics which give the work of art its unique distillation of a sense of being in the world." Visual form is a way of pointing to feelings, and space is filled with all sorts of motives – and the result is a richness of emergent awareness registered in the course of looking and seeing. Finkelstein underscored the fact that small differences in location and small variations in weight of rectangle, stroke, or color in relation to others give different meanings to forms in the visual field. "What is true of these paintings must also be true of vision itself, but in a larger and more labile sense. Experimental psychologists are not even aware of the need to be sensitive to such poly-referential qualities."

Richard Wollheim gave considerable thought to the significance of art and its nature as the proper study of aesthetics. For Wollheim it was categorically not the organism's response to art, as psychologists since Fechner have maintained, but it is the meaning that is the core of art.

Like Arthur Danto, Wollheim believed every work of art contains specific meanings. In *Painting as Art*, Wollheim presented an account of artistic meaning in four important principles. These were:

1. Each work of art has its own, its one and only, meaning.
2. This meaning is determined by the fulfilled intentions of the artist, where intention is used broadly to refer to the desires, beliefs, emotions, fantasies, and wishes – conscious, preconscious, and unconscious – that cause the artist to make the work as he does.
3. The artist's intentions are fulfilled insofar as the work of art that he felt caused to create, in turn cause in a suitably sensitive, suitably informed spectator the appropriate experiences.
4. The work of art that is the bearer of meaning thus determined is determined in part by its history of production.

Of the four principles, the one which Wollheim felt may be the most difficult to accept was that of integrity, namely, "one meaning and one right interpretation for each and every work of art." To support his position Wollheim stated, "If artists over

the centuries had not succeeded in putting across what they wished to convey, they would have turned to some other activity to transmit what they intended." And yet, it is possible to see that the work which has a one and only meaning can be shot with ambiguity. It is possible to see that it may be layered, and that once these layers are excavated they could all fit together. It is even logical that for historical reasons meanings should be reformulated in order to keep them in touch with new realities.

The multidirectional efflorescence of modern art forms reflects the creative history of their feverish evolution – the mementos of their own hyperbolic time and place. As such they are indices of the bewildering complexity of society's evolution. No real understanding of the art of any time or place can happen without an appreciation of the art's current socially construed history, nor of the 'psychology' which animated the particular time and place, nor of the 'intimacy' of the symbols that described its time. Psychologists, besides perceiving and cognizing, must begin to learn to read artistic symbols as the flesh, blood, and bones of a century exuding the essence of a people's joy, pain, and desperation in a time when nothing seemed impossible.

See also: Aesthetics and Creativity; Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Cognitive Style and Creativity; Divergent Thinking; Imagination; Innovation; Perception and Creativity.

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Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity

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Glossary

Art Refers to all the arts (see below) or, depending on context, the graphic arts only, such as paintings.

Arts, the Refers to all the arts, including literary and performing arts, as well as popular art.

Arts audience Includes attendees at theater, dance, and music concerts; visitors to art museum; playgoers; and readers of literature (poetry, novels, short stories).

Big- c and little- c creativity The distinction between the creativity of great art and famous artists in contrast to the

creativity found in everyday activities and among ordinary people, respectively.

Clinical psychology See qualitative.

Humanities, humanistic See qualitative.

Psychology Represented by two approaches to the arts; scientific (see below) and clinical.

Qualitative An approach to the arts that emphasizes the discursive, personal, individual, speculative, and subjective.

Scientific An approach to the arts that is objective, quantitative, methodological, and empirical.

Introduction: The Larger Context

Art is undoubtedly a creative achievement of major importance, dramatically demonstrating what it means to be human and offering a unique perspective on mental life, emotions, attitudes, relationships, and behavior. Art is therefore prototypical, a significant sample, revealing a wide array of psychological phenomena, and additionally, a means for personal fulfillment and a source of individual pleasure. An integral part of human experience, art parallels, reflects, and influences people, society, and culture. For good reason, art and artists are synonymous with creativity. Psychology is therefore well advised to consider the relationship between art and creativity.

A substantial body of psychological literature, in fact, does address artistic creativity. In this article I examine its overlap with creativity in general, the important topics and issues it addresses, major findings, and some general directions for future research. My focus is on the scientific approach to the psychology of creativity, although I touch on psychoanalytic and related perspectives, and to a lesser degree, social and other broad influences that facilitate or restrict artistic creativity. Largely ignored, though, is artistic creativity across cultures, including non-Western examples, where artists are often anonymous and credit for creative works is not assigned to individuals. The full story of artistic creativity is embedded in a larger matrix of historical, intellectual, professional, and market forces.

Key Topics

Why Study Artistic Creativity?

Aside from its bearing on creativity, art dramatically illustrates a wide range of psychological phenomena, ranging from the personal, cognitive, and developmental to familial, social, and interpersonal. Art also provides the materials with which to study psychological topics, including aesthetics (creative works as beautiful) and aging (the old-age style of late-life creativity). The empirical study of art is also an interdisciplinary bridge

between science and the humanities. In addition, research on art has the potential of challenging psychology by pointing out omissions in coverage and suggesting alternative interpretations of established findings.

With respect to creativity, great art and recognized artists illustrate its highest level, and in nonartists, too, when they reacting to art with new ideas and revelatory feelings. The content of art and the lives of artists, furthermore, suggest ideas about creativity to be tested and provide the materials with which to do this. Artists and arts audiences also serve as research participants in studies of creativity. Furthermore, psychologists who are open to art, the writings of scholars, and the biographies of artists bring new viewpoints to established assumptions and accepted interpretations of creativity based on investigations of nonartistic materials with participants in neutral settings.

Research on artistic creativity can be done for non-utilitarian purposes, as an intellectual exercise, and also for practical reasons: selecting creative people, usually through tests; improving the educational curriculum; training leadership in businesses and organizations; determining the kinds of audiences attracted to the arts; contributing to an understanding of the relationship between creativity and psychopathology; and using drama, paintings, and literature in art therapy. Furthermore, whatever is learned about artists of renown and works of art that revolutionized the field (Picasso and Cubism, the Impressionists and the use of light) – so-called big-C creativity – is applicable to ordinary people in everyday circumstances, like raising children, or small-c creativity. Big-C creativity reflects the highest and most obvious instances, though, which makes it clearer and easier to specify than little-c creativity in developing theories and doing research.

Definitions

References have been made to art, artists, and arts audiences, as well as psychology and creativity, as if their meanings

were straightforward. But these terms resist easy definition. Nonetheless, a start must be made, for who and what about creativity is studied determines interpretations and explanations of creativity.

Art, artists, art audiences

1. *Art*: Art is a collective term that includes paintings and literature, photography and cinema, opera and plays, architecture and the performing arts, and both their high (classical) and low (popular) forms. Given this diversity, the question of what is art is a perennial one. Consequently, a great deal of contentious debate centers on whether art means something different for everyone, who decides on what is art, and if more or less anything can be called art. These issues concern philosophers, like Nelson Goodman, and most recently Dennis Dutton in *The Art Instinct*.
2. *The artist*: The definition of artist is also neither precise nor fixed, resulting in considerable uncertainty over who is an artist, what artists do, and for whom they do it. However artists are defined – and whatever art is – they make art and the public generally appreciates it.
3. *The arts audience*: The creativity of artists and art seem more self-evident than the case for arts audiences. The experience of concert- and play-goers, attendees at art museums, and readers of literature is occasionally unique, profoundly emotional, often thought provoking, and perhaps life-changing, all of which can be considered creative. Consider, too, the parallels between artists and viewers of paintings, listeners to music, observers of dance, and readers of poetry. In both practitioners and spectators, aesthetic sensibilities are engaged; imagery and imagination are aroused; fresh ideas, deep feelings, and novel ideas are triggered; and thinking and behavior are redirected or modified. A further parallel: just as art is a specialized endeavor and artists small in number, relatively few people appreciate the arts, attend arts events, read literature, and even fewer could be called esthetes or aesthetic. In addition, audiences engaged with the arts, like the heightened sensitivities of artists, are a special filter through which to understand creativity. Most importantly, without an audience for the arts, art and artists might not exist, at least as we know them today, and our views of creativity would be quite different.

Creativity

Definitions of creativity vary considerably, initiate fierce discussions, and arouse controversy. Consider the different kinds of creativity suggested by synonyms such as these: genius, 'giant,' (near) great, master ('the master'), exceptional, (super) star, talented, polymath, gifted, and (highly, very, unusually) original. Then there are autistic savants, creative in one area and sub-par in others. Mention has already been made of big-C creativity (the greatest artists, the masterpieces) and little-c (everyday) creativity, a distinction that leads to another tough question: Is everyone creative, at least to some degree? Accordingly, creativity is normally distributed but varies in amount. Democratizing creativity this way makes it congruent with

critics who see art as elitist, class-based, ethnocentric, and more (removed from the people, marginalized, nonparticipatory, uninvolved with the community, exclusionary, and directed to wealthy, older, and white patrons).

Problematic for defining creativity, too, are the many ways in which it is expressed. Painters, novelists, and musicians differ in obvious ways. Nonetheless, we usually assume the process is similar among artists, as well as in creative scientists, inventors, engineers, and other nonartists. If true, then painters, composers, and authors – compared to less creative nonartists – should more readily recognize, accept, and appreciate scientific and other kinds of creativity (painters' views on modern poetry, artists on the latest technological achievements) and vice versa (scientists on contemporary art). This prediction, as far as I know, has not been tested.

More certain are descriptions of creative works of art (or creative anything): they are of high quality (exceptional, outstanding, the best); original (inventive, new, novel); appropriate (useful, relevant); communicated; accepted (eventually if not immediately); persisting over time; and influential. Creative outcomes, all concur, are not derivative, an elaboration or extension of something developed by someone else at an earlier date. Substantial agreement also exists on descriptions of creative people, which are quite extensive (listed later) and include many of the same terms applied to creative works (original, nonconformists). Places, too, are called creative (a classroom), as are historical periods and societies (the Golden Age of Greece, Renaissance Florence).

Psychology

Psychology, too, is not a term with a single meaning, and each takes a different approach to artistic creativity. Qualitative orientations are represented by Freudian (psychoanalytic), Jungian, Rankian, and psychodynamic positions with clinical and therapeutic preoccupations. In depth narrative analyses are applied, for example, to creative writers (Dickinson, Melville, O'Neill, van Gogh, Virginia Woolf, and especially Shakespeare). Scholars, critics, and historians often incorporate these interpretations into discussions of artists and art.

Quantitative approaches to artistic creativity, also known as the scientific, empirical, objective, experimental, and academic, and emphasized in this essay, fall under several headings. The psychology of art (or psychology of the arts) and the psychology of aesthetics (psychological aesthetics, the psychology of aesthetics) focus on the importance, role, correlates, and effects of art. Most rigorous, precise, and criticized (for its reductionism) is experimental aesthetics. With roots in philosophy, it translates the concepts of beauty, pleasingness, harmony, and many other qualities (balance, rhythm, liking, preferences, attractiveness, appeal, satisfying, 'good') into simplified and hence manipulable and studiable laboratory surrogates (color patches, sounds, and syllables for paintings, music, and literature, respectively). Cutting across these approaches is the psychology of literature, of music, of paintings, and so on, and research that concentrates on the artist, the work of art, and the audience for art. Mention should also be made, from an historical perspective, of Gestalt psychology, an early school of psychology that gave serious attention to the arts.

Background and Approaches

Background

Creativity is a relatively new topic in psychology. Even though Freud published *Leonardo da Vinci and a Memory of His Childhood* in 1910, and *Creative Artists and Daydreaming* in 1908, scientific attention only began around 1950. Important advances in research and theory have been made by a number of psychologists. (A short list includes Teresa Amabile, Mihaly Csikszentmihalyi, Howard Gardner, Howard Gruber, J. P. Guilford, Kay Redfield Jamison, Donald MacKinnon and members of the Institute of Personality Assessment and Research he headed (including Frank Barron and Ravenna Helson), Colin Martindale, Anne Roe, Albert Rothenberg, Mark Runco, Keith Sawyer, Dean Simonton, Robert Sternberg, E. Paul Torrance, and Robert Weisberg.) Textbooks, books of readings, and handbooks on creativity have been published; and studies and essays are found in the *Creativity Research Journal*, *Journal of Creative Behavior*, *Leonardo*, *Poetics*, and *The Psychology of Aesthetics, Creativity, and the Arts*. Division 10 of the American Psychological Association (Society for the Psychology of Aesthetics, Creativity, and the Arts) specializes in the areas noted in its title. The International Association of Empirical Aesthetics, concentrates on aesthetics and art, and publishes *Empirical Studies of the Arts*. Scientific literary studies are promoted by IGEL, the German abbreviations for the International Society for the Empirical Study of Literature.

Approaches

General

Creativity can be approached in one of two general ways. One is 'from above' (big-C creativity), where the focus is on outstanding artists, great works, and reactions to recognized art. The alternative is creativity 'from below' (little-c creativity), which studies ordinary people and general psychological processes, often in the laboratory or other kinds of controlled settings. Generalizations about creativity can therefore flow in either direction: up, from 'below,' or down, from 'above.' Similarly bidirectional is the application of the concepts, methods, and models of psychology to artistic creativity, or alternatively, the translation of the writings of art historians, musicologists, literary critics, artists, and other experts in the arts into psychological terms that are studied with traditional scientific methods. Rarely are the arts approached from both above and below simultaneously, in parallel fashion, or sequentially. The topic is too complex.

Psychoanalytic

The psychoanalytic and allied approaches to creativity (e.g., Jungian) are the most well known, endorsed, and criticized. The focal point is the individual and his or her personal experiences, especially their unconscious origins and disguised manifestations. The Freudian view is that a work of art is therefore an unconscious, symbolic, and indirect manifestation of an artist's repressed wishes from childhood, usually sexual in nature. These creative forces are known as primary processes, in contrast to secondary processes, which depend on conscious skills that apply an approved veneer onto baser urges. Creative output is therefore a sublimated defense mechanism that

protects artists from being overwhelmed by childhood anxieties. Audiences can then safely project their own camouflaged traumas of infancy onto socially approved artistic products. Creativity is therefore, in a sense, biographical for both artists and audiences. While some psychoanalytic concepts have become part of mainstream academic scientific psychology (the subliminal, or un verbalized material below the threshold of consciousness) the reverse is less often the case.

Scientific

The scientific psychological approach to creativity applies the standard array of empirical research tools to works of art, artists, and audiences: testing (psychometrics), correlations, experiments, cross-sectional and longitudinal studies (studies take place at a single time or over an extended period, often years, respectively), interviews, case studies, and the content analysis of biographical, archival, and written material (the historiometric method). These methods yield information on the personality of creative people (autonomy, openness to experience); cognitive abilities (problem-finders/definers/solvers; stimulus free rather than stimulus bound); development (usually emphasizing the younger years); social characteristics (attitudes, values); and interpersonal relations (most often involving family relations). Examined, too, are individual differences, distinctions between minority groups, and gender (e.g., creative men and women face and overcome different demands).

Scientifically oriented psychologists also investigate innate determinants of artistic creativity in biology (genetics, heredity), sociobiology and evolution (the random variations that facilitate survival), and neurophysiology (sensory, affective, and verbal areas of the brain). Neuroaesthetics, a recently coined term, is the scientific study of the neural consequences of contemplating a creative work of art, such as the involvement of the prefrontal cortex (in thinking) and limbic systems (for emotions). Physiological accounts locate creativity and its underlying correlates but do not tell us what creativity is, what it does in relation to self, others and society, and in whom it happens, why and when. These questions are more germane to experientially and behaviorally oriented psychology. Mathematical models of creativity, such as chaos theory, address other sorts of questions.

The broadest approach to creativity places it within social, cultural, economic, political, and historical contexts, where one might find references to art as reflecting national character, a nation's values, and a people's 'spirit.' The emphasis is on the controlling roles of institutions, corporations, markets, ideology, laws, censorship, and other sources of power, the gatekeepers. Related topics are the means of communication (critics, dealers, collectors); the art community (the relation of artists to one another, now and in the past; the New York City environment); the receptivity of different kinds of audiences, such as teenagers; the importance placed on the artist's self versus others; the artist as teacher and entrepreneur (merchant, businessman); and most simply, the need for artists to earn a living. In contrast to psychological approaches, broad approaches to artistic creativity are centered on external agents (collectors, philanthropists, patrons, critics, mass media, reviewers, curators, and museum directors) who facilitate or stultify creativity.

What Has Been Learned?

Psychology has learned a great deal about creativity, both artistic and otherwise, only a small part of which can be touched upon in the limited space available here. Much is known about the personal characteristics of creative people: they are tolerant of ambiguity, risk takers, solitary, persistent, hardworking, versatile, consumed by their work, and driven by intrinsic rather than extrinsic motives (doing something well for its own sake rather for rewards). A great deal of attention is also given to the cognitive characteristics of creative people. They diagnose a problem; conceptualize, reconstruct, redefine, and redirect their thinking; and generate, synthesize, invent, and extend their ideas on how to proceed. Creative thinking is also described as putting the artist or audience member into a state of 'flow,' where the engagement with art is so intense as to make one oblivious of external events.

Within the cognitive realm, too, an important distinction is made between convergent and divergent thinking. The divergent thinker (related to oppositional, bisociational, and Janusian modes of thought) is characterized by having many possible answers to a problem while the convergent thinker looks for the one right (or best) answer. Creativity favors the divergent mode, although convergent thinking is also necessary, for instance, in learning, remembering, and applying rules, techniques, conventions, and skills. Thus, a single flash of intuition, a hunch 'out of the blue,' is not enough but has to 'fit the facts' and meet certain requirements. Thus, convergent and divergent modes operate jointly, or one or the other may be ascendant at different times in the creative cycle.

Intelligence plays a somewhat uncertain role in creativity. For example, how high an intelligence is needed for artistic creativity, compared to scientific creativity? And does it have to be high at all (whatever 'high' means)? Several kinds of intelligence have also been proposed (eight so far), some more applicable to different areas of the arts than others. Thus, visual-spatial intelligence is critical for artists, musical intelligence is necessary for composers, verbal for writers, and kinesthetic for dancers. The different kinds of intelligences work together. For example, dancers have to rely on musical intelligence when performing with an orchestra, and interpersonal intelligence is needed in working with other dancers, the choreographer, and various stage personnel.

Creative works of art have also received considerable study. A major and sustained project is plotting the years in which creative output ascends, peaks, and then declines for different kinds of artists, and artists as a group compared to others, like scientists and scholars. A related topic examines changes in creative expression with age, such as the old-age style, which some interpret as a sign of renewed creativity rather than an indication of loss. These and other areas of study and findings in the study of creativity, in general, are covered in the many chapters that make up the volumes of this encyclopedia and its previous edition.

Indeed, some complain of too many facts about creativity, artistic or otherwise, and not enough coherence between them. Several heuristic devices help organize the abundance of information. An early but still useful classification refers to the stages of creativity: preparation (studying, reading); incubation (silent or unconscious thinking); illumination

(insight, clarification); verification (checking the validity of the idea, working out the details); communication (insuring that breakthroughs are understood by others); and acceptance (promoting, networking). Another helpful framework speaks of the '4 Ps' of creativity: person, product, process, and press (the environment). Useful, too, are the '7 Is' of creativity: inspiration, imagery, imagination, intuition, insight, incubation, and improvisation. Constructive as well is an emphasis on certain key features: fluency (number of different responses); flexibility (variety of responses); originality (of the responses); and elaboration (developing and adding details). An interesting model speaks of the two cycles of creativity: generative (of ideas, possible solutions, research possibilities, trial and error) and explorative (testing and evaluating). Another distinction is made between artists who are conceptual (Picasso, Matisse, Warhol) or experimental (Mondrian, Kandinsky, Pollock). The former did their greatest work suddenly and early in life while the latter changed gradually later in life. A provocative notion divides artists into those who have a rough idea of what they want to accomplish, which propels them in a certain direction; and others who 'fiddle around' until they stumble onto something they like or satisfies them. A similarly broad perspective categorizes artists into those who work within the current paradigm but extend, elaborate, or develop it; another group rejects current models and finds its own way; and a third set that falls between the first two in attempting to integrate the old with the new.

Issues

Much is known about creativity and the arts, and a variety of approaches, conceptions, and models seek facts and ways to organize them. Nonetheless, a number of important issues remain unresolved in understanding artistic creativity.

Is Artistic Creativity Scientifically Studiable?

Probably the most basic issue is whether the scientific study of artistic creativity is possible. Art is, by definition, subjective, unique, and individualistic while science is objective, general, and abstract. How is rigor possible where imagination reigns supreme? How much sense do statistical accumulations make when our interest is in a particular work, a specific artist, or a personal response? Scientific studies, by their nature, aggregate artists, works, and observers/listeners/readers, resulting in bland generalizations, characterless and without identity. The inherently conservative canons of science stand in sharp contrast with the revolutionary, avant-garde, and nonconforming world of art. Can individual and general interests be integrated? The distinction, generally known as the ideographic (the particular) and the nomothetic (the universal), respectively, arises when individual differences are focused upon, as is often the case with personality. Ideally, specific and general aspects of artistic creativity should be investigated simultaneously, an Herculean task that becomes Sisyphean if societal and similarly broad determinants are also factored in. One partial solution is to use particular examples of art and anecdotes about artists to illustrate anonymous generalizations. Another option is to study one artist

(Shakespeare, Mark Twain) or one work (Picasso's *Guernica*, Darwin's notebooks) in depth, using multiple measures.

Needless to say, there are also significant similarities between art and science that need to be kept in mind. Like artists, scientists rely on intuition (hypothesis), seek order (through numbers and statistics), and struggle for meaning (with theories). Furthermore, given a choice among several equally possible explanations, scientists select the one that is 'elegant,' 'good,' 'right,' simple, pleasing, and beautiful – or in a word, aesthetic. Scientists and artists also rely on imagination, persistence, and other personal traits and cognitive abilities that spur curiosity and satisfy a need for sensibleness. Bear in mind, too, that some artists of renown, like Leonardo, were also eminent scientists. Not unusual are scientists with considerable artistic talents (Einstein, physicist and violinist; C. P. Snow, who first penned the 'two-cultures conflict,' physicist and novelist). The two disciplines, moreover, rely on the abstract, and increasingly so in the history of art with the advent of modernism. Picasso and Braque, it is said, developed cubism in order to explore the possibilities of pictorial space.

Are There Different Kinds of Creativity?

Picture a novelist, playwright, poet; think of literature, music, architecture. How could this diverse range of practitioners and practices reflect a single model of creativity? Each domain has, at least to some degree, different origins, pathways, and talents. Nonetheless, a general underlying creative process seems reasonable, along with differences in artistic expression specific to each medium. The issue then is specifying the identities and contrasts, the dimensions on which they lie and how much of one or the other.

Differences between creative artists are related to the question of differences between artists as a group and creative non-artists (scientists), and between creative and minimally creative people. Here again, in a similar guise, is the distinction between big-C and little-c creativity, which in turn is embedded in an even larger question touched on earlier: Is creativity universal, an integral part of human nature? As if concentrating on masterpieces, famous artists, and aesthetic people were not difficult enough.

These questions become irrelevant, though, for those who maintain there is no such thing as creativity. People do creative things not because they are creative but because they are skilled, adept in certain techniques, follow the necessary procedures, extensively trained, dedicated to practice, endowed with a beneficial genetic endowment, and blessed by a supportive family and environment. In rebuttal: How account for so many not becoming creative artists (or creative anythings) with similar genetic, personal, familial, and environmental advantages? The answer may reflect a difference in motives or attitudes: "I am (or will be) creative." "I am determined to do great things." "I will make a name for myself." Whether such decisions move the individual toward actually becoming creative may depend on a string of fortuitous external events (the 'breaks').

A less radical position places creativity within an already established field of psychology, rather than as a relatively separate and distinct subject, as is currently the case. Accordingly, some put creativity within the framework of ordinary

thinking, an extension of everyday cognition. But relocating creativity leads to new problems. If equated with problem-solving, for example, who sets the problem, the individual or external circumstances? A problem may arise when an artist wants to do something different from earlier work or because she is competing with another artist. Further, what happens when there is no problem to be solved, as when a creative person is just 'fooling (or playing) around,' enjoying himself, curious, or simply lucky? Also, how account for spontaneous solutions to unexpressed problems? "It just came to me, I don't know from where." When creativity is dispatched to another area, whether to cognition, personality, or development, new and unforeseen difficulties emerge. In addition, when creativity is submerged within another area of psychology, some might say it loses its special cachet.

Who Is Studied?

Progress on many of the issues raised above depends on who is studied. Often, the sample is based on convenience: undergraduates, children, patients in therapy, the institutionalized. And what are we to make of individuals who sincerely believe they are creative but no one else does (except perhaps their mothers)? Relatively few studies, moreover, recruit artists, and even fewer are eminent or recognized as creative by experts (historical figures are the exception). Creative people are most often selected on the basis of high scores on a creativity test, of which there are several differing in structure and rationale. Unknown is whether research participants drawn this way are actually creative outside of the testing room, representative of little-c creativity, or future exemplars of big-C creativity.

When studies are limited in the ways described above, artists, scholars, critics, and the public at large judge them as irrelevant and trivial. Smacking of scientism, too, are investigations that add a smidgeon of data, show off a new technique, or cleverly retest an old idea. Off-putting, too, is the misuse of correlational findings, as when an outstanding trait of creative people (say independence) is used to explain, predict, or foster creativity in others.

What Is Studied?

What about artistic creativity is studied? The focus is usually on cognition, personality, or some other process like motivation. Much less attention is paid to what artists actually do, the work itself, and what makes it creative. Yet it is the creative end-product that ultimately matters; it has an impact, makes a difference, changes things. Creative outcomes are original; the individuals who bring them about are, in the final analysis, secondary.

Neglected as well are judgments of what it is about a work that is special, unusual, or creative, either by experts or non-artists. How is it perceived? What stands out? Are feeling or thoughts evoked? To illustrate my point, let's say authorities advise visitors to an art museum that a work or an artist is creative. Would they agree, be indifferent, 'go along,' or laugh up their sleeve ('a chimp can paint just as good'). To the distress of connoisseurs, the proverbial man (or woman)-in-the-street, prefers 'pretty pictures,' mass-produced kitsch, Elvis

Presley portraits on silk, big-eyed children, or portraits drawn by street artists for \$10 (\$5 extra for color). Surveys never ask, as far as I know, "If money were no object, would you buy this Rembrandt/boxed CDs of Beethoven's sonatas/complete set of Shakespeare's works/a season's subscription to the opera/theater/ dance?" Investigations and discussions of artistic creativity should, to be complete, consider people's actual reactions to what others call creative (or art).

The public also holds some strong opinions, some would say myths, about creative artists (often shared with artists themselves). They are alienated recluses, Bohemian, starving, working in obscurity (in a garret), suffering (tubercular), overly sensitive, rejecting worldly success, divinely inspired, engaged in a sacred pursuit, and slightly mad. The extent of these beliefs should be empirically investigated. For example, are they correlated with attendance at arts events?

When Is Creativity Acknowledged?

Herman Melville died unknown. Keats, dying, wrote "Here lies one whose name was writ in water." Stravinsky's *Le Sacred du Printemps* provoked a riot of angry concertgoers. Numerous historical figures, once considered creative in their time, no longer are (see older editions of encyclopedias). The time-bounded nature of creativity is also illustrated by childhood prodigies who did not fulfill their early promise, and brilliant young artists who failed to live up to their potential (while others surprised their teachers).

Shifts in the recognition of creativity, at least in part, depend on a paradox. Creative work is novel in relation to what is known and accepted. Eventually, creative breakthroughs become known and accepted. Subsequently, and inevitably, they are superseded by more recent creative achievements. Creative work therefore takes place in a fuzzy zone, somewhere between the familiar and unfamiliar, the recognizable and unrecognizable, the identified and the unknown. Revolutionary efforts fall outside the traditions of a particular time, 'on the edge,' and if too far out they are deemed unacceptable and rejected.

At What Age Does Creativity Emerge?

For Freudians, the source of creativity is planted very early, before age five or so; the rest is destiny. Creative forces then blossom in adolescence or early adulthood. Others argue that creativity evolves and appears relatively late in life. For example, Freud, Darwin, and George Bernard Shaw did their major works in middle age or later (although they displayed their talents earlier). Van Gogh is a famous case of a late starter. An extended developmental perspective on creativity focuses on the age at which individuals realized their special gifts, how they felt about them (superior, accepted, resentful?), and why certain professional paths were chosen over others when abilities lay in more than one area. These kinds of questions are addressed by systematic studies of early records – letters, sketches, notebooks – for events that foreshadowed later accomplishments.

Are Interdisciplinary Exchanges Possible?

Psychologists in general are not especially acquainted with the arts or particularly well read in the humanities. Likewise,

scholars in the humanities are not versed in the scientific method and its technicalities; artists are even less proficient in such matters. The temperaments attracted to these disciplines sharply differ, not to mention their dissimilar training and goals. This insularity can only become worse as professions become increasingly more specialized and narrow in scope. The 'two cultures conflict' is not an easy barrier to overcome. A few figures, though, E. H. Gombrich in art history and Rudolf Arnheim in the psychology of art, to name just two notable individuals, successfully integrated their knowledge of scientific psychology, the arts, and the humanities. Interdisciplinary crossings are therefore possible and more likely to occur, at least among psychologists, as they delve into art and art history through research on artistic creativity. Their journeys tangibly demonstrate the fruitfulness of interdisciplinary links, and make it harder for scholars and artists to ignore the results of such crossovers.

Creativity as Health or Pathology?

Creativity is associated with health, self-fulfillment, and problem-solving but also with mental illness (the 'Sylvia Plath effect') and at least historically, with criminality, with which it was believed to share the same genetic sources, albeit with more benign consequences. Creativity therefore reflects both the bright and dark side of human nature, its healing and suffering aspects. Falling somewhere between these extremes are views of creativity that see it as eccentric, unpredictable, contrarian, and mystical. Contradictory notions about artistic creativity need to be made explicit, recognized, and clarified.

The Morality of Artistic Creativity?

Deserving some comment, too, is the uncertain relationship between artistic creativity and morality. Artists argue for complete freedom to do their work, to go their own way, no matter how outrageous, odious, and upsetting it may be to others. Scientists, too, grapple with the consequences of their work (developing the atomic bomb, for example) and whether the ends to which their works are put should be their concern or consigned to politicians. Artists have resisted this sort of self-scrutiny and therefore continue to come under attack for anti-social rebelliousness.

Future Research

Studies of creativity would do well to include art, artists, and arts audiences, and to conduct investigations in artistic venues, like concert halls, possibly during intermissions, at the end of performances, and with mail-in questionnaires. If psychology's research agendas are dominated by traditional and familiar practices, they will remain blind to the possibilities offered by the arts. Refreshingly new points of view are likely to emerge if historians, literary critics, and artists are listened to carefully and read conscientiously. Investigators should also become more acquainted with creative artists through interviews, case studies, and historical sources; be open to guidance from experts when selecting works of art to include in studies and

when interpreting the results of such efforts; and serve as participant observers in book discussion groups, at gallery openings, and other artistic settings. Psychologists may find that artists, scholars, and arts audiences are not as concerned with the same problems as they are (the sources, development, and trajectory of artistic creativity) and instead are preoccupied with what's 'hot' and who's 'in,' predicting changes in artistic style, and puzzling over the millions spent for a single work at art auctions. Artists may indeed mull over the origins of their creativity – or agonize over critics' reactions; scholars might very well scratch their heads over what makes a work of art creative – or how it differs from previous efforts; audiences at a musical concert relish their aesthetic experience – or vainly search for a comprehensible melodic line. In other words, psychologist should pay more attention to the real art-world.

For example, arts audiences may wonder whether exposure to the arts affects their creativity (or their children's) and in what ways. Do new ideas arise, are dormant feelings aroused, and will previous ways of thinking and behavior be nudged in new directions? Further, will some become active participants (join the stage crew at a community theater) or develop an artistic hobby ('Sunday painters,' take up the piano)? Amateur artists, although large in numbers, are a neglected segment of the art-scene, falling somewhere between professional artists and casual consumers of the arts. The study of amateur art and artists might therefore clarify the relationship between little-c creativity and big-C creativity.

Conclusions: The Reciprocity of Knowledge

A great deal is known about artistic creativity, although a number of critical issues, discussed above, need to be explored further. Unresolved matters, however, should not mask the substantial contributions scientific studies of artistic creativity have made to psychology. They are also a counterweight to Freudian analyses that dominate discussions in art history and the humanities in general. Masterpieces do not arise solely from the unconscious and artistic genius does not necessarily spring from repressed childhood experiences. Empirical studies, too, liberate artists by increasing their awareness of the cognitive nature of art-making. Arts audiences, too, benefit from objective knowledge about the benign origins for the pleasures of art.

The typical modes of scientific analysis are rational, deductive, precise, logical, and mechanical. These are balanced by inquiries into what it means to be a creative artist and to experience an artistic work with an emphasis on intuitive and empathic thinking and sensual and expressive feelings. Prominent, too, are introspective, experiential, and phenomenological self-reports, interviews, case studies, historical information, and autobiographies. Research materials are also expanded by the inclusion of novel visual forms (paintings), complex sounds (music), complicated verbal texts (literature), unfamiliar movements (dance), and subtle tactile information (sculpture). Expanded, too, are the populations studied (artists) and the settings for research (in art museums). The widening of research methods, materials, and locales are refreshing antidotes to the artificial, simplified, and isolated limitations of the typical psychology laboratory. Consequently,

psychology's boundaries are extended, researchers' technical skills are sharpened, and theorists' conceptual frameworks are stretched, not to mention the addition of fascinating topics to study.

The unfettering of traditional research paradigms is not without its perils, though, such as managing the subjective vagaries of self-reports. The advantages gained by studying artistic creativity comes at a price and psychologists are hard pressed to use their ingenuity in applying the scientific canon correctly and meaningfully. The challenge of resolving the inevitable difficulties of investigating sublime phenomena requires psychologists to be, in a word, creative. But the effort is worth it, especially since artistic creativity adds a welcome facet to positive psychology, neglected until recently.

Summing up: The psychology of creativity is advanced by the study of art, artists, and arts audiences. Conversely, writers, painters, composers, and other practitioners of the arts profit from scientific psychological studies of artistic creativity, as do literary critics, musicologists, and scholars along with readers of poetry and other kinds of art audiences. Competing approaches to artistic creativity, the multitude of undigested facts, the challenging issues that arise, and the increased opportunities for research sketched in this review should stimulate new thinking, some of it hopefully creative. Important questions about artistic creativity – say, unexpected changes in styles of painting or literary expression – are less tantalizingly distant than they initially seemed.

See also: Aesthetics and Creativity; Art and Aesthetics; Brain and Neuropsychology; Cognitive Style and Creativity; Crime and Creativity; The Dark Side of Creativity; Definitions of Creativity; Divergent Thinking; Everyday Creativity; Flow and Optimal Experience; The Four Ps of Creativity: Person, Product, Process, and Press; Genius and Greatness; Historical Conceptions of Creativity; Historiometry; Implicit Theories; Intelligence (as Related to Creativity); Janusian, Homospatial and Sepconic Articulation Processes; Mad Genius Controversy; Moral Issues in Creativity; Multiple Intelligences; Nature/Nurture and Creativity; Perception and Creativity; Perspectives; Problem Finding; Problem Solving; Prodigies; Sociobiology; Testing/Measurement/Assessment; Theories of Creativity.

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Relevant Website

<http://www.google.com/search?hl=en&q=What+is+art%3F&btnG=Google+Search>
– What is art?

Associative Theory

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Glossary

Associative theory An explanation of creative thinking as the process by which disparate elements come together in new combinations for a useful purpose.

Brainstorming A technique for producing a large quantity of ideas while postponing judgment on the quality of the ideas.

Convergent thinking Thinking that brings together information focused on solving a

problem, especially problems that have a single correct solution.

Divergent thinking The ability to generate a variety of associations to a word or solutions to a problem.

Incidental learning Unplanned or unintentional learning in which ideas or relationships previously seeming to be irrelevant are later associated.

Historical Foundations

Associative theory holds that creative ideas occur when disparate elements come together to form a new idea or solution to a problem. There is a general consensus in the field today that having a broad search process that enables a variety of associations to occur helps creativity. The importance of broad associations in the creative process has been a central component of several theories of creativity which will be reviewed in this article.

The associative theory of creativity explores the ways in which ideas or solutions to a problem might be generated and how those ideas are linked together in the mind. Historically, a variety of philosophers, scientists, and psychologists have pondered and researched the importance of associations in the creative process. Associationism was first a philosophical idea asserting that mental processes operated by the association of one state with its successor states. British associationists including John Locke and David Hume maintained that this principle applied to all mental processes. Ideas were said to be associated in the mind according to certain laws including contiguity and resemblance. Ideas could therefore lead to further ideas and this served as the understanding of mental functioning in general.

Alexander Bain wrote of the idea of incubation, when new combinations of elements can sprout from that which is already in an individual's mind. One can imagine already existing ideas in a person's mind, free-floating and continuously bumping into each other and combining. Sometimes, ideas will combine in ways that are not new, useful, or of any particular interest; however, other combinations may be a unique or novel solution to a problem, and grab the attention of the individual, such that the idea becomes conscious and is recognized as creative. Similarly, Albert Einstein spoke of 'psychical entities' which made up thoughts and how the combining of these elements was the 'essential feature of productive thought.' Such perspectives on the importance of combining already existing elements in new ways can be viewed as the influential precursors to associative theory.

Mednick's Associative Theory

In 1962, Sarnoff Mednick published his associative theory of the creative process, stating that creative thinking was the process by which disparate elements come together in new combinations for a useful purpose. A creative solution to a problem comes about by bringing together multiple ideas which only when combined in a new way become useful as a viable solution. A combining of more remote elements is viewed as more creative than the combining of more similar items. For example, the Beijing National Stadium known colloquially as 'the Bird's Nest,' designed for the 2008 Beijing Summer Olympics, addressed the need for an original stadium with the model of a nest, thus bringing together two remote concepts into one creative product.

According to Mednick, a person can produce creative solutions through any of three separate processes: serendipity, similarity, or mediation. A creative solution stems from serendipity when associative elements are evoked by a person's situation and are accidentally put together. Accidental discoveries, such as when US Navy engineer Richard T. James accidentally knocked a spring off his work table and invented the Slinky, are considered serendipitous. A creative solution might also be produced through similarity, such as when associative elements are evoked because of their similarity to another element, such as with words that rhyme. Lastly, creativity might arise from the process of mediation, in which associative elements are evoked through the mediation of a third common element. In other words, there may be two associative elements which appear unlinked until a third mediating element is presented at which point the association becomes clear. For example, a medical diagnosis might serve as the mediating link between multiple symptoms which would otherwise appear unrelated.

Mednick identified a variety of variables that could contribute to the likelihood of someone coming to a creative solution or making a novel association, with a strong focus on individual differences. Each is discussed below in more detail:

1. the need for associative elements;
2. an individual's associative hierarchy;

3. the number of associations one makes;
4. the influence of cognitive and personality styles; and
5. the process of selecting a creative combination.

To make novel associations between elements or ideas, one must have associative elements in mind with which to work. Simply put, one cannot put two things together if one does not have two things. As Mednick stated, "an architect who does not know of the existence of a new material can hardly be expected to use it creatively." Moreover, the more associative elements to which one has access, the more permutations and combinations are possible. Thus, individual differences in experience, memory, knowledge or verbal ability have the potential to affect one's level of creativity given the nature of the task.

The Associative Hierarchy

Associative theory often refers to an individual's associative hierarchy, as shown in Figure 1. The associative hierarchy depicts the ways in which different individuals will produce associations to a problem, such as "how many ways can you think of to use a tire?" An individual with a flat hierarchy will first give common associations like "put it on a car to drive," then is more likely to also make some unlikely or uncommon associations as well, such as "make a tire swing," or "use it as a snow tube for sledding." In contrast, a person with a steep associative hierarchy will also first produce the typical solutions to the problem, but will then show a steeper decline in their ability to keep thinking of ideas, resulting in very few uncommon associations being produced.

Mednick stated that the person with the flatter hierarchy can be said to be the more creative person, while the person with the steeper hierarchy is less creative. Not only did the person with the flat hierarchy produce more solutions in total, but also would produce more original solutions. This pattern of response generation for the more creative person, the person with the flat hierarchy, is explained by postulating that in this creative person's mind, more ideas are connected, but the associations between the ideas are not as strong.

This set up allows for a more interconnected mind, such that a given problem will lead to a wider range of solutions including those which are less common. In other words, word associations for the more creative individual will be less stereotyped or common. For example, a person with a steep hierarchy might respond to 'table' with typical associations like 'cloth' or 'dinner,' but then run out of associations, while a person with a flatter hierarchy might continue on to an answer such as 'ping pong.' For the creative individual, associations may be weaker but they are farther reaching.

The associative hierarchy leads to two important implications. First, if one expects less creativity from an individual with a high concentration of associative strength in only a few responses, then one can predict that the greater the number of occasions on which a person has already solved a given problem using one particular solution, the less likely the individual will be to produce a creative solution in the future. Given the problem of a flat tire, and elements consisting of a spare tire and a wrench, who would generate possible solutions much beyond the tried and true response, "change the tire"? In other words, given the same problem, the same materials, and a solution that worked last time, one will have a steep associative hierarchy. This means that given the same problem and the same materials, an individual who is new to the scene is more likely to be creative than someone who has been presented with the same problem many times before.

Second, the hierarchy posits that most people, no matter the level of creativity, will begin by giving typical answers, or ideas that are not very original. Thus it seems that the novel associations are only produced after one has depleted their reservoir of more obvious ideas. This notion that the more creative ideas will come later in the associative process suggests that when an individual is faced with a problem there is benefit in taking enough time to get past the obvious solutions in order to reach those more remote connections. Such a technique speaks to the power of brainstorming, discussed further below.

The greater the number of associations an individual can produce for a given problem, the more likely their chances are of producing a creative solution. This notion is not

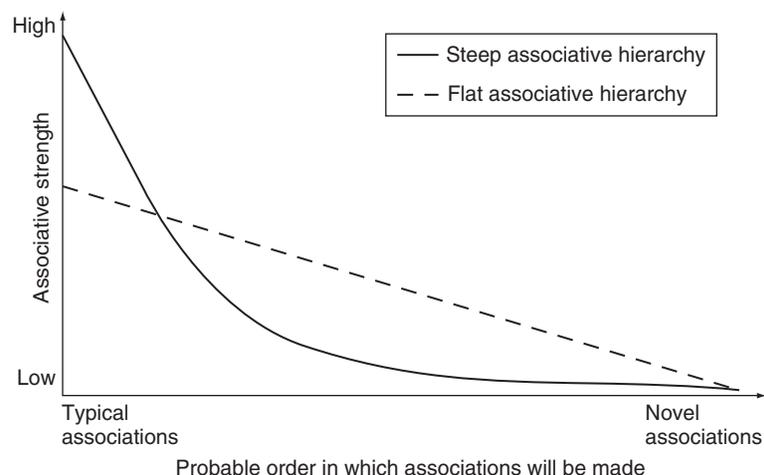


Figure 1 Possible associative hierarchies according to Mednick's associative theory.

completely separate from the associative hierarchy in that an individual with a steep associative hierarchy does not produce as many associations or solutions as someone with a flatter hierarchy, and thus is less likely to produce a creative association. Therefore, a person with a flat associative hierarchy is more likely to produce novel associations not only because of their weaker but broader associations in general, but also due to the sheer quantity of responses they are more likely to generate.

A possible explanation for this phenomenon, based in associative theory, is that the more associations that are made, the more likely it is that a link to a new associative element that will continue facilitating more associations will be found. For example, a person naming animals may begin with unoriginal answers like cat or dog, but once they think of cow, they suddenly have a bridge to a host of other barnyard animals previously unreported. An important note here is that the speed with which someone reaches a creative solution is not taken into account, as mentioned previously, it is usually only after the stereotyped responses have been depleted that more creative solutions are uncovered.

Given that a greater number of associative elements and number of associations produced are both likely to lead to more creative solutions, associative theory must also grapple with how an individual's previously learned methods for approaching a problem and their personality style in terms of persistence or motivation might influence their likelihood of producing creative solutions. Individuals with instruction in brainstorming or other techniques for enhancing creativity are more likely to reach creative solutions.

Selecting a Creative Combination

When making creative associations between elements, a variety of associations can be produced, but what will cause a person to pick one solution to a problem over another? Mednick's answer to this question reaches back to the definition of creativity as a product which is both novel and useful. The 'usefulness' of a solution can be used to distinguish an original solution from a creative one. In other words, the requirements of a problem come to be elements themselves. For example, when asked "how many ways could you use a tire?" it is implicit that the solutions produced must include a tire, and must be a way of using it. Answering "rubber" does not meet these requirements the way that, "put it on a car to drive" does. Furthermore, while "give it as an engagement ring" might be original (in that no other respondent has ever given this answer), it is not a useful solution for what to do with a tire, and thus should not be counted as a truly creative solution to the stated problem.

Mednick asserted that the novel association or solution achieving the closest fit with the set of problem requirements is the solution which gets selected. For example, a diagnosis that is able to explain all of a patient's symptoms will be chosen over a diagnosis that explains only half the patient's symptoms leaving the other half unexplained. The solution explaining all the patient's symptoms is the more useful. Therefore, the creativeness of a given solution can be seen as some function of the number of requirements that the product meets. A solution meeting all the requirements is more creative than a solution only meeting half.

Remote Associates Test

An advantage of the clear predictions made by associative theory about individual differences and creative products is that they are testable. In 1967, Sarnoff Mednick and Martha Mednick operationalized associative theory's definition of creativity with the Remote Associates Test (RAT). Since its inception, it has been used to test a variety of predictions about creative thinking.

The original RAT consisted of about 30 items administered with a 40-min time limit. For each item the subject was presented with three words which seemed to be unrelated (playing, credit, report) and the subject was asked to produce a fourth word that would serve as the associative connection between the disparate words presented (card). The test items were intended to make the subject think creatively, by taking given associative elements and creating a novel combination by providing the mediating link. Mednick emphasized the importance that the links be strictly associative such that a subject must use creative thinking and not logic, concept-formation, or problem-solving to reach the same solution. A subject's score was calculated as simply the total number of correct answers out of 30 items.

Mednick reported the RAT to have high reliability with samples of undergraduate males and females. Original validity studies found that high RAT scorers got good grades from teachers rated as flexible and low grades from teachers rated as dogmatic, and vice versa for those subjects with low RAT scores. Mednick also reported significant positive correlations between high creativity and social attitudes of liberalness. In follow-up papers, RAT scores were also found to correlate with the Creativity Rating Scale (CRS) on which professors were asked to rate the creativity of their graduate students. The RAT was not found to correlate with the Miller Analogy Test (MAT) nor with scores of Grade Point Average (GPA).

However, critiques of the RAT have also been prevalent. The test does not seem to take into account the motivation or other intrinsic factors, including those which Mednick wrote about himself, such as past experience or number of associative elements available which could also affect someone's appeared level of creativity. Later research found that an individual's ability to solve RAT items was significantly related to a variety of cognitive abilities, most notably verbal ability. Daniel Fasko has made similar arguments, citing research showing weaknesses in Mednick's original theory. For example, individual differences show that highly creative people tend to avoid repeating themselves more than less creative people. Fasko asserts that Mednick's associative theory may require some revisions to address the complexity of creativity.

Continual Word Association

In a follow-up paper published in 1964, Mednick and colleagues continued to explore associative theory using a continual word association task. One of the predictions stemming from associative theory was that the greater the number of associations a person makes in response to the associative elements of the problem, the greater the probability of reaching a creative solution. This notion leads to the hypothesis that highly creative people should produce a greater number of associations

when they are presented with a stimulus than less creative individuals.

In this line of research, instead of looking at the associative hierarchy of an individual, the associative hierarchy of individual words were examined. The associative hierarchy of a word is defined by group word association norms. Thus, a word is said to have a steep associative hierarchy if it elicits only one dominant association and then many other associations all of low response strength. In contrast, a word is said to have a flat associative hierarchy if it does not elicit any single dominant response, but instead elicits many responses all of somewhat equal frequency.

Research findings using both continual word association and the RAT seemed to support associative theory and the associative hierarchy notion. Participant's level of creativity, as measured by the RAT, related directly to response frequency. Furthermore, words with flat hierarchies did elicit a larger number of responses than did word with steep hierarchies. In terms of individual differences among words, results found that high frequency words elicited more responses than did low frequency words, and that nouns elicited more responses than did adjectives.

Findings in this area also addressed the speed with which people produced associations. Mednick's hypothesis was that highly creative individuals would respond relatively slowly but steadily, emitting many responses during continual word association. Instead, although the high RAT scorers did produce more responses total, they also did so at a consistently more rapid pace than other groups. Results such as these, showing mixed results with the RAT, suggest that the interpretation of creativity as merely associative behavior is too simple. Creativity is perhaps more complex than initially presented, again suggesting the need for revisions to Mednick's original theory.

Incidental Learning

In his 1967 paper on incidental learning, Patrick Laughlin makes the links between creativity and the use of remote associations clear. It is suggested that the process of forming, retaining and using remote associations is essential in both creativity and incidental learning. Laughlin defines incidental learning as a situation in which apparently irrelevant ideas or relationships must later be associated with each other. Based on associative theory, it is therefore predicted that a more creative individual will display better incidental learning.

Two possible factors are hypothesized to explain the connection between creativity and incidental learning. First, Laughlin suggests that a highly creative person might have greater perceptual sensitivity to the seemingly irrelevant stimulation presented in an incidental learning scenario. Second, it is also possible that the highly creative person is better able to retain the stimuli from the scenario in a more accessible form in order to use the information later for solving the incidental learning task. This notion seems closely linked to Mednick's ideas about the availability of information previously stored. In line with associative theory, Laughlin's incidental learning study results were interpreted as "reflecting wider deployment of attention and less screening out of irrelevant past experiences by high creatives during problem solving."

Other Measures

A wide variety of other association measures exist to further the understanding of associations in creativity. The Kent-Rosanoff Word Association Test (KRWAT) is another word association measure. The measure has shown significant correlations with other creativity ratings for engineering honor students and research scientists. Participants respond to each stimulus word with the first word that comes to mind. This measure was the first to have objective scoring and norms presented in frequency tables; however, the test was criticized for not incorporating individual differences in responses due to factors such as socioeconomic status, age, or education level.

One important development is that tasks such as the RAT are now seen involving some convergent thinking, where information is brought together to form a single solution. Insight tasks would also fit this category. In contrast, associations and creativity are increasingly measured using divergent thinking tests. A divergent thinking test is another measure of creativity which can also be used to explore remote associations and ideational patterns. Divergent thinking is a more open-ended task than the RAT in that subjects are asked to generate as many responses as they can think of to a given stimuli. For example, a subject might be asked to "name all the uses you can think of for a button." Aside from the sheer number of ideas presented by a person (fluency), the individual answers might also be scored in terms of their originality. Current measures used in this area include J. P. Guilford's Alternate Uses Task, Michael Wallach and Nathan Kogan's adaptation of the Alternate Uses Test for children, and the Torrance Tests of Creative Thinking (TTCT).

Psychodynamic Perspectives on Associative Theory

Classic psychoanalytic theory has a different view of associations and creativity. In essence, individual differences in comfort with primary process ideation accounts for the number and originality of associations. Primary process thinking is, according to Robert Holt, drive-laden oral, aggressive, and libidinal content and illogical thinking related to that content. It is a developmentally early, primitive system of thought not subject to logic and heavily affect-laden. Sigmund Freud thought that if individuals repressed 'dangerous' thoughts and wishes, then there would be a general intellectual restriction. In a primary process mode of thinking, ideas are easily interchangeable and attention is widely and flexibly distributed. There should be a broader search for associations for individuals comfortable with primary process ideation. There is strong empirical support for this hypothesis on various divergent thinking and association tasks, especially with male participants.

The psychodynamic perspective is consistent with Mednick's associative theory. It provides one explanation for why some individuals have such a steep associative hierarchy and others have a flat hierarchy. There is a looser connection among ideas for individuals who have easier access to primary process thinking. There is not such a strong bond among ideas and images so that more flexibility of thought and associations can occur.

For true creative production to occur, individuals must go back and forth between primary process thinking and more

logical thinking (secondary process). This ability to access primary process in a controlled fashion is Ernst Kris's concept of "regression in the service of the ego." Because production of a novel and useful product requires original associations and evaluation, both broad associations and critical thinking are necessary. The RAT actually measures both of these processes. As previously mentioned, the RAT is not a pure association task. It has been categorized as closer to an insight task because it requires broad associations but then has one correct answer that must be selected. In psychodynamic terms, one must access primary process thinking and then use critical evaluation to select the right response. Creative production is, at least, a two stage process. In an attempt to test this assumption, James Murray and Sandra Russ used the RAT with college students. They also gave them the Rorschach and scored it with Holt's well-validated primary process measure. The adaptive regression score on the Rorschach reflects both primary process content and the control of that content. This score significantly related to the RAT for the total sample and more strongly in the male participants ($r=0.42$). This relationship was independent of SAT scores. In addition, adaptive regression related to the RAT more strongly than to measures of divergent thinking. We concluded from this study that a two-stage process accounted for the cognitive operations underlying adaptive regression and the RAT. The first stage was a generative stage while the second stage was an evaluative stage. In that sense, the RAT is a more global measure than are divergent thinking tests and is a more accurate reflection of the creative process.

Mood and Associations

Affect and mood are important variables in influencing the range of associations and creativity. Dimensions of affect account for individual differences in range of associations but also can increase frequency and originality of associations when manipulated. Much of the research in this area has used a mood induction research paradigm. Mood is induced by having individuals watch a movie, receive a gift, or think of a memory. In a series of well-designed studies, Alice Isen and her colleagues found that positive affect induction resulted in increased creativity when compared with control groups. She concluded that the positive affect cues positive memories and a large amount of related cognitive and affective content. This process results in defocused attention and a more complex cognitive context, which, in turn, leads to a greater range of associations and interpretations. Interestingly, in one of her studies, she found that induced positive affect resulted in a broader range of first associations to neutral words. They were more unusual and diverse than for individuals in control groups. This is different from what one would predict from Mednick's theory that common associations would occur first for everyone. In another study, Isen did find that positive affect improved performance on the RAT. Results for negative mood induction have been mixed. A few studies suggest that mild forms of negative affect could facilitate some kinds of problem solving tasks. In a recent meta-analysis of 25 years of mood and creativity research, Matthijs Bass and colleagues concluded that positive moods do produce more creativity than neutral

moods if the positive moods are activating (happiness) and associated with approach motivation.

There are other current theories about why the involvement of affect broadens the associations. Gordon Bower's associative network theory conceptualizes emotion as a memory unit. The activation of the memory unit aids in retrieval of events associated with it and primes emotional themes for use in free association. In a model by Issac Getz and Todd Lubart, the emotional resonance model, endocepts that represent emotion are attached to concepts or images in memory. These emotional memories are partially interconnected and can activate one another.

One important implication of the research on mood and creativity is that breadth of associations can be altered by the involvement of emotion, especially positive emotion. The steepness of an individual associative hierarchy gradient is influenced by affect.

Brainstorming

As suggested by the associative theory a large number of factors contribute to an individual's level of creativity, including those mentioned previously such as affect, motivation, past experience, number of associative elements available, and the decision process to choose a creative solution from all the ideas generated. Thus, it can be argued that one's creativity is not a fixed entity, but rather something which can be enhanced or diminished dependent on situation, experience, mood, or one of a host of other factors.

One common technique for enhancing creativity is brainstorming. Brainstorming typically involves generating all the tentative solutions to a problem that one can think of, while postponing evaluation of viability of any of the solutions until after all ideas have been recorded. Sidney Parnes and Arnold Meadow have reported on experimental groups instructed in creative problem solving, in which brainstorming was emphasized. Findings have shown increased productivity on tests of creative ability as compared to controls. With this same group of instructed subjects those who used brainstorming were found to be more creative than a group in which there was a penalty for 'bad ideas.' Further study has found significantly more quality ideas produced in groups instructed to brainstorm than in groups that did not receive instructions to brainstorm. Analyses found a positive correlation between the quantity and the quality of ideas, such that the increase in good ideas created by brainstorming is most likely the result of the overall increase in ideas produced by using the technique.

Brainstorming can be beneficial in both individual and group formats, although results here have been somewhat mixed. Using a group of engineers, group participation in brainstorming was shown to significantly improve the creativity of the group members. Such results fit with associative theory in which the novel ideas produced by one group member might elicit associations to even more novel ideas in another group member. The group format allows for each member's ideas to be the stimulus for others. However, such results will only be found if members can contribute ideas without fear of judgment by others. Groups in which there is

anxiety of evaluation, or groups in which there is a perceived knowledge discrepancy, such as groups containing an expert or leader, can lead to diminished creativity as people withhold ideas to avoid judgment.

Consistent with Mednick's associative theory, several studies by Gary Forbach and Ronald Evans (1981) have found that high RAT scorers use incidental or environmental cues in problem solving more effectively than low RAT scorers. This seems to also be the case in group formats, and has some implications for brainstorming. Instructions to brainstorming groups emphasize the quantity of ideas generated and, at least temporarily, disregard the quality of the ideas. This should lead to the generation of associative cues which should in turn facilitate the further production of ideas by all group members. However, since the high RAT scorers use cues more effectively than low RAT scorers, it is the high RAT scorers who produce more ideas. Put simply, a strong linear relationship between RAT scorer and the quantity of ideas supports the notion that RAT scores can predict brainstorming productivity.

Conclusion

One test of a theory is the impact that it has had on a field. Using that criterion, Mednick's associative theory and the psychodynamic theory of association has been useful. Through theory and research, these conceptualizations focused the field of creativity on the importance of associations in creative thinking. It is now generally accepted that creative production is partially dependent upon having a broad search process and

novel associations. The RAT has proven to be a valid measure of a specific type of creative thinking and has been used in many studies of creativity in adults. Mednick, especially, provided an important foundation, in both his theory and his test, for other research programs and theories to develop. Although criticized as being simplistic in its' view of the creative process, it made a major contribution to the field. Current research and theories continue to focus on the important process of association in generating creative ideas.

See also: Emotion/Affect; Incubation; Knowledge.

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Asynchronicity

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Glossary

Asynchronicity An appropriate level of discrepancy that may stimulate creative thinking.

Cognitive dissonance Inconsistent cognitions that do not fit together and which motivate creative thinking.

Janusian thinking Cognition that uses two or more contradictory ideas simultaneously.

Person–environment fit Joint influences of individual and setting with similarity between the two expected to nurture creativity.

Tension Inner conflicts experienced as a result of interpersonal or intrapersonal mismatches.

Introduction

A considerable amount of knowledge accumulated in the literature on creativity comes from studies of eminent people whose lives and achievements justify their creativity. This tradition, evident in historiometric and Big-C research, has provided useful information that can be used to help understand creative lives. Asynchronicity is apparent in some of these lives and helps to distinguish creativity from expertise, giftedness, genius, or prodigiousness. It is also critical for understanding the personal, environmental, and domain-related foundations of creativity.

The concept of asynchrony was first discussed in detail by Howard Gardner, who analyzed Freud, Picasso, Stravinsky, Eliot, Graham, and Gandhi in his book *Creating Minds*. However, the effects of asynchronicity had been noted by other researchers. They used synonyms, such as tension, conflict, disequilibrium, or dissonance. This article attempts to show how the construct of asynchronicity has been interpreted in the field and how it relates to those other processes.

Gardner described how 'strategic mismatches or asynchronies' may underlie creativity. He disagreed with the proposition that creativity is the 'wake of the numerous interacting factors' and rather, contended that:

creative efforts are more likely to arise when there is a certain tension or asynchrony among principal factors that underlie human behavior. It is this tension that gives rise to creative works. (p. 101)

Asynchronicity or tension is not simply a situation that exists in creative people's upbringing. In fact, creative individuals often seek it, whereas others tend to do the same for synchrony. Novelties, creations, and new perspectives may be possible for people with unusual or uneven profiles who can think outside the box and see the world in alternative ways.

Three Levels of Asynchronicity

There are different kinds of asynchronicity, including conflicts with family members, homosexuality, early difficulties in school, irregularities in cognitive development, sickness, and loneliness

in childhood. Gardner classified potential sources of conflicts into three levels: personal, impersonal, and multipersonal.

Personal Level

Asynchrony on the personal level can operate in several ways. The first is actually a subpersonal aspect, which is about genetic, neurological, and brain-related differences residing in creative minds. As a matter of fact, attempts to explain such differences such as analysis of Einstein's brain after his death did not yield conclusive results or were abandoned later, as with the argument connecting creativity strongly with right brain function. However, research on people with brain injury and the case of autistic savants who can spontaneously find prime numbers in spite of being unable to perform basic multiplication or reading shows that neurological research promises an explanation of unusual minds. One commonly emphasized unusual characteristic related to brain function is the dominant hemisphere which, for the most part, refers to the left hemisphere taking over sequential, analytic, and verbal process whereas nondominant hemisphere processes are attributed to right-brain action involving simultaneous, visio-spatial or synthetic processes. This design is subject to change, even reversal, when the person is left-handed. Given the fact that most people are right-handed, the highly creative coping skills of left-handed people can be explained by this unusual hemispheric asymmetry. More studies are needed to elaborate upon this aspect of asynchronicity.

Another aspect of asynchrony at the personal level involves cognitive capacities and structures of creative people. As Gardner discussed in detail, creative people may either have unsurpassed levels of particular intelligences, as was the case with Picasso, who had very high spatial and bodily-kinesthetic intelligence with exiguous scholastic intelligence, or may possess an unusual blend of intelligences like Freud, who apparently had superior logical, intrapersonal, and linguistic-verbal intelligence. However, asynchrony sometimes also comes from thinking processes. Some research relating creativity to *primary process thinking*, which enables free association and thinking with metaphors and symbols, rather than *secondary process thinking*, which is logical and goal oriented, is critical to understanding the moment of inspiration and the concept of incubation. Here, asynchrony involves the function of primary

process thinking, which is regarded as an indication of regression serving the ego, while secondary process thinking would represent synchrony among a set of logical thoughts and assumptions.

The role of unusual cognitive patterns in creativity can be extended in different ways. Albert Rothenberg asserted that the creative thinking process involves *Janusian thinking*, which was defined as “the capacity to conceive and utilize two or more opposite or contradictory ideas, concepts, or images simultaneously” (p. 11). He argued that Janusian thinking is basically secondary process thinking that modifies primary process thinking by providing its ‘seeming ubiquity’ and allowing ‘primary-process-like material to appear in consciousness.’ He interviewed Nobel laureates from several fields and concluded that the Janusian process plays a significant role in scientific creativity. He identified four levels of process: (1) motivation to create; (2) deviation or separation; (3) simultaneous opposition or antithesis; (4) construction of theory, discovery, or experiment. Opposing ideas that emerge at the second and third level are often resolved and disappear at the fourth stage. The transition from the third to the fourth stage includes a state of asynchronicity or tension:

Strong motivation provides the drive to consider and conceive the inconceivable; emotional involvement, especially if it involves meaningful conflict, jibes with the cognitive tendency to focus on opposites and antitheses and bring these together simultaneously. The simultaneous opposition and antithesis, with the conceptual conflict retained among composing elements, seems to be isomorphic with emotional conflicts and other psychological processes. (p. 221)

Another critical quality of many creative individuals is their preoccupation with diverse modes of thought simultaneously. Divergent thinking accompanied by evaluative thinking or imaginative cognition paired with realistic cognition would mostly result in creativity, although they may not achieve that independently. Arthur Cropley argued that creativity is the consequence of the joint influence of divergent and convergent thinking, which are seen as opposing thinking modes. He supported this hypothesis with the case of Vincent van Gogh, whose artworks became well-known after he learned basic techniques of painting. His artistic potential, represented by divergent thinking, would not have been fruitful had he not acquired convergent thinking. Mark A. Runco added that even incompatibility between such diverse modes of thought might be useful when tension is triggered.

Some empirical studies can also be approached as documenting asynchronicity emerging at the cognitive level. Roni Reiter-Palmon and her colleagues examined the influence of cue consistency on problem construction. They found that the quality and originality of the solutions were higher in the presence of inconsistent cues. It is quite possible to argue that tension springing from inconsistent cues might elicit creativity. According to Keith James and his colleagues, tension frequently functions as a signal that indicates a need to fix, modify or resolve on the perceiver’s part.

The third aspect of asynchrony on the personal level is noncognitive, which is more about personality and emotions. The creativity literature lists numerous personality characteristics of creative individuals that can be related to marginality

such as childlike nature, daydreaming, playfulness, contrarianism, and nonconformity. Each of those characteristics can be seen as a source of asynchronicity. Einstein is a remarkable case for the role of personality in creativity. Gardner argued that Einstein preserved his childlike nature and naivety even as an adult, and this enabled him to approach problems in a different manner from others. In this way, he was able to ask the critical questions the answers to which he could find later. For example, the question “Why is the sky blue?” would be a childhood curiosity for many who later quit thinking about this question without searching for any answers. What makes Einstein and few others different is their unending interest in such basic yet significant questions that would lead to many scientific elaborations.

W. Ed McMullen argued that many creative people are ‘paradoxical personages’ by which he referred to the coexistence of eight polarities in their personalities. First, most creative people tend to delay closure and are open to new ideas while at the same time they feel a strong urge to achieve closure and eventually form a gestalt. Second, they are inclined to swing between the modes of lateral thinking and logical thinking. Third, they can also merge the unconscious into consciousness which allows them to keep up ‘mindless perception.’ Fourth, creative people are often fault finders and destructives, but they also reconstruct and make new syntheses. Fifth, they mostly have passion, but they also need to stay calm and reasonable. Sixth, they are both ego-centered and empathetic since they desire success, power, fame, and honor, yet are also altruistic, concerned about others and their well-being. Seventh, they are usually confident about their abilities and proud of their successes while they are humble and aware of their weakness and ignorance for the most part. Last, their insight emerges when they are in a state of relaxed attention, which is the moment of shift between work and relaxation. Likewise, Mihaly Csikszentmihalyi discussed the complex personality of creative people as an integration of contradictory extremes. He argued that creative people are usually both energetic and quiet, smart and naïve, disciplined and playful, imaginative and realistic, extroverted and introverted, humble and proud, masculine and feminine, rebellious and traditional, passionate and objective, and suffering and joyful.

As for emotions, relationships with the opposite sex are mostly exploitive and temporary. In such cases, broken relationships were sometimes followed by suicides. As Arnold Ludwig showed in his search for the ‘Price of Greatness,’ higher rates of suicide among members of the sample with exceptional creative achievement was one of the costs that some of them encountered. Also, several studies indicating a relationship between mood disorders and creativity can be looked at within the realm of personal noncognitive asynchronicity. The frequent association of creativity with mental illnesses, specifically mood disorders, should be recalled here. Nancy Andreasen found that 80% of creative writers experienced a mood disorder like depression, mania, or hypomania at least once in their lives. In another study by Hagop Akiskal on award winning European artists and writers, two-thirds of the participants reported cyclothymic or hypomanic tendencies, and half of them experienced a major depression. Mood swings of creative people provided them with unique perspectives which were scarcely achieved by those with regular moods.

Impersonal Level

The second level of asynchrony involves the domain of knowledge, the impersonal level, where creative individuals need to interact. Knowing about the domain is a necessity for making a contribution to or challenging it. There was no cubism, psychoanalysis, or physics of special relativity before Picasso, Freud, and Einstein learned about, influenced, mastered, and evolved the domains, and eventually created their own domains. If they had been in complete agreement with their domains, they would not have revolutionized those domains and shaken the earth. Therefore, discontent or dissatisfaction with the domain is often fruitful and can initiate epistemological changes in that field. A good example of this is Freud, who began with philosophy and switched to scientific medicine. Going through neurology, neuroanatomy, and psychiatry, he came up with a new domain, psychoanalysis, which influenced many other domains from visual arts to political science.

Knowing a domain is a crucial aspect of creativity because the learning process brings recognition of the gaps and inconsistencies regarding the content. Scientific creativity has a lot to do with the domain. In the sciences, many contributions arise from those gaps and inconsistencies in the domain. In physics, for example, Newton's physics represented the core of the domain for a long time, and Einstein acknowledged that:

The whole development of our ideas concerning natural phenomena [...] may be conceived as an organic development of Newton's thought

in the article in which he discussed the limitations and weaknesses of Newtonian physics.

Multipersonal Level

The third level of asynchronicity is the perspective of the field, which is the multipersonal level. Creativity does not come out of a vacuum. There may have been many creative ideas that remained unrecognized because the people who evaluated the work did not find them impressive and valuable. Such lack of fit between the creative person and the field might result in a fruitful asynchrony in cases where the creative people could resist the forces of the field and launched their own influence in spite of the price such as being alone like Freud. Mihaly Csikszentmihalyi mentioned E. O. Wilson and presented his works as an example of attempts to construct a new domain called Sociobiology, connecting social sciences with evolutionary biology. Just like the examples above, he had severe disagreements with people within the field. Another example of asynchrony at the multipersonal level is Hilde Domin, who is a famous poet and writer. She had to wait for 6 years to publish her poems because of the politics of the field. Her naivety and lack of knowledge about a 'literary mafia' helped her to sustain and have an independent literary career.

Dichotomous Classification

The asynchronicities exemplified above are simply based on Csikszentmihalyi's systems approach involving the interactive or dialectical relationship of the three elements: person, domain, and field. Mark A. Runco preferred *tension* to represent

the construct, and classified asynchronicities into two groups: intrapersonal and interpersonal. With this categorization Runco related the personal level to intrapersonal tension that implies a misfit between the situation and its perception by the individual, or to inconsistent thoughts that associate the field and domain with interpersonal tension.

Intrapersonal tensions are crucial for creativity. Csikszentmihalyi used the term *cathartic originality* to describe the underlying processes of artworks. He argued that the discomforts that are rooted in repressed tensions of childhood may stimulate creative works after the individual becomes mature and better able to handle them. Unsurprisingly, psychoanalytic views on creativity have supported this argument. William G. Neiderland reported that psychoanalysts encounter common factors such as tragic early childhood experiences, traumatization and conflicts, loneliness, loss, and discontent with body image among creative people in their clinical experiences. Many creative people's response to such unfortunate experiences is a heightened emotional reactivity that evokes their awareness of already existing oversensitivity to internal and external stimuli. The feelings of being incomplete, ugly, and deficient among creatively active individuals are often replaced by sensations of completeness, adequacy, and strength through artworks. Martin S. Lindauer explained the stylistic changes of artists in the same way. Personal conflicts like physical or emotional handicaps are sometimes compensated for through artworks. The presence of grief, ordeal, pain, and irregularities in biographies of some creative people confirms this notion.

In the intrapersonal case, further elaborations can be made. For instance, Leon Festinger called tension arising from two or more inconsistent cognitions *cognitive dissonance*. According to him, it is human nature to sustain an internal consistency among opinions and attitudes. This consistency is a state of consonance and equilibrium in which individuals are free of tension. With the emergence of new situations or the acquisition of new knowledge, existing cognitions are challenged, and individuals are motivated to reduce the dissonance and achieve consonance again. Therefore, the presence of dissonance is mostly an antecedent condition that stimulates human cognition to a new synthesis. This is how cognitive dissonance may result in creative thinking. Colin Martindale hypothesized that creativity is related to resistance to cognitive dissonance in the sense that creative people, unlike most others, may not be motivated to achieve consonance. The more people tolerate novelty and deal well with incongruity and respond to it in a flexible way, the more they experience dissonance, taking advantage of it, and eventually, the more creative they become.

Is this the case in real life? Edward Boring, who wrote '*Cognitive Dissonance: Its Use in Science*,' argued that:

Any reader of Kepler's biography will wonder how the three great planetary laws could have emerged from so inconsonant a mind, in which mysticism was mixed up with a passion for accurate observation, which perceived as one of its great intellectual achievements the spacing of the six planets in the solar system as related to the shape of the five regular geometrical solids, a mind which took astrology seriously, and which experienced ecstasy over both its true and false successes. (p. 683)

Cognitive dissonance theory makes it possible for creativity researchers to see the link between intrinsic motivation and

creativity, given the fact that Festinger regarded cognitive dissonance theory as fundamentally motivational. Since dissonance is discomforting, it often functions as a source of arousal. The dissonance provides most people with a directional goal in terms of which they can either search for memories to support the desired conclusions or search out new knowledge to create a new explanation. The latter is actually how cognitive dissonance leads to the motivated reasoning resulting in creativity.

According to Jean Piaget, intrinsic motivation is preceded by certain cognitive operations. This occurs when individuals encounter new knowledge that they cannot make sense of. In this case, new ideas are not compatible with current conceptions, and disequilibrium emerges and continues until the individual assimilates or accommodates to reach equilibrium again. At that point, it is critical to point out that creativity is achieved as long as individuals can adapt to new information and expose themselves to perennial conflicts, even as they grow older. Morris I. Stein also acknowledged the role of disequilibrium, claiming that it takes place at the beginning of the creative process.

Another kind of asynchrony is related to cortical arousal. Colin Martindale argued that something is wrong with the arousal system of creative people. He observed that their arousal level does not linearly increase with the arousal potential of the stimuli. At some point, there is a 'dip' in their arousal, which seems to correspond to the moment of inspiration, unlike uncreative people, whose cortical arousal increases with the arousal potential of the stimulus. He showed that the EEG activity of creative people was lower during the inspiration phase than uncreative people, whereas there was no difference in the elaboration phase. He linked lower level of arousal with the unfocused attention that enables elaboration of several mental elements simultaneously.

Asynchronicities at the interpersonal level may occur in the family environment, too. Robert S. Albert and Runco argued that incongruent parent-child relations can create tension, which enables the child to develop autonomy. From a factual standpoint, loose relationships of eminent physical and biological scientists with their parents as well as findings regarding the high rates of parental loss in the exceptionally gifted population seem to support this hypothesis. Sibling rivalry, family size, birth order, and parental expectations are important factors to be considered as potential sources of asynchronicity at the interpersonal level.

Considering the larger spectrum, cultural marginality could also be mentioned under the umbrella of the interpersonal level. According to Thorstein Veblen, the intellectual success of the Jews in Europe is related to their cultural marginality. In Freud's case, he had to leave Austria because of Nazi oppression. Before his life in France, Picasso lived in Spain and kept his ties with his native country. According to Csikszentmihalyi, a distinguishing feature of the centers of creativity throughout history was that they were at the crossroads of cultures and cosmopolitan life in those cities.

Asynchronicity Versus Person-Environment Fit

A frequently mentioned factor involved in creativity is the rule of 'being in the right place at the right time,' which refers to a

good match of the person with familial, social, economic, political, or cultural surroundings. According to this view, the concurrent presence of these advantages paves the way for creativity. Creativity is defined as the outcome of the individual's behavior in a context. Therefore, the joint contribution of person and environment should be taken into consideration. To exemplify this, a nonconformist individual within an environment that encourages or tolerates nonconformity would be a good match for creativity. However, the asynchronicity approach seems to disagree with the idea of person-environment fit.

According to asynchronicity, the coming together of several positive factors or coincidences may explain the emergence of prodigiousness or eminence, but not creativity. For this reason, the rule of 'being in the right place at the right time' works in the opposite manner for creative people: for creativity to emerge at least to some degree, the right time and place implies a context that brings lack of fit or disharmony. According to Runco and Joni R. Gaynor, the matching should be optimized so that an appropriate level of discrepancy for creativity is maintained. For this reason, Simonton described the best mentors as those who fall between the 'too similar' and 'too dissimilar' ends. Daniel Rubenson and Runco also argued that an optimal mix of individuals is necessary for creative productivity. This also means that too much as well as too little asynchronicity is mostly unproductive.

Unproductive Asynchronicity

In their discussion of the concept of asynchronicity, Gardner and Contance Wolf asked the following question: "When does asynchronicity become counterproductive?" This question was legitimate, given the observations (i.e., Aristotle: "All extraordinary men distinguished in philosophy, politics, poetry and arts are evidently melancholic") and research findings such as those associating creativity with madness. Runco admitted the interpretive nature of tension that makes it hard to generalize, and responded to Gardner with "more is not necessarily better." According to him, even the optima may not be optimal at certain times. While some amount of asynchrony motivates, it may be inhibiting when it becomes excessive. Ideally, it is best when

the tension is distributed such that the individual is not overwhelmed by one experience, nor from accumulation of disturbance and depletion of resources. (p. 188)

Briefly, the optimum level of asynchrony is the situation where individuals are challenged but can adapt and grow. According to Michael Rutter, the optima depend not only on the amount of tension but also on the way individuals react to it. The cognitive capacity of individuals determines how much tension they can successfully cope with.

On the other hand, such generalizations may also fail in several cases. Keith James found that originality is improved when people perceive conflicts in the domains on which they focus. Howard E. Gruber went further and argued that the association of tension with fields ranging from sciences to arts differs. He suggested that sciences are linked with interpersonal tension while arts are related to intrapersonal tension.

As a result, there may be domain-dependency in the optimal level of tension. Csikszentmihalyi described the optimum level of asynchronicity between the person and the fields as follows:

The creative individual must reject the wisdom of the field, yet she must also incorporate its standards into a strict self-criticism. And for this one must learn to achieve the dialectical tension between involvement and detachment that is so characteristic of every creative person.

The inverted-U-shape relationship between creativity and asynchronicity has been attributed to several reasons. According to Martindale, optimal performance occurs at a moderate level of cortical arousal. James A. Easterbrook proposed that this relationship is mediated by task complexity: higher levels of arousal are efficient for simple tasks but not for complex tasks. Task performance decreases at low or high arousal levels compared to the optimal level because of the presence of irrelevant cues or lack of several cues, respectively. Optimal performance should be expected when individuals have several cues that can be used for a novel and original idea.

In a study on the comparison of high versus low creative people with respect to anxiety and defense mechanisms employed, Ingegerd Carlsson found that the high-creative group had more anxiety than the low-creative group. Particularly, she reported that mild and moderate signs of anxiety are found 'almost exclusively' among the high-creative group as measured by meta-contrast technique. If we consider anxiety as a form of asynchronicity at the personal noncognitive level, these findings confirm an inverted-U-shape relationship between asynchronicity and creativity. An example of unproductive asynchronicity in organizations is intensified interpersonal conflicts. Although some level of conflict helps new ideas and syntheses to emerge, too much conflict undermines a positive working environment, resulting in rumors, gossip, and destructive competition.

Asynchronicity in Practice

Education

If asynchronicity is essential for creativity, can we create asynchrony to stimulate and enhance creativity? According to Piaget, children do not show interest in any stimulus if it is far above their cognitive level or when it is a routine task. The ideal situation is the presentation of stimuli that are somewhat challenging but graspable for a child. This level of discrepancy was disputed by Lev S. Vygotsky, who introduced the concept of the *zone of proximal development*, defined as:

the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers.

The creative potential of children can be maximized through challenges that fall within the zone of proximal development. According to Runco and Radio, one critical factor for parents and teachers is their recognition of creativity in children because providing environments that support creativity is only possible if they believe that the children possess it at

some level. Once they have a realistic perspective about the creativity of their children, they can regulate their expectations (known as *scaffolding*).

Apparently, the view of asynchronicity has solid bases in education. Contrary to frequently suggested approaches such as unconditional positive regard, which refers to acceptance of ideas without any criticism, asynchronicity suggests confronting the individual with the defects and drawbacks of creative products and encourages showing ways to improve creativity at the creator's pace. However, this may become unproductive, depending on the children's perceptions. Instructional activities can be designed in such a way that students experience tension. Teachers can point out, for example, the gaps and incomplete parts of the ideas and theories instead of merely providing the facts. According to E. Paul Torrance, tension is aroused when we sense incompleteness or disharmony. This tension lasts until we come up with explanations or solutions resulting from long-lasting processes of trial-and-error, manipulation, guessing and testing. Having students notice and recognize disharmony and incompleteness can be intriguing and curiosity-provoking.

Organizations

Asynchronicities are useful for organizational creativity, too. Indeed, Michael A. West argued that innovation and conflict are concomitant:

If a new way of doing things is introduced within an organization and no conflict is generated (that is, there are no disagreements about the content or process of the innovation), or if there is no resistance by organization members to the innovation, then this innovation is not really new nor does it offer a significant contribution to the organization. Innovation threatens the status quo and thereby produces conflict. (p. 101)

Various benefits of conflict and asynchronies have been found in studies of organizations and the workplace. Lorraine Dagitino suggested that brainstorming techniques should be designed to yield ideational conflicts because creative ideas arise from conflict and confusion. Victor A. Thompson complained about the conditions within a bureaucracy led by a monocratic social structure. Driven by the purposes of productivity and control, these conditions do not contribute to creativity and should be changed. He suggested a looser, decentralized, and evolving structure, which allows freer communications, rotation of assignments, modification of the incentive system, and changes in management practices. Empirical studies support the role of conflict in organizational creativity. Keith James and his colleagues found that conflict can enhance or hinder creativity depending on the situation and individual. Perceived conflict improved creativity on tasks that match an individual's orientation and reduced it for tasks outside of that orientation.

Objective Assessment of Asynchronicity

As Gardner and Wolf acknowledged, finding asynchronicities is not difficult. This can make the concept more elusive and subjective for scientific study. As a matter of fact,

even with the benefits noted above, there is no objective way of assessing both asynchronicities and synchronicities. The lack of empirical research on asynchronicity is a corollary of the absence of objective criteria. However, some special methods of measuring creativity are based on ideas similar to asynchronicity. One such example is the Chiara S. Haller and Delphine S. Courvoisier approach to personality tests as an indicator of asynchronicity given the premise that the response pattern of creative people is complex. Complexity of their responses stems from the presence of contradictory traits in their personalities. Haller and Courvoisier hypothesized that creative individuals will be inconsistent in their responses to test items, choosing contradictory poles. Therefore, we would see more variability in the responses of creative people than in those of noncreative people. They tested this hypothesis by comparing students from art and psychology majors. They found that complexity in conscientiousness was greater among visual art students than music and psychology students, and visual art students showed greater overall complexity than psychology students.

Another idea that is consistent with asynchronicity is to measure creativity based on the hypothesis that creative people prefer asymmetry over symmetry. The Barron Welsh Art Scale is an example of this kind. The scoring was based on whether participants like or dislike stimuli which are either symmetrical or asymmetrical. The underlying idea is that creative artists prefer asymmetric, irregular, or even chaotic figures. John C. Rosen found that this test discriminated artists from nonartists, while scores were not significantly different between art students and established artists. Further attempts to clarify the definitional scope and objective assessment of asynchronicities would stimulate studies of the role of asynchrony in creativity.

Conclusion

Asynchronicities in the lives of creative people are many and can be classified into three groups – personal, impersonal, and multipersonal, or two groups – interpersonal and intrapersonal. Asynchronicity provides a unique perspective for understanding creativity, and the wide range of asynchronicities complies with the recent conceptualizations of creativity as a ‘syndrome.’ A certain level of asynchronicity seems to be helpful for creativity, but too much may be counterproductive. A critical issue regarding asynchronicity research is the difficulty in assessing it as we lack objective measures. Asynchronicity also challenges the view of person–environment fit, which asserts that synchrony between the person and environment is favorable for creativity. Further studies are needed to resolve this controversy.

See also: Janusian, Homospatial and Sepconic Articulation Processes; Synchronicity and Creativity.

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Attention

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Glossary

Attentional priming A broadening or narrowing of the scope of conceptual attention elicited by a corresponding change in the scope of perceptual attention.

Attentional scope The amount of perceptual or conceptual information selected for cognitive processing.

Conceptual attention The selection of stored information from long-term memory for potential access to consciousness.

Latent inhibition The ability to filter from attention stimuli that are perceived as irrelevant to a current goal.

Nonaffective cues Stimuli that do not involve conscious experiences of pleasure or pain, but that are associated with, and at least implicitly signal benign versus threatening situations.

Theoretical Considerations

Psychological research exploring the role of attentional selection in creativity has substantially contributed to elucidating, and thereby demystifying, the processes by which innovative alternatives are generated. Contemporary empirical inquiry into the link between attention and creativity is grounded in the work of associative learning theorists, who more than a half-century ago proposed that the capacity to innovate is influenced by the way that the strengths of potential responses to stimuli are distributed. Specifically, among individuals with more steeply graded distributions, closely associated responses to a particular stimulus possess a disproportionate amount of strength, rendering these responses extremely likely to be emitted to the exclusion of other, more remotely associated responses. For example, in a verbal free association task in which individuals are asked to generate words that come to mind in response to a given cue, those with steeper associative response gradients may only generate closely associated responses such as 'chair' or 'cloth' when presented with the stimulus word 'table.' In contrast, among individuals with flatter associative response gradients, the probabilities of emitting closely versus remotely associated responses are more equally distributed. Therefore, such individuals may be more likely to produce responses that are distantly related to the stimulus – for instance, 'leg' or 'fable' in response to the word 'table.'

Critically, since individuals with flatter, more distributed, response gradients are relatively inclined to produce remotely associated responses to a particular stimulus, they are posited to show greater creativity, as the availability of relatively unconventional responses is essential for the production of novel yet practical solutions. In an early test of this proposition, individuals were administered the Remote Associates Test (RAT). On this task, individuals are required to find a word that associatively links three distantly related words (e.g., ATOMIC FOREIGN MOWER — — —; Answer = POWER). Performance presumably benefits from possession of relatively flat associative gradients, as correct answers constitute non-dominant responses with respect to all three stimulus words – for instance, 'power' is only weakly linked to 'foreign.' In support of the notion that flatter response gradients are associated with

higher creativity, it was found that RAT performance was positively correlated with several indices of creative ability, including the originality of scholarly research.

Recently, the classic ideas of the association theorists regarding the link between individual differences in response gradients and creativity have been fruitfully reconceptualized as involving variations in attentional processes. According to a number of theorists, attention may be seen as a process of selection that occurs on both the perceptual and conceptual levels. On the perceptual level, individuals may focus attention broadly, to select a wider array of external stimuli for processing, or narrowly, to restrict selection to a limited subset of these stimuli. For instance, when viewing a desktop computer, attention may be directed broadly, to encompass the CPU, monitor, and keyboard, or narrowly, to encompass only one or two of these external stimuli, the reflections of which are impinging on the visual system. However, individuals not only need to select percepts for processing on the external level, but also to select which concepts in memory they will activate, that is, bring to mind, to play a role in conscious thought. Broader conceptual attention may be viewed as a tendency to activate a wider array of interconnected concepts stored in long-term memory, for instance, the concepts of 'CPU,' 'monitor,' and 'keyboard,' whereas narrower conceptual attention may be seen as a tendency to activate only a smaller subset of these concepts.

In light of the assumption that potential responses are stored in, and activated from, long-term memory in the same manner as semantic concepts, it has recently been proposed that the flatter response gradients described by the associative theorists may be viewed as a special case of broadened conceptual attention, and steeper gradients as a special case of narrowed conceptual attention. This insight has helped inspire a growing body of research aimed at addressing the factors that moderate the scope of conceptual attention, expanding or constricting access to information stored in long-term memory, and thereby facilitating or impeding creative thought. Researchers have investigated the influence on creativity of both chronic individual differences as well as transient situational variables posited to moderate conceptual attentional breadth. While this research is still in its nascent stages, a number of major findings have emerged in recent years.

Conceptual Attention and Creativity: Research Findings

Individual Differences

To recapitulate, the scope of conceptual attention may be understood as the quantity of information that is rendered accessible to consciousness at a given point in time. Broader conceptual scope signifies that a greater number of concepts in long-term memory, including those remotely associated with the stimuli that currently occupy focal awareness, are poised to enter into conscious thought. Given this view, it may be argued that an important phenomenon associated with conceptual attention is the extent to which information that is irrelevant to ongoing goals retains accessibility to consciousness. For instance, if an individual is locked out of his or her car, concepts such as 'keys' and 'lock' may be highly accessible to awareness because they are relevant to the goal of regaining entry. However, perceptual stimuli, such as the sound of passing cars, and conceptual information, such as the makes and models of these cars, should be screened from awareness inasmuch as they are both irrelevant to goal pursuit and only stand to foster distraction.

Latent inhibition (LI) is an attentional process by which both perceptual stimuli and conceptual information deemed irrelevant to current pursuits are automatically (i.e., latently) filtered from conscious awareness. At first blush, it would seem that this is an entirely adaptive process, the absence of which would promote confusion and disruption of ongoing behavior. Indeed, consistent with this inference, there is compelling evidence that individuals who exhibit lower LI are more prone to disordered thought and ultimately more likely to be diagnosed with schizophrenia. However, consistent with the foregoing proposition that broad conceptual attention facilitates creative cognition, it may be proposed that reduced LI should also increase the amount of information accessible to conscious awareness for use in devising innovative alternatives. To clarify, individuals who fail to filter out presumably irrelevant information will retain this information such that it may be considered along with information presumed relevant. When concepts activated during a prior task are considered along with those deemed pertinent to a current task, this may serendipitously foster the discovery of creative combinations of ideas.

Logically speaking, if attenuated LI fosters innovation, it should be correlated with personality traits associated with increased creativity. According to personality researchers, two such traits are openness to experience and extraversion. Openness is characterized by intellectual curiosity and the proclivity to seek out new and unusual ideas. Extraversion is also characterized by a penchant for exploratory behavior, but more broadly reflects sensitivity to, and a tendency to seek out, rewarding stimuli in the environment, including, but not limited to, social stimuli.

In recent work investigating the link between these personality traits and LI, research participants were presented with a repeating sequence of nonsense syllables interspersed with bursts of white noise. Their focal task was to count the number of times a particular syllable appeared. Here, the noise bursts were irrelevant to task completion, rendering it adaptive to exclude them from focal attention. In a subsequent task, the same interspersed auditory stimuli reappeared; however, the

nature of the task was altered: Colored disks now additionally appeared on screen immediately preceding the offset of each noise burst and participants were responsible for identifying the temporal association between these bursts and the newly presented visual stimuli. This involved attending to stimuli, here, noise bursts, that were previously irrelevant. Therefore, to the extent that individuals had already allocated attention to these irrelevant stimuli on the first task, they should more readily attend to them on the second task. As such, reduced LI was operationally defined as faster identification of the connection between noise burst and colored disk onset in the secondary task, reflecting an initial broadening of attention to encompass both relevant and irrelevant information. Interestingly, those who showed reduced LI on this measure also scored higher in assessments of both openness to experience and extraversion, suggesting a link between attenuated LI and traits known to be associated with creative endeavor and achievement.

Of course, findings such as these present a rather puzzling quandary: If reduced LI is associated with both psychosis and creative achievement, what distinguishes reduced-LI individuals who produce great creative works from those who degenerate into madness? Cutting-edge research has suggested that at least one critical moderating factor may be intelligence. Eminent creative achievement is significantly more likely among individuals with both reduced LI and higher IQ scores. Although the exact reason for this interaction remains poorly understood, it has been speculated that high IQ may allow individuals to adaptively control how thoughts that unintentionally gain access to awareness are utilized. Given this enhanced ability to regulate how the contents of consciousness are employed, high IQ individuals may benefit from access to irrelevant details as these may contribute to a larger base of material from which to generate innovative alternatives. Individuals with higher IQ may also be better able to cope with the maladaptive consequences of reduced LI, those associated with enhanced proneness to psychosis, thereby preserving their ability to benefit from its creativity enhancing effects.

Situational Factors

Recent research has also made great headway in identifying variables that may transiently influence the scope of conceptual attention, and thereby creativity, within the same individual under different circumstances. The bulk of this work pertains to the attentional impact of signals regarding whether the current situation is relatively benign or threatening.

Affect

Perhaps the primary signal regarding the extent to which an individual is currently safe or in danger lies in his or her affective responses, the emotions or moods that he or she experiences in a given situation. Positive affective states, such as happiness, signal to individuals that their current situation is benign or safe, whereas negative affective states, such as anxiety, signal that the situation is dangerous. Several theorists have recently proposed that these signals also tune the scope of conceptual attention, with negative affective states constricting, and positive states expanding the range of stimuli that are rendered accessible to consciousness. Undergirding this proposition, it has been

argued that the constricted focus of attention associated with negative affective states should be adaptive in dangerous or threatening situations because it reinforces an exclusive focus on the problem at hand and information pertinent to solving this problem. Attention to ideas or plans of action that are irrelevant to a current threat generally stand to foster distraction and thereby heighten potential risk. Correspondingly, the broader scope of attention associated with positive affective states has been posited to make individuals more likely to engage in novel thought and action patterns. This is posited to help them build their repertoire of knowledge and skills, and to acquire additional resources, such as new social connections, all of which ultimately aid in survival. Restated, exploration of new ideas when the situation is relatively benign, a process facilitated by an expanded scope of conceptual attention, may help individuals develop skills useful for surviving future crises.

The notion that positive, relative to negative, affective states broaden the scope of conceptual attention has received empirical support in a number of studies. One common paradigm used to assess this hypothesis involves either experimentally inducing or measuring differences in current mood, then having participants complete a categorization task in which they are to rate the goodness-of-fit of a set of exemplars to a number of familiar categories (such as furniture, vegetables, or vehicles). The exemplars given vary systematically in their prototypicality. For instance, 'bus' and 'camel' may be offered as relatively prototypical and nonprototypical members of the category 'vehicles,' respectively. More inclusive categorization, revealed by rating nonprototypical exemplars as better fit to their overarching categories, can be seen as at least partly resulting from broadened conceptual attention, as this entails increased cognitive access to features shared between more and less typical exemplars. To illustrate, broader conceptual attention may help individuals recognize that both a bus and a camel make groaning noises and emit noxious odors, thereby leading them to judge a camel as more vehicle-like in nature and thereby as a better fit to the category.

Notably, using this categorization paradigm, it has been found that individuals in positive moods are more likely to accept less prototypical exemplars as category members (including 'camel' as a vehicle and 'cane' as a type of clothing). In complementary fashion, it has been found that individuals who are currently or chronically anxious are less likely to accept nonprototypical exemplars as category members. Consistent with these results, multiple studies have also demonstrated that individuals in positive, relative to negative or neutral moods show improved RAT performance (see above) and a tendency to produce unusual free associations to a given word, suggesting that they are more likely to bring to mind material from memory that is comparatively inaccessible to consciousness.

Given the hypothesized link between mood and conceptual attention, and between broadened attention and enhanced creativity, it may be predicted that positive, relative to negative, moods enhance creative performance. Accordingly, a host of evidence has been marshaled in support of this proposition. For instance, in one set of studies, individuals were induced into different moods and asked to solve the Duncker candle task. In this classic task, participants are presented upon a

table with a candle, a box containing tacks, and a matchbook. They are asked to attach the candle to the wall such that it does not drip wax on the table. Most participants fruitlessly attempt to pin the candle directly to the wall using the tacks or to glue it to the wall using melted wax. However, the only viable solution involves pouring the tacks out of the box and using the container as a pedestal for the candle. Responding in this manner has been characterized as requiring an ability to overcome functional fixedness, that is, the capacity to use an object with a previously well-established function in a new way. This ability may be viewed as a special case of breaking mental set, a fundamental component of creativity. Moreover, it may be seen as benefiting from expanded conceptual attention, inasmuch as this should increase accessibility to associations that are relatively remote from conscious awareness, for instance, the nonobvious idea that the box is not only a container, but an object in its own right that can be attached to the wall. In line with the hypothesis that positive moods expand conceptual attention and thereby bolster creative thought, both children and young adults induced into mildly positive moods have been found to be more likely to solve the candle task than those in neutral or mildly negative moods.

However, despite the presence of much supportive evidence, other recent findings have suggested that the foregoing conclusions regarding the influence of affect on attention and thereby creativity may be oversimplified. For instance, according to mood-as-input theory, the effects of mood on creativity result less from the moderation of the scope of conceptual attention and more from differences in sheer effort. Provocatively, the theory also proposes that the effects of mood on creativity may be reversed under certain circumstances. Essentially, mood-as-input theory proposes that the information provided by positive and negative moods can either facilitate or diminish the amount of effort that individuals put into generating creative alternatives. The effects of mood on creative effort depend on which stop rule is used during performance of the task. If individuals are led or inclined to adopt an enjoyment-based rule – "stop when you no longer enjoy the task" – those in positive moods assume they do enjoy the task and continue to put in effort, whereas those in negative moods assume they do not enjoy the task and withdraw effort. This ultimately leads those in positive, relative to negative moods to show enhanced creative output. In contrast, if individuals adopt a performance-based rule – "stop when you've reached an acceptable level of performance" – those in positive moods assume that they feel good because they have done enough and thereby reduce their efforts, whereas those in negative moods assume they feel bad because they have yet to accomplish enough and thereby increase their efforts. This leads those in negative moods to surpass those in positive moods in terms of creative output. These predictions have been confirmed in several studies.

While this model cannot necessarily account for all effects of mood on creative thought, for instance, effects on RAT performance or flexibility in categorization, it does at the very least suggest that the effects of moods and emotions on conceptual attention and creativity may be supplemented, if not overridden by, more context-dependent and deliberate decisions regarding effort allocation. It has also been shown that

positive and negative moods can sometimes facilitate creativity through qualitatively distinct mechanisms. Specifically, positive affect may indeed expand the scope of attention, enabling access to material used to devise innovative alternatives, whereas negative affect may constrict attention, but compensate for this by mobilizing the effort to generate more potential solutions from the comparatively limited cognitive material that remains available. In sum, while it is clear that both conceptual attentional scope and effort allocation are significant moderators of the influence of mood on creativity, a comprehensive understanding of their unique and interactive effects will require additional research.

Nonaffective cues

As discussed in the preceding section, although its interplay with other variables related to creative output has not been fully elucidated, the tuning of the breadth of conceptual attention by positive and negative affective states has been proposed to be adaptive for survival. To reiterate, the narrowing of conceptual attention associated with negative affective states helps individuals focus on information most relevant to escaping a current threat, and when that threat has passed, the broadening of conceptual scope associated with positive affective states helps them learn new skills that might aid in escaping or avoiding future threats. However, while affective experiences, such as emotions and moods clearly constitute essential signals conveying to individuals that they are in relatively benign versus threatening situations, they are not believed to be the only signals that serve this purpose. Rather, it has been proposed that individuals are capable of intentionally or unintentionally using countless cues from their bodies or from the external environment to determine whether they are relatively safe or threatened. Therefore, while positive and negative affective experiences may wield a particularly powerful influence on the breadth of conceptual attention, there may be a range of other, perhaps more subtle, signals that inform individuals whether their present circumstances are benign or threatening. Like affective states, these supplementary signals may also lead individuals to expand conceptual attention when they convey that the situation is safe, and to constrict it when they convey that the situation is unsafe. In the last decade, there has been an explosion of research investigating this proposition. Overall, this work has revealed a great deal of evidence suggesting that a variety of nonaffective situational cues – stimuli that do not involve conscious feelings of pleasure or displeasure, but that nonetheless inform individuals of benign versus threatening situations – moderate the scope of conceptual attention. The nonaffective cues that have been most extensively explored include engagement in approach and avoidance-related motor actions, virtual enactment of approach and avoidance behaviors, and incidental exposure to colors associated with safety versus danger. Research on the effects of each of these types of cues on conceptual attention and creativity will be discussed in turn.

Approach and avoidance-related motor actions

Numerous theorists have proposed that over the course of the lifetime, pulling the arm toward the body (arm flexion) is predominantly associated with approaching desired objects,

as when eating palatable food or hugging a friend. It is also linked to the offset of painful stimulation, as when withdrawing one's hand from a flame. Correspondingly, pushing the arm away from the body (arm extension) is predominantly associated with avoiding undesired or noxious objects and is linked to the onset of pain, as when touching a flame.

Recently, it has been hypothesized that by virtue of the habitual associations between approach-related arm contractions and positive outcomes, and between avoidance-related arm contractions and negative outcomes, that mere engagement in such contractions may be sufficient to tune the scope of conceptual attention much as do positive and negative affective experiences.

To empirically assess this possibility, researchers have asked individuals to perform arm motor actions analogous to those used in acquiring desired objects or rejecting undesired objects by having them lightly yet steadily press their hands upward (approach) or downward (avoidance) against a platform. To prevent individuals from consciously inferring the meaning of these actions, which might bias the results by leading them to deliberately try to (dis)confirm the hypotheses, participants have typically been provided with the cover story that their arm contractions were intended to produce differential brain hemispheric activation and that the experimenters would be analyzing the effects of this activation on their subsequent task performance. Afterwards, while engaging in either arm flexion or extension, individuals have been administered a number of tasks meant to gauge the breadth of conceptual attention.

Studies using this basic paradigm have yielded a number of provocative findings. For example, one recent experiment examined the differential influence of approach and avoidance-related arm motor actions on conceptual scope using a part-list cuing recall task. In such tasks, individuals are provided with a number of word lists to memorize. Each word belongs to one of a predetermined number of familiar categories such as fruits or vegetables. After attempting to commit the words on a given list to memory, individuals are presented with a subset of the words, including a varying number from each category, to be used as cues to help them recall the remainder of the words that were presented. A host of prior studies have revealed that in recall tasks such as this, the more retrieval cues that are selected from a particular category of words, the more difficulty individuals have remembering the remaining words in that category.

Part-list cuing inhibition of this type has been explained in terms of processes of conceptual attentional selection. Essentially, it has been argued that when an item from a categorized list is offered as a cue, this leads individuals to first retrieve their memory of this cue. This act of cue retrieval has been posited to involve narrowing the spotlight of conceptual attention upon the stored memory of the cue, a process that as a collateral effect leads to the inhibition of the memories of items that are closely related. This process is adaptive because it prevents accessible related items from interfering with efficient retrieval of the target item. As an intuitive example, when trying to retrieve the word 'lemon,' it would be helpful if the names of similar fruits (for instance, 'apple,' 'orange,' or 'lime') were diminished in their accessibility such that they would not compete for selection.

In light of this reasoning, it has been hypothesized that nonaffective cues associated with safety, such as arm flexion, relative to those associated with danger, such as arm extension, may attenuate part-list inhibition by reducing the extent to which conceptual attention is honed upon the retrieval cues provided. Consistent with this idea, it has recently been found that part-list inhibition, again, shown by an impaired ability to recall words cued by members of the same category, was all but eradicated among individuals led to flex their arms during retrieval, whereas it was left entirely intact among those led to extend their arms during retrieval. These findings have been replicated several times using other assessments of conceptual scope, including but limited to related measures of memory blocking. Moreover, in none of these studies has there been any evidence that the manipulation of arm motor actions reliably influenced conscious emotional experience, suggesting that the effects at issue are nonaffective in nature. These effects have also remained significant after statistically controlling for variation in the subjective effortfulness of the arm actions as well as for task enjoyment. Therefore, there now exists fairly consistent evidence that approach motor actions, as a form of bodily 'benign situation' cue, compared to avoidance motor actions, as a form of bodily 'threatening situation' cue, broaden the scope of conceptual attentional selection.

In light of these findings regarding conceptual breadth, the question naturally arises as to whether approach relative to avoidance motor actions correspondingly enhance creativity. As discussed earlier, a broadened scope of conceptual attention should bolster the ability to produce innovative solutions by facilitating activation of material in memory that is relatively inaccessible to awareness. To test this, researchers have had participants engage in arm flexion or extension while they completed well-known creative insight problems, such as the following:

A dealer in antique coins got an offer to buy a beautiful bronze coin. The coin had an emperor's head on one side and the date 544 BC stamped on the other. The dealer examined the coin, but instead of buying it, he called the police. Why? *Solution:* The year 544 BC predates the birth of Christ; therefore, a coin from that year would not be inscribed with an abbreviation for 'Before Christ.'

In this problem, despite the fact that virtually all participants know what BC stands for, this knowledge is only weakly accessible to consciousness in part because it is unnecessary for understanding the problem. For this purpose, knowledge that BC signifies a year occurring prior to AD 1 or merely denotes a time of antiquity is sufficient. Therefore, it may be posited that an expanded scope of conceptual attention should help activate knowledge of BC's literal meaning, thereby facilitating solution.

Consistent with this prediction, individuals who engaged in approach, relative to avoidance, motor actions were found to show an improved ability to solve creative insight problems of this variety. Notably, these nonaffective cuing effects have been replicated using creative generation tasks as well. For instance, in one study, participants performed arm flexion or extension while they completed a variant of the Torrance alternative uses test. Specifically, participants were given a minute to list as many creative uses for a brick that they could think of, refraining from typical uses or uses that were virtually impossible.

Afterwards, their responses were independently judged with respect to their creativity. It was found that individuals who had engaged in approach, relative to avoidance, motor actions generated more original uses, controlling for fluency (the sheer number of responses tendered). This convergently supports the notion that nonaffective safety, relative to danger, signals expand the scope of conceptual attention, facilitating entry into consciousness of the unconventional associations that inspire innovative solutions.

Critically, if arm flexion bolsters creativity by broadening the scope of conceptual attention, rather than simply enhancing task motivation, then it should also undermine performance on tasks that benefit from narrowed conceptual scope. Analytical reasoning is a domain of problem solving that involves carefully focusing attention upon the premises given and logically deriving conclusions from these premises. Therefore, whereas activation of material that is remotely associated with the information given may facilitate creativity, in the case of analytical reasoning, activation of remote associates does not bolster task performance and may indeed disrupt it by fostering distraction. Accordingly, it has been found that engagement in approach, relative to avoidance, motor actions impairs, rather than enhances, the ability to solve analytical reasoning problems (akin to those included on the GRE Analytical exam or LSAT). This supports the contention that nonaffective safety, relative to danger, signals do not merely bolster task motivation, but expand the breadth of conceptual attention, undermining performance when the task at hand requires concentration upon a limited set of information.

Virtual enactment of approach and avoidance-related behavior

Researchers have also examined whether the mere thought of approaching a reward versus avoiding a threat may suffice to trigger the processes of attentional tuning posited to influence creative thought. While such thoughts may not lead to affective arousal, they may nonetheless moderate the scope of conceptual attention due to their cognitive association with benign versus threatening situations. Researchers have investigated this possibility by administering to participants paper-and-pencil maze tasks in which a cartoon mouse was to be led through the maze to find a piece of cheese or to escape a hovering owl. 'Virtual' enactment of approach and avoidance behaviors via maze completion was not found to affect emotional experience. This is unsurprising given that it only entails 'helping' a cartoon rodent obtain an imaginary incentive or avoid an imaginary threat. However, since maze completion does activate material in long-term memory related to actual safety or danger, it was predicted to influence attention much as do arm flexion and extension or happy and anxious feelings. Restated, virtual approach enactment (safety-related signal), relative to avoidance enactment (danger-related signal), was hypothesized to broaden conceptual attention and to enhance creativity.

This proposition has received support from several studies. For example, in one study, individuals were administered either the approach or avoidance maze task followed by a Stroop task. In this task, participants are exposed to a series of color words that are printed in either congruent colors (e.g., 'blue' printed in blue) or incongruent colors (e.g., 'blue' printed in yellow). They are instructed to identify as rapidly

as possible the color in which each word is printed. Since there is an automatic tendency to read a word to which one is exposed, in cases of incongruent coloring, individuals are forced to choose a non-dominant response (naming the color of the print, instead of the identity of the printed word). This may be hypothesized to benefit from a broadening of conceptual attention, as this would increase the accessibility of nondominant responses. Therefore, since benign, relative to threatening, situation cues are posited to expand the scope of attention, they should improve Stroop performance on incongruent trials. This prediction was borne out using the cheese and owl maze tasks – virtual enactment of approach behavior speeded responses to incongruent Stroop trials relative to virtual avoidance enactment. There were no performance differences between the approach and avoidance groups on congruent trials, indicating that the aforementioned effects were not a simple result of differences in effort. In related research, virtual enactment of approach versus avoidance behavior has also been shown to affect creativity, with incentive versus threat-related maze completion engendering an improved ability to produce original alternative uses for an object with a pre-established function (for instance, a brick).

Color-based signals

Another type of nonaffective cue that has been found to influence attentional breadth and creativity is incidental exposure to distinct colors. According to theorists, the color red often, if not invariably, signals danger. For instance, it is frequently used to mark errors on homework by instructors and to signal traffic hazards, as in stop signs and road flares. It is also a non-verbal signal of anger in humans and other species. In light of this common association, it has been proposed that when the color red is salient, at least in performance settings, it prompts the goal to avoid threats. This in turn leads to a constriction of the scope of attention, which ultimately eventuates in diminished creativity. Of course, just as red signals danger, other colors are more typically associated with benign or safe situations. For example, it has been proposed that the color blue is often, if certainly not always, associated with tranquility (as in the classic song lyric, “nothing but blue skies from now on”). This common association correspondingly enables it to function as a nonaffective safety cue, exposure to which expands conceptual attention and facilitates creativity.

To empirically assess these ideas, researchers have unobtrusively exposed individuals to either the color red or blue by altering the background hue of their computer displays or placing differentially colored swaths of paper on their test instruction packets. Studies have revealed that on tasks that presumably benefit from narrowed attention, individuals exposed to red outperformed those exposed to blue. For instance, they were better at determining whether pairs of identical or highly similar stimuli were exactly the same or not, a task that demands careful attention to the information provided. In complementary fashion, exposure to blue, relative to red, has been repeatedly demonstrated to broaden the scope of conceptual attention and promote creativity, as shown by improved performance on the RAT and an ability to generate more creative alternative uses. In a particularly intriguing recent study, participants were provided with pictures of a number of different toy parts and asked to design a novel

children’s toy using some subset of these parts. Remarkably, when the parts were depicted in blue, individuals produced toys that were independently rated as more original in design than when the parts were depicted in red. Notably, consistent with the view that these findings are nonaffective in nature, none of the reported studies on the effects of color on attentional scope and/or creativity have found that the color stimuli differentially influenced mood or transient emotional experience.

Attentional priming

Although affective and nonaffective safety and danger signals are the most intensively investigated types of attentional tuning cues, researchers have recently turned their efforts to identifying other types of situational factors that may influence the scope of conceptual attention and, with it, creativity. One such factor is the scope of perceptual attention, the amount of sensory information that is selected for processing. A number of theorists have proposed that the mechanism used to select which perceptual stimuli will occupy the focus of attention is the same as, or at least strongly associated with, the mechanism used to select which of the conceptual representations (e.g., facts, expectancies, images) stored in long-term memory will be brought to mind. Building on this notion, it has been hypothesized that changes in the scope of perceptual attention may elicit corresponding changes in conceptual attentional scope. More precisely, expanding or contracting the scope of perceptual attention, by focusing on a broader or narrower area of sensory space (e.g., a larger or smaller visual area), may in turn increase or reduce the amount of information activated in long-term memory. With regard to creativity, it follows from this reasoning that by inducing individuals to focus on a wider versus more constrained area of visual space, this should momentarily narrow conceptual scope, impairing creative thought by impeding access to remote associates.

This ‘attentional priming hypothesis’ has found support in a recent series of experiments. For instance, in one study, participants were presented with a series of 1 s computerized displays, each containing a set of nine digits. The number three was presented in half of these displays and participants were tasked with indicating as quickly as possible whether a three was present or not. To manipulate the scope of perceptual attention, in the broad scope condition, digits were scattered about the periphery of the computer display, requiring that participants search a wide area of sensory space. Correspondingly, in the narrow scope condition, digits appeared within a 2-in. radius of the center of the display, requiring that visual search was limited to a constrained area. Afterward, participants were administered two creative generation tasks, one in which they were asked to generate creative alternative uses for a brick and another in which they were to devise a creative title for a humorous photograph (of a dog holding a bagel in its snout). Consistent with predictions, individuals who were led to focus perceptual attention broadly versus narrowly, showed greater originality on these tasks, as judged by a set of independent coders. These results were replicated using different manipulations of perceptual scope, for instance, by having participants focus on wider versus narrower areas of geographical maps. They were also replicated using different measures of creativity, including an

exemplar generation task on which participants were asked to provide as quickly as possible the most unusual exemplar of a given category (e.g., birds, sports) that they could think of. While such findings require additional corroboration, they do suggest that subtle, situationally-elicited changes in the focus of sensory attention may at least transiently influence access to the cognitive material required to produce innovative solutions.

Conclusion

In sum, recent research building upon the seminal ideas of associative learning theorists has suggested an integral link between the scope of attention and creative thought. Specifically, it has been proposed that an expanded spotlight of conceptual attention facilitates awareness of relatively inaccessible or peripheral information, thereby bolstering the ability to produce innovative alternatives. This notion draws support from personality research showing that traits associated with a diminished tendency to inhibit irrelevant information predict creative achievement. It is also supported by a range of evidence demonstrating that situational cues associated with safety broaden conceptual attention and bolster originality, whereas cues associated with danger narrow conceptual scope and impede originality. Cutting-edge research has also suggested that situationally induced expansions or contractions of perceptual focus correspondingly facilitate or inhibit access to the remote associates used to generate creative alternatives.

While research over the last decade has yielded a number of provocative findings regarding the role of attentional processes in creative cognition, many important questions remain almost entirely unexplored. Researchers are currently investigating the limiting conditions of the effects of attentional scope on creativity, as well as exploring potential moderators of these effects, including motivational intensity, differential hemispheric activation, and social power. Whatever conclusions ultimately emerge from this ongoing research, it seems increasingly likely that in the coming years, many of the primary factors that influence creative thought will be identified, and their roles elucidated, using the theories and methods of psychological science.

See also: Divergent Thinking; Emotion/Affect; Insight; Memory & Creativity; Problem Solving; Remote Associates.

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Relevant Websites

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Attitudes and Creativity

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Glossary

Adaptability Organizing to change routines deliberately. Characterized by anticipating problems and developing timely solutions, staying abreast of new methods with prompt and widespread acceptance of change.

Brainstorming A divergent thinking technique to generate ideas that encourages quantity, hitchhiking and freewheeling with no criticism allowed.

Convergent thinking Selecting best options from a broad range of possibilities.

Deferral of judgment Withholding judgment to allow for divergent thinking. Keeps divergent and convergent thinking separate.

Divergent thinking Generating information without applying judgment and without analyzing.

Efficiency Organizing for routine production; doing the routine well.

Flexibility Organizing to cope with temporary interruptions to routines, unpredictable work overloads or emergencies; 'fire fighting.'

Fuzzy situation An undefined problem or situation viewed from a deliberately neutral position.

Ideation-evaluation A two-step creative thinking process sequencing divergent thinking and convergent thinking.

Simplex A circular four-stage, eight-step process of creative problem solving involving ideation-evaluation in each step.

What Are Attitudes?

The concept of attitude has been a fundamental construct since the beginnings of systematic research in social psychology and has evolved into a field shared among various social sciences including sociology, organizational behavior, educational psychology, communications, political science, and marketing. Despite the long history of attitudes and attitudinal processes research, there is no consensus on precisely what an attitude is and how it can be identified. There is a general understanding that an attitude has, at its core, an element of evaluation. One might describe attitudes as summary judgments of a stimulus, object, or event which aid individuals in structuring their complex environments. As such, attitudes can be seen as items of social knowledge, built from experiences, beliefs, and feelings generated by an attitude object.

The literature suggests that attitudes consist of three response types: affective, cognitive, and behavioral. That is, an attitude consists of how we feel, what we think, and what we are inclined to do about something. This represents the so-called tripartite model of attitudes. Though related, there is evidence that the three types of responses are different. Thus an attitude could be thought of as the categorization of a stimulus object along a continuous evaluative dimension based upon three classes of information: (1) cognitive information; (2) affective information; and (3) experience information concerning past behaviors, separately or in combination.

The literature also suggests a one-component view, which proposes that affective responses to attitude stimuli or objects are based solely upon cognition. Describing the attitude concept as cognition is another way of stating that attitudes are, in fact, items of knowledge; however, it must be recognized that this knowledge has an important experiential base, heavily characterized with emotions and driven by how the individual has responded to the stimuli in the past. Thus the single component and tripartite views are not completely dissimilar.

Unlike personality, attitudes are expected to change as a function of experience, and there is evidence that attitudes based on direct experience predict behavior better than those based on indirect experience. There are numerous theories of attitude formation and change, including consistency theories, self-perception theory, persuasion, social judgment theory, balance theory, and processing models. Processing models are used to explain that true attitude change results when both affective and cognitive processing of information occur in parallel. Some attitudes are much easier to change than others. Trying to change a person's commitment to a long-held position, such as the value of family, religion or politics, is more difficult than changing one's perception of a new brand of chewing gum. Individuals' attitudes related to their creativity represent one such position which may be difficult to change. Such creativity attitudes have conceivably 'worked' for them in their life or career progression. As ego-involved attitudes, they represent parts of one's 'self-picture' and are often closely held.

However, there are ways to positively impact peoples' attitudes toward creativity without threatening their self-image and instead expanding their skills in using their personal creativity. For example, educational studies have consistently found that elementary school teachers typically have negative attitudes toward students with personality traits associated with creativity. However, experiments have demonstrated that creativity training can positively impact such teacher attitudes. Later in this article additional examples of creativity attitudes and change are provided.

The Importance of Creativity to Organizations

The importance of creativity to the well being of society is clear when one considers the degree to which globalization and economic conditions require individuals and organizations to adapt their resources to changing demands to remain

competitive. Creativity can facilitate and increase problem solving and adaptability skills. While many organizations pay lip service to creativity, the most effective organizations recognize its importance and develop positive attitudes toward it. Effective organizations are simultaneously efficient and creative. The efficient organization follows well-structured, stable routines to deliver its products or services in high quantities with high quality and at low cost. It reacts quickly to unexpected turns of events to maintain routines with minimal disruption and without becoming mired in bureaucracy. In a stable world, efficient organizations may be successful. But in a changing world, organizations also need creativity as an ongoing process.

While organizational efficiency implies mastering routine, organizational creativity requires mastering the process of deliberately changing routine. Organizational creativity is a proactive process: it allows the organization to deliberately and continually change and adapt. It entails deliberate discontent – discovering new problems to solve, finding new things to do, and adopting new technologies and methods before anyone else. Adaptability is disruptive. It requires looking outside the organization for new opportunities, problems, trends, technologies, ideas, and methods that may dramatically improve or completely change routines or introduce completely new products and services. Creative organizations anticipate problems and opportunities, and develop timely solutions and new routines. They deliberately and continually change routines to improve quality, raise quantities, reduce costs, and stay ahead of competitors. The people in such organizations exhibit positive attitudes and behaviors consistent with creativity. They accept new ideas and solutions promptly and the acceptance is prevalent across the entire organization. In short, they have a positive mindset, which includes positive attitudes toward creativity and creative work. This article focuses on increasing understanding of how attitudinal factors contribute directly to organizational creativity, as well as demonstrating how organizations can deliberately incorporate creativity into their culture, rather than just talk about it.

Organizational Creativity as a Process Requiring Positive Attitudes

Organizational creativity can be portrayed as a continuous, dynamic, circular three-phase process of finding good problems, solving them and implementing good solutions (see Figure 1).

Creative organizations demonstrate a positive attitude toward problems. In fact, they seek them out as opportunities for disruptive change. Unfortunately, in lesser organizations the word 'problem' is often perceived negatively. In the creative process of Figure 1, problems are anticipated and sought proactively. They are viewed with a positive attitude as opportunities for innovation and improvement. As solutions are implemented, new problems or opportunities are discovered. For example, top Japanese corporations place newly-hired research and development scientists and engineers into sales departments to begin their careers. The intent is for them to learn experientially how to discover the problems of the customer, and recognize that such learning is the beginning of innovation.

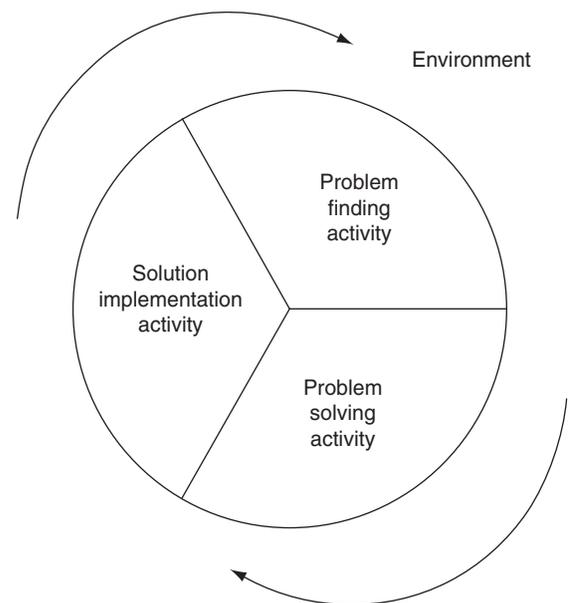


Figure 1 Creativity activity in an organization.

Thus, a positive mindset toward creativity begins with a positive attitude toward problem finding, meaning the behavior of continuously and deliberately discovering and formulating new and useful problems to be solved. In organizations, this includes anticipating new customer needs to generate new products or services, discovering new ways to improve existing products, services, procedures and processes, and identifying opportunities to improve the satisfaction and well-being of organizational members and pertinent groups outside the organization. On the other hand, problem solving means developing new, useful, imaginative solutions to these problems. Solution implementing means implementing such new solutions for successful change. Each implemented solution leads to new, useful problems to be discovered – hence the circular process. Research shows that effective organizations do what it takes to mainstream such a process (make it an everyday habit among its members) for continuous innovation and for intrinsic motivation. Positive outcomes for employees from increasing organizational creativity include greater motivation, job satisfaction and teamwork.

Research on Creativity Attitudes

It is important to realize that the study of creativity from any standpoint can be difficult and complex. For one thing, there is no single agreed upon definition of creativity. Another reason is that creativity is multi-faceted because so many factors contribute to its development and expression. These factors can be classified as personal (such as cognitive, motivational, and attitudinal), social, and environmental. While there is no lack of theorizing about attitudes associated with creativity, there has been only a small amount of empirical research attempting to operationalize these theories. Those few empirical studies can be divided into two different levels of analysis: macro and micro. Macro level studies investigate the role of attitudes

toward creativity at the organizational level while micro level studies attempt to understand their role at the individual level. But first, why has the subject of creative attitudes been so widely ignored in empirical research? One reason might be a perceived lack of applicability. Surprisingly, many researchers seem unaware of already existing research that establishes the significant role attitudes play in creative performance. However, a more likely reason is that changing attitudes of any kind is not an easy task. Perhaps no area of research in social psychology has been as active as the formation and change of attitudes. In fact, in many areas of study other than creativity, the linkage between attitudes and behaviors has been the subject of considerable research and controversy. The belief that attitudes have important implications for behavior in organizations is implicit in various areas of human resource research. Various balance theories predict that individuals who experience inconsistency among their feelings, beliefs, and behaviors are motivated to restore balance. An individual's sense of commitment to an organization as an attitude has been found to have numerous moderators beyond relevant work-related factors. There is only a small direct correlation between an individual's job satisfaction and performance on the job. In short, the relationship between attitude and behavior is complex and is an important area of research. A positioning of this missing relationship in creativity research is an objective of this article.

Macro Level Creativity Attitude Research

Macro level research on attitudes toward creativity can be categorized as being either 'attitudes toward change' or 'attitudes toward creativity.' A variety of measures of personality orientation toward change have been developed to understand the roles various groups play in an organization's adoption of change initiatives. For example, managerial attitudes toward change have been positively related to organizational innovation.

The second category of macro level empirical research consists of a program of field work by creativity researcher Min Basadur and his colleagues, who developed scales to measure the extent to which organizations do not value new ideas, have negative stereotypes of creative people, and whose employees feel too busy for new ideas. These provide an opportunity for innovation-minded managers to enhance creative behavior among staff by nurturing and developing specific positive attitudes. To the extent that employees value new ideas, believe that increased creative behavior and performance can be developed and is not the sole domain of a select few, and feel they are not too busy for new ideas, they are more likely to engage in creative thinking and to try to improve their creative performance.

Some theorists have offered conceptual models explaining how individuals' attitudes play important roles in creativity. For example, some theorists have argued that a negative attitude suppresses creativity but that creativity is enhanced through positive attitude adjustment. Thus organizational processes encouraging positive attitudes toward creativity would be expected to lead to greater engagement in creative activities and to be a requirement for organization-wide creative performance. Finally, some have proposed that a can-do attitude in

an organization's employees during crisis situations is a key factor determining whether or not executives adopt a crisis-as-opportunity mindset, and in turn perceive the opportunity presented in the crisis as attainable.

Empirical Micro Level Creativity Attitude Research

The role of attitudes in creativity can also be understood at the individual or micro level. At the end of the day, creativity is something that a person or team actually does. Creative behaviors produce creative results. Thus, mechanisms by which creative behaviors can be developed or triggered are important for organizations to learn if they truly want to achieve ongoing creativity and organizational effectiveness. In the sections below, empirical evidence is presented that creative attitudes open the doors to, and trigger, such creative behaviors and results. The important linkage between attitudes and behaviors in creativity was identified in field research by Basadur and his colleagues, George Graen and Stephen Green. They summarized the available organizational creativity research into three distinctly different types. The first was identification (of creative people), the second was organizational factors (affecting creativity) and the third was improvement. They undertook a direct test of improving creativity by training and tried to address two major questions: "Does creativity training work?" and "If it does, then how does it work?" Their literature search on improvement turned up seven significant opportunities to advance the research.

First, creativity training as a subset of organizational and industrial training had suffered from many of the problems of organizational training research in general, along with facing some unique problems. Research on 'laboratory training' (i.e., training intended to change behavior and/or skill) had provided no evidence about effects on individuals' problem-solving skills. Only a small number of research studies had dealt with any attempts to teach problem-solving and decision-making skills. Second, those studies that had been done on creativity training were mostly 'nonreal world' or fictitious in nature. Most often they involved asking college students to generate ideas for solving a fictitious, neutral problem such as imagining uses for a wire coat hanger. Only a very few studies concerning real-world problems were found in the literature and much like training research in general, very few had tried to assess behavior change back on the job. Third, most studies showed methodological weaknesses. Fourth, many of the problems in creativity-training research involved measurement issues. Compounding these problems was the difficulty in arriving at even a common definition of what creativity means.

Fifth, there had been no significant investigation of the mechanisms by which creativity training might work. The training had been done on a kind of black box basis; that is, provide training and check to see what came out at the other end, without attempting to find out what was going on inside in terms of intermediate attitudes and behaviors. Essentially, none of the research in creativity training had addressed the intermediate steps of the traditional training model: training develops Understanding to change Attitudes to change Behaviors to achieve superior Results. For example, most of the previous research had tested the brainstorming technique.

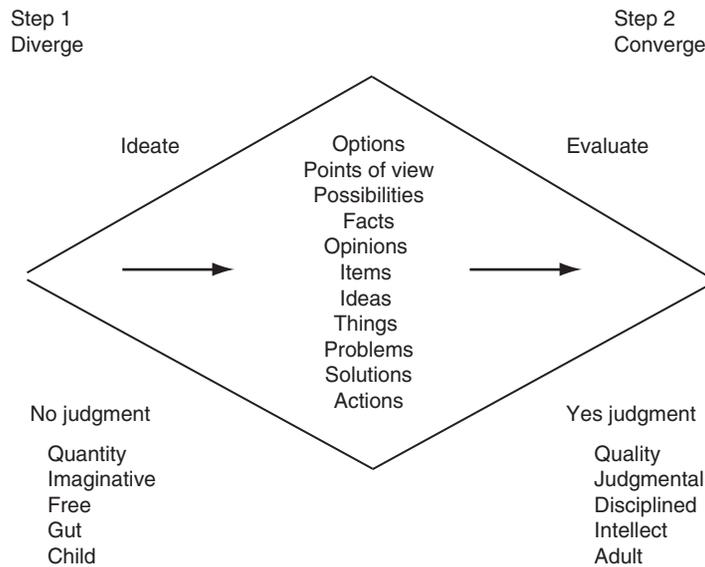


Figure 2 Ideation–evaluation: a sequential two-step creative thinking mini-process.

Brainstorming is the thinking tool most often used for the first half of a two-step thinking process labeled ideation–evaluation (see [Figure 2](#)). The ideation–evaluation process in [Figure 2](#) can be summarized as the deliberate separation of imaginative, nonjudgmental, divergent thinking from nonimaginative, judgmental, convergent thinking. The latter is delayed until the former has had an opportunity to be developed adequately. The emphasis is on doing both kinds of thinking, but separating the two. It is the deliberate use of both ideation and evaluation in a skilled, planned, orderly way.

None of the brainstorming research had attempted to measure to what extent the subjects actually accepted the value of ideation–evaluation and performed it skillfully during the brainstorming experiment or more permanently back in the real-world setting. To what extent brainstorming performance correlated with the attitude of willingness to accept ideation–evaluation and the behavior or skill in using it was never tested. In other words, in many of these earlier research studies, giving brainstorming instructions was all the training there was (as if this was sufficient to obtain sudden changes in brainstorming attitudes and behaviors). It is one thing to ‘nod your head’ to say you understand brainstorming rules. It is an entirely different thing to use the brainstorming rules skillfully, especially on real-world problems on issues that are important to participants.

Several laboratory experiments had indicated that inhibitory influences make training (giving brainstorming instructions) of groups less valuable than training of individuals, however, none of these experiments measured intermediate attitudinal or behavioral effects of such training. It seemed not only unlikely that simple brainstorming instructions would qualify as sufficient training, but also that many group participants would truly accept and use those instructions. They were more probably inhibited within the group and collectively lacked sufficient attitudes and skills in the ideation–evaluation mechanism. These groups should be called untrained, undertrained, or underdeveloped groups. Unless trainees significantly increase their acceptance of and skill in ideation–evaluation, neither they nor their groups should be

expected to improve their creative performance compared to untrained individuals or untrained or nominal groups. In other words, training in creative problem solving must be of sufficient quality, impact, and duration to effect real improvements in attitude toward (acceptance of) the mini-process of ideation–evaluation and its application (behavior). This line of thinking may explain why so few new management techniques become permanent and why many earn the ironic label of flavor of the month.

Sixth, among the few real-world creativity-training studies available, results had been conflicting. For example, one study suggested that such training is useful to managers and professionals in improving creative problem-solving performance on real-world problems, while another disagreed and suggested it only leads to ideas which are very similar to those produced without training. However, a major difference between the studies was that one provided much less training (1.5 hours) than the other (10 hours). One might speculate that the briefer training did not provide sufficient training to unfreeze and change participants’ attitudes and behaviors toward ideation–evaluation, or really induce participants to accept or practice the ideation–evaluation process when confronted with a real-world problem, whereas the other did.

Seventh, the value of training in a complete process of creative problem solving appeared virtually uninvestigated. Most studies involved only brainstorming, which is not a complete process of creative problem solving but rather one tool. Brainstorming is the generation of potential solutions without evaluation to a presented, predefined problem. The literature emphasized the need to study more complete processes of creativity. There were two aspects to this line of thought. First, most researchers in creativity agreed that (1) evaluation was an important aspect of the creative process; and (2) there are stages to the creative process above and beyond simply finding solutions to already identified problems. There was some discussion that finding new useful problems to solve is a separate and more important stage of the creative process than finding useful solutions to already

identified problems. To be of value to real world organizations, training in attitudes, behaviors, and skills requires a more complete process of creativity than a simple tool of ideation such as brainstorming.

Attitudes Are Needed to Make the Creative Process Work

Based on this analysis, Basadur, Graen, and Green set out to comprehensively test the effects of applied setting training featuring a complete process using ideation–evaluation in each step and taking into account many of the above described deficiencies in creativity research. The complete process trained, called Simplex, is described below and can be represented as eight ideation–evaluation steps within the four stages of **Figure 3**. The problem-finding phase of **Figure 1** has been divided into two stages – problem generating and problem formulating – and the process is a circular, continuous, four-stage process of generating, conceptualizing (formulating), solving, and implementing.

Ideation–evaluation occurs within each of the eight steps of the Simplex process. Ideation, or active divergence, is the generation of options without evaluation (deferring judgment). Evaluation, or active convergence, is the application of judgment to the generated options to select the most significant options. Separating ideation from evaluation is a vital aspect of this two-step process. This mini-process must be executed skilfully.

The research systematically measured for the first time the impact of creative problem-solving training on individuals

both immediately after training, as well as later, after they returned to work. The researchers conducted a field experiment in which they expected that providing creativity impactful training would improve five variables: (a) acceptance of the ideation–evaluation thinking mini-process; (b) deliberate practice of the ideation–evaluation thinking mini-process; (c) problem-finding performance; (d) problem-solving performance; and (e) solution implementation performance. The first of these five variables is attitudinal, while the second is behavioral. The researchers suggested that these two attitudinal and behavioral variables were necessary antecedents of the three performance variables. Unless a positive change in attitudes and behaviors were achieved – motivating participants to separate divergent and convergent thinking and to deliberately apply divergent thinking – training would not improve ideation performance. The research tried to measure the extent to which a change in acceptance of (attitude) and practice of (behavior) ideation–evaluation could result from training, and the extent to which it could result in a change in performance. This link between training and actual change in acceptance and practice of the fundamental ideation–evaluation process had simply been assumed to occur in previous research. The expected training effects are modeled in **Figure 4**.

Figure 4 offers the starting point of a theoretical model to explain how training increases organizational creativity and innovation. This model postulates that, in order to achieve meaningful increases in problem finding, problem solving, or solution implementation performance and organizational results, the impact of training must be sufficient to increase acceptance (attitudes) and practice (behaviors) of the ideation–evaluation process. For simplicity’s sake, the model excludes

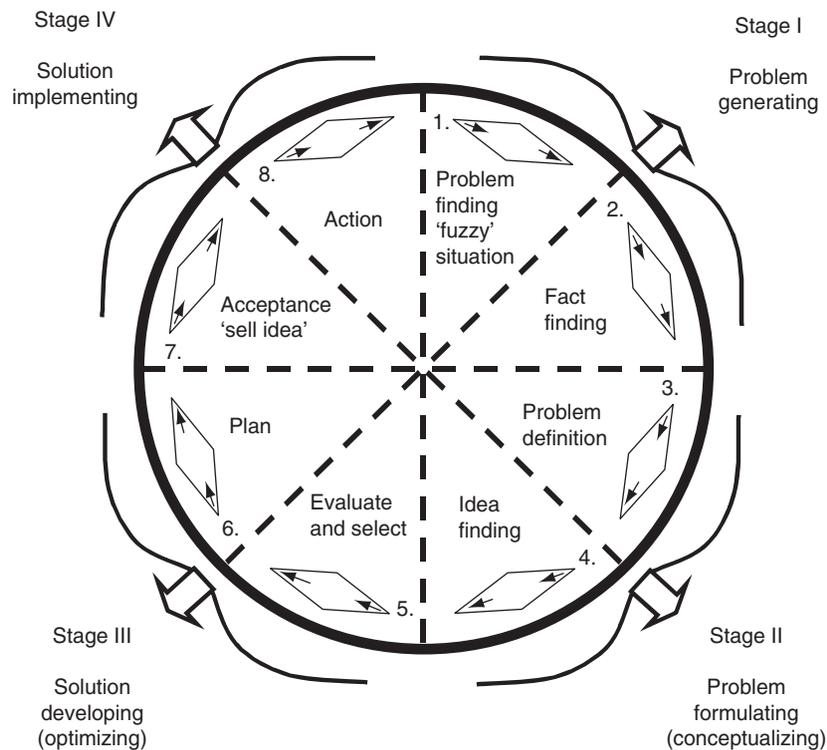


Figure 3 The Simplex creative process as a whole.

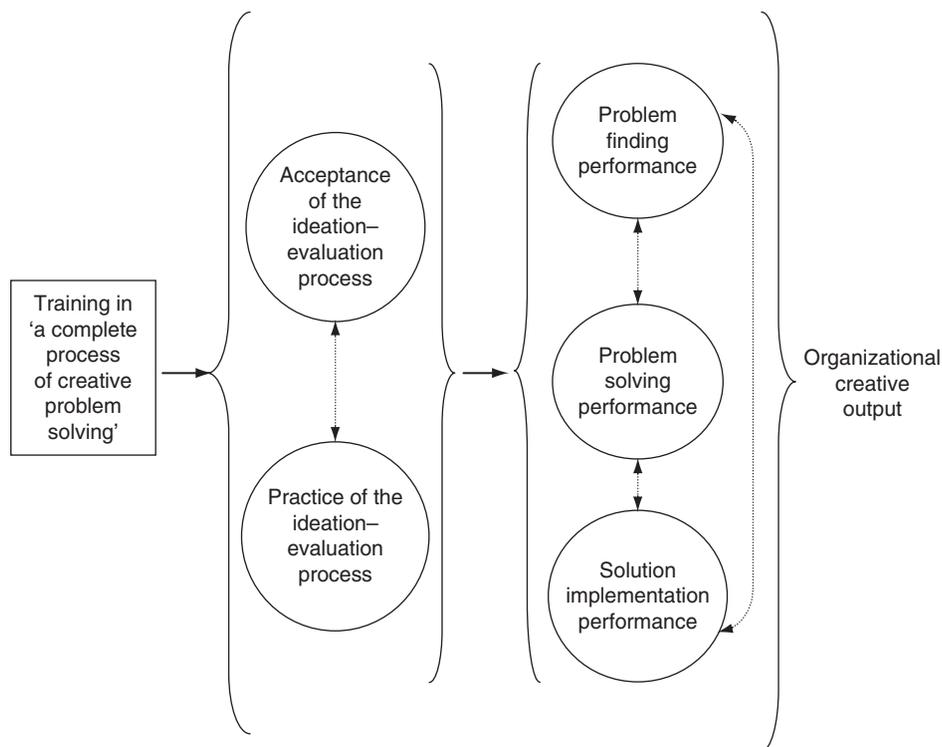


Figure 4 Effects of Simplex training on attitudes, behaviors, and performance.

various organizational, group and individual work-related factors that also affect creativity.

The research explored the effects and mechanisms concerning individual attitudes, behaviors, and performance in a real-world setting (rather than in a laboratory setting). What little previous research had occurred in relatively real-world settings had been limited to group variables. It was also suggested that, compared to simple brainstorming, a complete process such as Simplex would prove more useful and more credible (and less subject to the skepticism that often plagues creativity training) among participants from real-world business and other organizations. Unlike earlier research in which participants were asked merely to apply brainstorming rules without training, Basadur and colleagues stressed the importance of building attitudes and skills through at least two days of hands-on practice using real-world problems.

There were three premises underlying the training. The first was the recognition that, for most people, the ideation step is more difficult than the evaluation step of the process. Our society, including our school systems, tends to reward and hone our evaluation capabilities and preferences and promote their use virtually to the exclusion of ideation. Eventually that results in the dominance of evaluation skills. Engineering students have been found less able to use their imagination upon graduation than they were when they entered school four years earlier. The second premise recognized that, even within the above context, there are individual differences between people's relative preferences, aptitudes, and abilities in the two steps of the ideation-evaluation process. Some people may be relatively better in ideation or in evaluation. The third premise was that the training, while designed to strengthen both steps of the ideation-evaluation process, was

expected to have the most impact on the step of the ideation-evaluation process that was least developed in each trainee.

Research participants included staff drawn from the engineering department of a large consumer goods industrial company. The organization requested the training to promote an increase in creative performance in applied research. Two days of intensive training in creative problem solving (depicted in Figure 3) was primarily experiential and practice oriented and included a series of diverse tasks encouraging participants to discover concepts not considered before, such as ideation-evaluation and the value of both divergence and convergence in thinking. Using a 'learning by doing' model, the training was applied to real-world problems, in addition to case studies. For example, each person generated an individual work problem and then developed a solution and implementation plan before leaving the training session. These processes encouraged transference of creativity concepts to personal frames of reference. Within the design, delayed measures were constructed to reflect attitudinal and behavioral changes transported back to the regular work setting.

Compared to a control group, the experimental training group achieved significant increases in the acceptance and practice of ideation-evaluation and also in the performance variables measured. Multiple method measures, including on-the-job observation, demonstrated that employees made gains in attitudes and behaviors and were seen to be more open-minded to new ideas and approaches, less likely to jump to conclusions as to the nature of a problem, more positive in reaction to new, unusual product ideas, less prone to negative evaluation during idea generation, more capable of generating a good quantity and quality of problems, more likely to consider different problem definitions prior to choosing one as best, and more likely to try new, unusual approaches.

The results supported the model in Figure 4. The model is primarily useful for identifying the key constructs that must be affected in order for training to succeed. In summary, the research suggested that unless attitudes toward divergent thinking are positive or become positive, divergent thinking as a behavior is not likely to be practiced on the job.

Development of Micro Level Creativity Attitudes and Measures

The research by Basadur and his colleagues subsequently led to more precise modeling of how divergent thinking attitudes enhance divergent (ideation) thinking behaviors and skills. In 1985, Basadur and fellow researcher Carl Finkbeiner created measures of two specific attitudes that enhance these process skills. They suggested that the ideation–evaluation process has both attitudinal and behavioral components, and unless the process is accepted attitudinally, it will not probably occur. Using a 14-item questionnaire, they measured two specific attitudes that indicate acceptance of ideation–evaluation: the tendency to (not) evaluate prematurely (preference for deferral of judgment) and the preference for ideation (active divergence). They suggested that these two attitudes enhance and encourage the practice of the two related behavioral skills. Encouraging active divergence leads to generation of more options and deliberate development of many points of view. Encouraging avoidance of premature convergence reduces the urge to prematurely judge or analyze a fledgling thought.

They also suggested that a low tendency toward premature convergence would trigger a high preference for active divergence. That is, the former, more passive attitude is a prerequisite trigger for the latter, more active attitude. When people become skilled in reducing premature convergence and increasing active divergence, they create more, higher-quality options. These two measures of the acceptance attitudes are used in various ways in the research reported in this article as explained later. For example, evidence has been gathered that individuals whose attitudes favor ideation do better on divergent tasks, those whose attitudes reflect a preference for evaluation do better on convergent tasks, while those whose attitudes reflect both perform equally well on both types of tasks. The work is modeled in Figure 5.

Multi-Dimensional Creativity Attitudes

The research has also provided evidence that both the variables of (attitude) acceptance and (behavior) practice of ideation–evaluation are multidimensional rather than single dimensional. One’s attitudes and behaviors in applying the ideation–evaluation two step process probably differ in each of the three–phases of the complete process. For example, someone may prefer to defer judgment and actively diverge in the solution-finding phase more than in the problem-finding phase, or vice versa. Later research provided evidence of different optimal ratios of ideation and evaluation in each of the phases for different fields of endeavor. Thus, six new

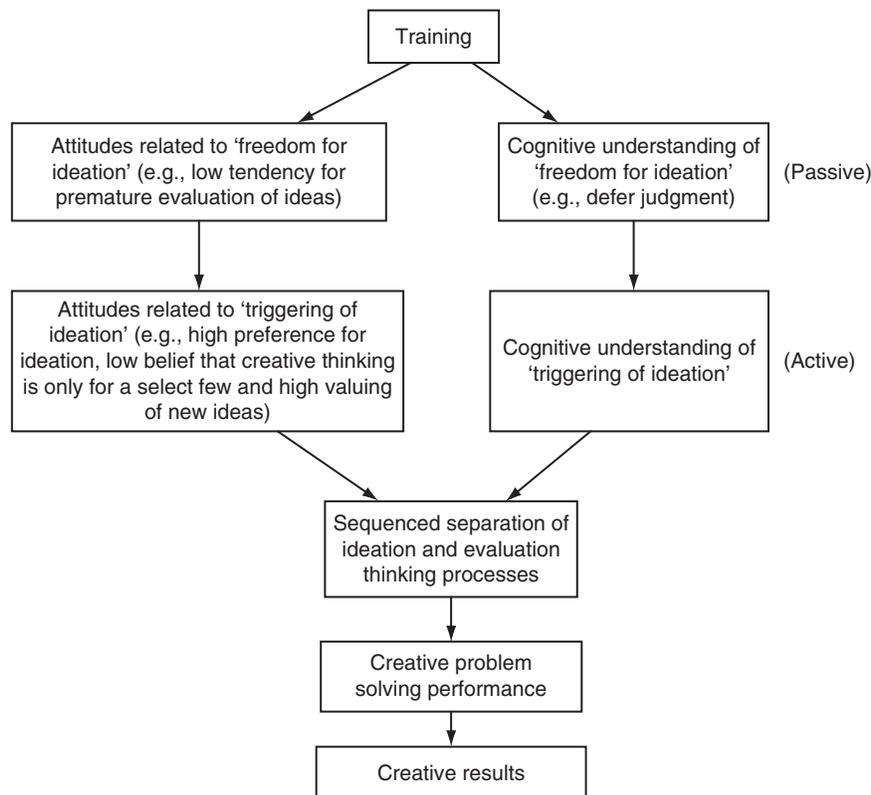


Figure 5 Speculative model of creative problem-solving training differentiating between ‘ideation freeing’ and ‘ideation triggering.’

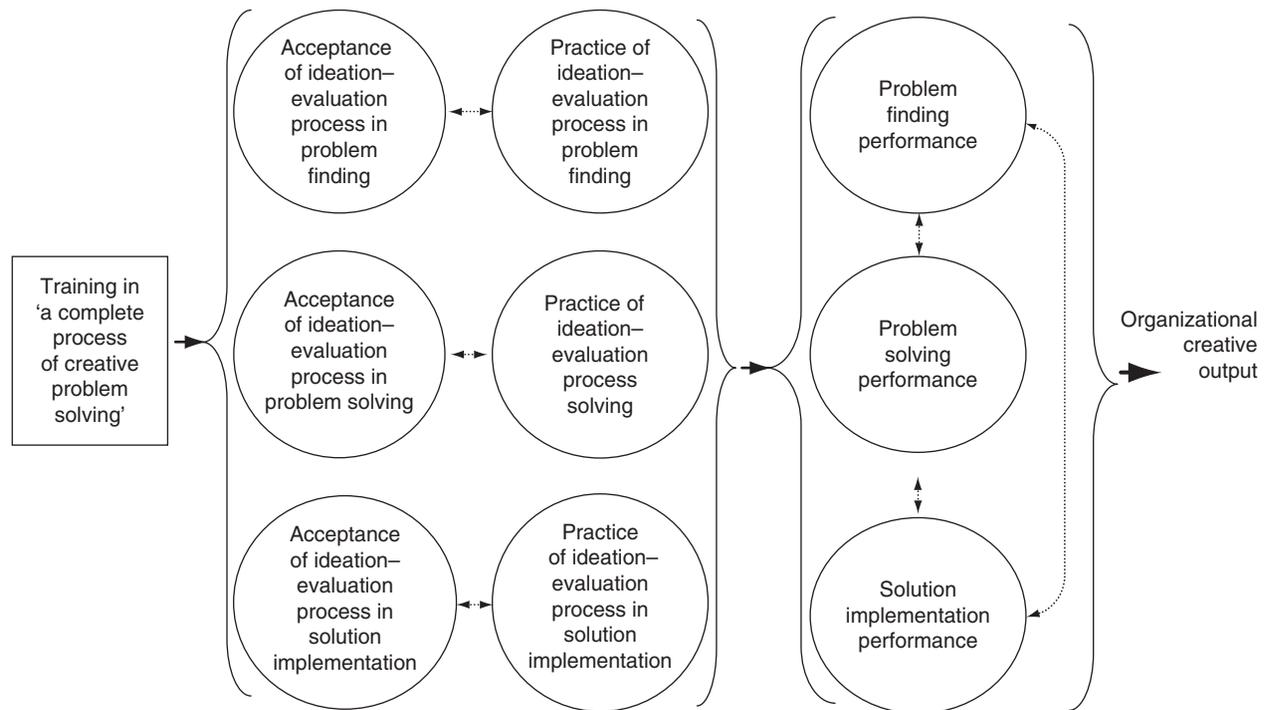


Figure 6 Revised model for training creative behavior in an organization.

antecedent variables replaced the two antecedent variables in [Figure 4](#). The attitudinal antecedents were labeled acceptance of ideation–evaluation in problem finding, acceptance of ideation–evaluation in problem solving, acceptance of ideation–evaluation in solution implementation. Similarly, the behavioral antecedents were labeled ‘practice of ideation–evaluation in problem finding,’ in problem solving, and in solution implementation. The revised model of training effects is shown in [Figure 6](#) which suggests that changes in acceptance of (attitude), and practice of (behavior) ideation–evaluation in each of problem-finding, problem-solving, and solution implementation are necessary antecedents to corresponding changes in performance.

Optimal Ideation–Evaluation Attitudinal Ratios

Basadur and colleagues’ program next began exploring the relative contributions of ideation and evaluation at each of the three phases of the process of [Figure 2](#) in field research. For example, do these relative contributions differ by field of organizational endeavor? Perhaps different optimal ideation–evaluation ratios exist for any job or any organizational function. Perhaps in short-range, time-pressured, high implementation-oriented jobs, evaluation (convergence) is relatively more important than ideation (divergence). Perhaps in long-range, less time-pressured, less implementation-oriented jobs, the reverse is true. Perhaps jobs exist between these extremes in which ideation and evaluation are about equal in importance. Empirical testing was conducted of the idea that fields of endeavor with differing emphases on various phases of the complete creative problem solving process differ correspondingly in the ideation–evaluation preference

ratio of individuals working in these fields. The results supported the notion that people working in various different fields of endeavor in organizations have different ideation to evaluation (I/E) preference ratios corresponding to the varying relative amounts of problem finding, problem solving and solution implementation that their work entails. People working in fields favoring problem finding had higher I/E preference ratios than those working in fields favoring problem solving and solution implementation. People working in fields favoring problem solving had higher I/E preference ratios than those working in fields favoring solution implementation. For example, in manufacturing, characterized by short-term, clear-cut activities leading to action within specific time limits, participants favored an evaluational, converging approach over an ideational, diverging approach. This would be a solution implementation (SI) field of endeavor. In contrast, participants working in environments such as pure research, in which time is a less limiting factor, and action is secondary to understanding, favored a diverging approach over a converging approach. This would be a problem finding field (PF) of endeavor. Between these two extremes were various fields in which, based on problem finding already done by others, one develops solutions for others to implement. Here, moderate time limits for action exist, and favor diverging and converging about equally. This would be a problem solving (PS) field of endeavor including jobs such as administrative or marketing (see [Figure 7](#)).

Changing Creativity Attitudes

Many people who work in organizations may have negative attitudes toward creativity, divergent thinking, and new ideas.

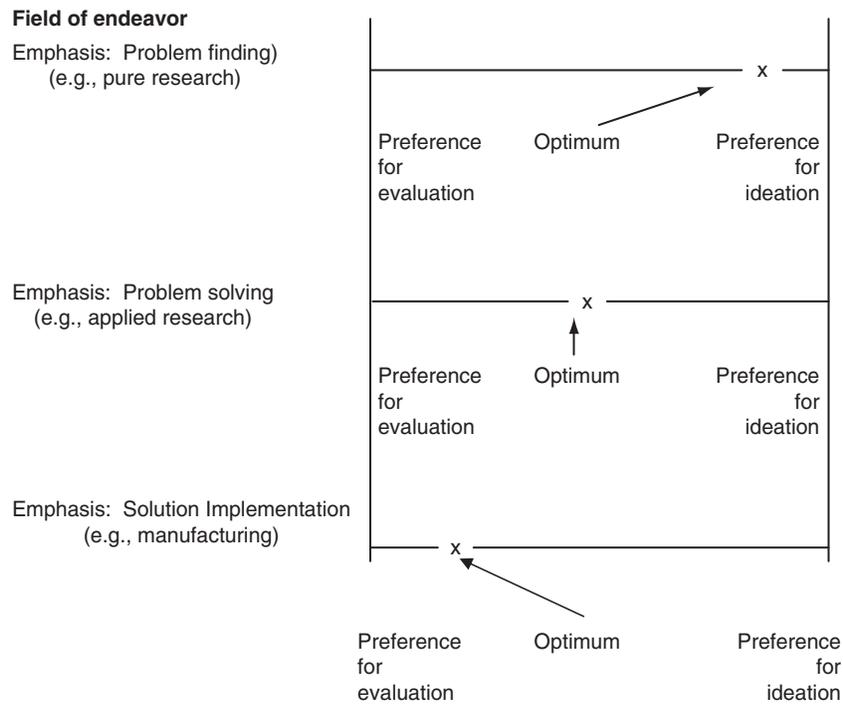


Figure 7 Different optimal ideation–evaluation attitudinal preference ratios for different fields of endeavor.

As a result, employees with more innovative styles are typically viewed with more mistrust and negativity by others. They encounter greater difficulty in getting their ideas accepted because they tend to propose more unusual solutions and may even redefine given problems in unexpected new ways. Others in the organization tend to have negative attitudes toward such divergent approaches inasmuch as the substantial changes they represent evoke feelings of discomfort and apprehension. Unless improvements in these attitudes can be achieved, efforts to increase divergent thinking and creativity may ultimately be fruitless. In 1986, Basadur, Graen, and Terri Scandura suggested that the attitudes of manufacturing engineers tend to be especially negative toward any form of divergent thinking and creative problem solving. They tend to see little room for creativity in their structured, implementation-oriented environment, where practicality is so highly valued.

Changing attitudes of any kind is not an easy task. Perhaps no area of research in social psychology has been as active as the formation and change of attitudes. In the 1986 study, the presentation of a multi-phase, complete process of creative problem solving based on synchronizing divergent and convergent thinking in each phase, was an attempt to persuade manufacturing engineers to engage in divergent thinking on their jobs and overcome their negative attitudes which might be a barrier to their use of creative problem solving. Hence, it was of interest to determine the extent to which the training (as a persuasive communication attempt) was able to effect changes in attitudes and the subsequent ability to incorporate creativity into the repertoire of job-related skills.

The research focused on the two attitudes toward divergent thinking identified by Basadur and Finkbeiner: (a) preference for ideation (active divergence), and (b) tendency to make

premature critical evaluations of ideas (premature convergence). For example, a person with a high preference for ideation (active divergence) in problem solving would probably find value in generating novel and varied solutions, considering multiple points of view and using initial solution suggestions as stepping stones to additional solution possibilities. A person with a high tendency to make premature critical evaluations of ideas (premature convergence) in problem solving would be quick to find a flaw in a solution offered and eliminate it from consideration, would probably display a high need to be decisive, would dislike wasting time with apparently nonproductive trains of thought, would feel each solution generated ought to be evaluated sequentially before proceeding to the next one, would not want to risk making a mistake, would believe there is one best way or one right answer to solve a problem, would have a low tolerance for ambiguity, and would prefer to optimize on one solution rather than explore multiple options.

The researchers hypothesized that training of the manufacturing engineers in the Simplex process (Figure 3) would lead to an increase in preference for ideation (active divergence) and a decrease in the tendency to make premature critical evaluations of ideas (premature convergence) in measurements taken five weeks after the training. The engineers were either trained as part of an intact work group or with other employees from various work units throughout the organization. The final results saw both measured attitudes toward creative problem solving (preference for ideation, and tendency to make premature critical evaluations of ideas) showing positive change after five weeks for the engineers trained in the intact work groups. However, the diffuse work groups showed statistically positive change in only one of the two measures

(tendency to make premature critical evaluations of ideas). Furthermore, there was some evidence of erosion of even the gain on the one measure in the first part after 10 weeks. Based on these results, it is possible that the engineers trained in intact work groups returned to their jobs along with others who had participated in the training and received peer support for divergent thinking in problem solving. In contrast, engineers in the diffuse work group returned to various work units throughout the organization and found less peer support for divergent thinking attitudes. The study showed that appropriate training can result in positive effects even in populations whose attitudes may be difficult to change, and that the use of intact work groups may enhance the impact of training.

A later experiment found that similar training was successful in affecting divergent attitudes in a wide range of employees. It also found that individuals with a natural preference for developing optimal solutions, as opposed to discovering new problems or playing with ideas, experienced significantly greater gains in attitudinal preference for active divergence following training.

Cross-Cultural Research on Creativity Attitude Change

With the development of the world economy and the erosion of cultural walls, organizations are seeing an increasing need for cross-cultural performance. The ability to learn, understand, problem solve and cooperate between cultures takes on greater importance. The more we know of how managers are similar or different in these respects, the more quickly and efficiently organizational creativity can be stimulated. Research into the impact of training on creativity attitudes and results has shown that it can offer the same successes with Japanese and South American managers as previously demonstrated with North American managers.

However, cultural factors can clearly have an impact on creativity attitudes. For example, the impact of training on the active divergence attitudes of Japanese managers was particularly strong. It is possible that the typical Japanese corporate reliance on consensus-style decision making and the value placed on harmony leads to a greater acceptance of the notion of avoiding premature judgment of others' ideas. This aspect of creative problem-solving training might be more compatible with their corporate culture than the process of actively diverging. In contrast, especially strong cultural forces may act against outrightly favoring active divergence on the job, since Japan is a shame culture. In order to save one's face and maintain personal security, one may try to avoid such thinking in particular. Impactful training in creative problem solving could have an especially high potential for improving attitudes toward active divergence under the consensus-and-harmony-oriented Japanese business culture.

Linking Creativity Attitudes, Behaviors, and Skills in a Causal Model

Additional research has demonstrated that training using the Simplex process significantly improves participants' evaluative skills, and those evaluative skills correlate positively with

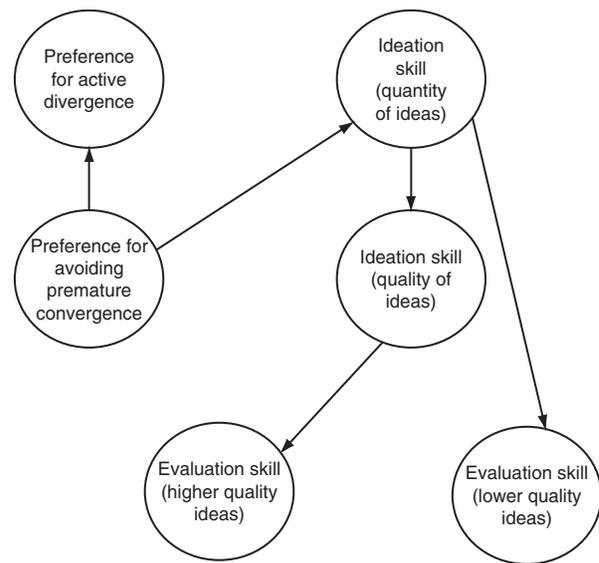


Figure 8 A causal model: how attitudes trigger ideational and evaluational skills.

ideational skills. This result is consistent with the theory that individuals with high ideational abilities have more opportunity to exercise evaluative skills. Additional work has found that the attitude of preference for avoiding premature convergence (deferring judgment) triggers the attitude of preference for active divergence. More importantly, this attitude of accepting deferred judgment is the more powerful attitude, and is significantly associated with the ideational and evaluational skill variables in [Figure 8](#). Increasing the preference for avoiding premature convergence encourages ideational skill in terms of quantity of ideas generated, which in turn translates directly into increased ideational skill in terms of quality of ideas generated and into evaluation skill in terms of more accurately recognizing lower quality ideas. The increased skill in ideation quality then translates directly to increased evaluation skill in terms of recognizing higher quality ideas.

Thus, the key appears to be the attitude of deferring judgment which triggers ideational skill in quantity of ideas generated. This skill, in turn, is strongly related to ideational skill in quality of ideas generated and also to evaluational skills. Interestingly, the increased preference for active divergence, which is triggered by the increased preference for deferral of judgment (avoiding premature convergence) did not play a direct role in enhancing ideational and evaluational skills. However, the possibility of an indirect role remains and raises the possibility of a moderating relationship that could be explored in further research. Additional research ideas follow below.

Future Research

There is ample opportunity for enterprising researchers to further understand the impact attitudes have on creativity at the individual, team and organizational levels while also providing real value to organizations willing to participate in empirical research. For example, the model in [Figure 6](#) invites increased

investigation of attitudes in the problem finding and solution implementing stages of the creative process. Also, no empirical testing has yet been done on the relationship between attitudes toward creativity and personality characteristics such as openness to experience and agreeableness. Given the current popularity of personality research in today's scientific management journals it would seem that this area of study holds much promise to bring creative attitudes to a broader audience. Finally, extending the cross-cultural research to additional important regions such as China and the Middle East would be most appropriate in our rapidly evolving world.

See also: Creative Products; Divergent Thinking; The Four Ps of Creativity: Person, Product, Process, and Press; Leadership; Problem Finding; Teaching Creativity.

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Relevant Website

www.basadur.com – Basadur applied creativity - revolutionizing how people think!

Attribution and Creativity

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Glossary

Consensus Agreement across a group of people.

Consistency Stability across time.

Covariation principle An effect is attributed to the one of its possible causes with which it covaries.

Dispositional factor Internal causal influence.

Distinctiveness Generalization across situations.

Fundamental attribution error The tendency of the observers to overestimate dispositional causes of behavior and to underestimate the influence of situational factors on behavior.

Self-serving bias The tendency to attribute desirable outcomes to dispositional factors and undesirable outcomes to situational factors.

Situational factor External causal influence.

Introduction

Creativity is a complex process and cannot be understood by just one explanation. It has predominantly been studied in terms of cognitive and personality processes, but recently situational forces have gained attention. Attribution theory is a sociology-based view that aims to understand the reasons for explanations of others' behaviors. Attribution theory, in essence, deals with people's responses to questions beginning with "why?". For instance, when individuals behave aggressively, is it people, their dispositions, the environment, or situational factors that are responsible for the aggressive behavior? If a person behaves creatively, should this be attributed to the person having high creative potential or to the forces of the 'press' that represent situational factors?

Background

Attribution theory was originally developed by Fritz Heider, one of the most important social scientists of the twentieth century. In 1958, he proposed the concept of 'attribution theory' in his book, *The Psychology of Interpersonal Relations*. His studies on social psychology inspired many other scientists, some from different disciplines. Approximately ten years after Heider's outline of attribution theory, Harold Kelley extended it to include cause and effect relations. As such attribution theory can be related to every area of psychology that involves judgment, perception, and thinking. In 1995 attribution theory was applied to creativity by Joseph Kasof in a special issue of the *Creativity Research Journal*. This article details the relevance of attribution theory to creativity.

According to attribution theory, creativity has both objective and subjective aspects. As often defined, creative products must be original, novel, and infrequent. This is the objective part of creativity and originality, novelty and infrequency constitute the main dimensions of many tests of creativity. Objective assessments of creativity are based on normative criteria. One of the main advantages of objective creativity tests is the evaluation of creative products by blind judges. This yields high inter-rater reliability. However, according to attribution theory, use of objective criteria involving such dimensions seems to

fall behind measuring creativity, since creativity does not emerge in isolation. Creative products must also be approved or accepted by the 'judges,' and this is the subjective part of creativity. Kasof argued that objective tests ignore the subjective aspects of creativity by explaining all of the variation in creative performance through individual differences concerning creative ability. He claimed that objective tests tend to reduce ecological validity. Overreliance on objective tests discards the point that reception of original products is socially constructed.

Consideration of creativity as a 'social construct' has at least one significant implication: there can be no objective criteria to measure creativity. Just as with evaluation of physical attractiveness, judgments of creativity also depend on social values. All judges have their own values, which influence their evaluations of the products. Judges – who may be scientists or experts but also laypeople – are the persons that decide whether a product should be approved, accepted, and valued. In 'controlled' studies, researchers decide what is creative and what is not, but in 'uncontrolled' real life settings, creativity is more about social judgment. In this view, even if the individual creativity is assessed, it cannot be thoroughly isolated from the social environment.

In a nutshell, attribution theory underlines 'situational factors' and challenges the conventional theories of creativity which used to focus on 'dispositional factors.'

Dispositional Versus Situational Factors

Throughout the centuries, both researchers and laypeople have attributed creativity mostly to genes, brains, and personal traits. These are all dispositional factors. For instance, Plato defined creativity as an inspiration, a kind of madness. According to Aristotle, the creative process is the product of natural laws; in other words, creativity comes from something that exists naturally. Kant also saw creativity as the kind of genius. He emphasized the unprecedented, spontaneous nature of the creative process. Galton, one of the most eminent scientists of the nineteenth century, extended Darwin's theory to creativity and defined creativity as an inherited ability.

In academia, creativity has been the subject of cognitive and personality psychologists, rather than sociologists or social

psychologists. Creativity first appeared as a concept in psychology literature in Joy Paul Guilford's Presidential Address, which focused on dispositional causes. This tradition has become the mainstream with the contributions of E. Paul Torrance, Frank Barron, Mark A. Runco and many others. When nearly 10000 studies were searched using the terms *creativity, sociology, environment, intelligence, and personality*, there were only ten entries under sociology, 50 under environmental factors, and 59 under cultural issues. On the other hand, there were 222 entries under intelligence, 243 under personality, and 280 entries under ability. Most of the dissertations on creativity also examined it on the individual level instead of the group level. This situation was not different for laypeople. According to most of the laypeople, creativity is a quality of persons and a personality trait and, to a large extent, comes from genes. Thus, people either have it or not, and most of people do not have it. Laypeople mostly do not think that creativity can be a continuum and all people can have it to some extent. This dichotomizing view could be a result of the overall tendency of the field to examine the personal differences between creative and noncreative individuals.

During the past 20 years, Joseph Kasof, Teresa M. Amabile, Mihaly Csikszentmihalyi, Dean Keith Simonton, and other researchers have focused on situational factors as well as dispositional ones. According to those researchers, creativity is not only a product of an individual effort but also a product of complex social systems. Their research indicated the influence of rewards and external motives, field and domain, and political situations and zeitgeist on creativity. Kasof did not negate the relationship between dispositional characteristics and creativity. However, he doubted the direction of the relationship between dispositional characteristics. Contrary to the common assumption, such characteristics can be the results, rather than the causes, of creativity. For example, creative people tend to be contrarian. According to Kasof, contrarianism does not lead to creativity, but creativity may result in contrarianism.

Kasof also explained three basic mechanisms that influence the attributions of creativity, some of which are covariation, salience, and self-serving bias.

Covariation Principle

'Covariation principle' was introduced by Harold Kelley who defined it as attribution of an effect to one of its possible causes with which it covaries over a period time. Covariation principle applies to the situations in which the attributors observed or noticed the effect two or more times. Accordingly, shifts from one kind of behavior to another yield different attributions for different reactions to this behavior. A famous example, known as the prisoner's dilemma, indicated that people's attributions regarding the same behavior pattern of a person can differ depending on the response of the reactant, see Table 1. In one case, a group of people observed two people, one of whom behaved cooperatively and the other also reacted cooperatively. When the first person, in turn, behaved competitively, 84% of the judges believed that the first person was competitive. In the other case, the actions of the first person were the same (cooperative and competitive, respectively) while the reaction was competitive in the second case. A smaller size of the observers (62%) believed that the first person

Table 1 Attributions of judges known as prisoner's dilemma

	Case I		Case II	
	Person I	Person II	Person I	Person II
Turn 1	Cooperative		Cooperative	
Turn 2		Competitive		Cooperative
Turn 3	Competitive		Competitive	
Result	84% judge person A to be competitive		62% judge person A to be competitive	

was competitive. The attribution of being 'competitive' about the first person is higher when the response of the second person is cooperative, than when the response is competitive.

Covariation principle explains the locus and stability of attributions in light of three variables. The first one is *consensus* which refers to generalization across persons. When people make attributions, they tend to consider whether all individuals behave similarly in a given situation. The second is *consistency* which is generalization across time. People often take into account if a person behaves similarly in other similar situations. The third one is *distinctiveness* which is generalization across situations. It explains if a person behaves similarly in different situations. People can know that their judgments are true if the judgment is associated distinctively with the stimulus (*distinctiveness*), if the judgment is similar to the judgments of other people (*consensus*), and if the judgment is consistent over time (*consistency*).

These three criteria are vital for attribution validity, however, they are not equally important. Consensus is more important for attributions of creative behavior than consistency and distinctiveness. The most important characteristic of creative behavior is originality and there is a negative correlation between originality and consensus. If the originality of a creative product increases, its consensus value decreases, and lower values for consensus cause higher internal attributions. Thus, highly creative behaviors are attributed to more internal causes than fewer creative behaviors. On the other hand, noncreative behaviors are attributed to dispositional factors only if the situation strongly supports the creativity.

Influence of number of creators on attributions may be a good example for the *covariation principle* in terms of *consensus*. The greater the number of creators, the higher the consensus and the more likely it is to be attributed to an external cause. Thus, when two or more scientists work on the same product independently, the consensus is higher than when it is made by only one scientist. Multiple creations are attributed less internally than single creations. In addition, if the multiple creators report the same creation at nearly the same time, the consensus will be higher, so the creation is attributed to more external causes. If two or more creators work on the same product at the same time, consensus is again higher than for single creations, so the creativity is attributed to external causes.

For consistency, if people behave creatively in a given situation over and over, their creativity is mostly attributed to dispositional causes. On the other hand, inconsistent creative products are attributed to situational factors, such as having a supportive boss for that time. If the creative product is not consistent, the creator has less of a chance to become

well-known even if the product is really good and valuable. As a result, those with longer careers have more of a chance to become well-known because they have more opportunities to produce creative products than those with shorter careers.

Although distinctiveness is not as important as consensus, it still influences the attributions of creativity. If people are creative in all situations, distinctiveness is lower, so the behavior is attributed internally. But if the creative behavior is common in one situation and rare in other situations, the creativity is attributed to external causes. If a person is creative in different domains, distinctiveness is lower; therefore, creativity is mostly attributed to internal causes. Hence, if two creators create the same number of products, but one's products are in different domains, he or she is considered more creative than the other. Even within a domain, if people use different styles, materials, etc., they are considered more creative than others who use the same styles or same materials. Having information about consistency and distinctiveness affects people's explanations about creativity. Most of the time, however, attributions are made without information about consistency and distinctiveness.

The relationship between these three variables results in different kinds of attributions. Lower levels of consensus and distinctiveness yield internal attributions whereas higher levels for consensus and distinctiveness result in external attributions. Higher levels of consistency tend to lead to more stable attributions. More discrepant levels of consensus and distinctiveness (i.e., higher for one and lower for the other) induce more complex attributions.

Saliency

Saliency plays an important role in the attributions of creativity. For example, think about the music group you like the most. Who might be the most creative person in the group? Most people would answer, "The lead singer." Because singers are more salient than guitarists, bass players or drummers, people perceive them as more creative than the other members of the group. If a poet appears on a TV show, people think that he or she is more creative than other poets who rarely show up on TV.

Saliency can operate in other ways, too. For instance, 'wishing to be alone' is seen as a characteristic of creative persons. Creative persons are considered unsociable, alone, and marginal ones, or unsociable, alone and marginal people are considered more creative than others. In a group, if a person has an unusual hair style or color, wears it different from others and behaves marginally, observers are more likely to believe that he or she is more creative than the other members of the group, even if there is no evidence to support this assumption.

Saliency is also related to the number of creators especially in scientific creativity. Scientific work has become more collaborative; therefore, attribution of scientific creativity to internal causes has decreased. However, while experimental studies are often done by multiple creators, theorists usually work alone. Therefore, theoretical studies are still attributed mostly to internal causes. Similarly, collaborative studies are more common in science than in humanities, so creativity in humanities is mostly attributed to internal causes in contrast to creativity in science.

Actually, the relationship between creativity and saliency is bidirectional. Creative products can also lead to saliency

because creative things are novel, and novel things are usually more salient. People tend to see salient products as a result of the personality of the creators and underestimate the impact of situations. However, there is an observer versus actor difference in saliency. When an individual observes another individual in a situation, the observer perceives the actor as more salient than the situation, but the actor perceives the situation in which he or she is in as more salient than himself or herself. Thus, the observer attributes the behavior more to dispositions than the actor. Of course, this can be due to the fact that creators experience the process, but observers can only see the product. This tendency of observers is known as *fundamental attribution error* or *overattribution effect* which refers to the tendency of the observers to overestimate the dispositional factors and to underestimate the situational factors. It occurs more commonly for creative behaviors than any other behaviors because creative behaviors are more novel and original, so they are more salient than other behaviors.

The relationship between saliency and creativity can also be seen in minority groups. Attributing creativity to people from minority groups is also common since they are highly salient. Therefore, creative people of minority groups are perceived as more talented than their actual performance, not just because of their creativity but also because of their rareness. According to Kelley, who introduced *augmenting principle*, if both inhibitive and facilitative factors of a behavior are present together, the greater causal weight is given to the facilitative ones. However, 'minority' here refers not only to cultural minority, but also to any rareness in number. In an empirical study, two equally creative groups were rated. Observers rated the smaller group as more creative than the larger group. This finding may also imply that the empirical studies about higher creativity among schizophrenics or physically handicapped can reflect a researcher bias. Psychopathologies or physical handicaps yield saliency which might attract researchers' attention more than others.

Stereotypic definitions of creative personalities can also be influenced by saliency effect. When we ask about the personality traits of creative individuals, lay people often describe them as nonconformists, independent, risk-takers, unsocial, and so on. On the other hand, it has been argued that creative people possess more complex personalities whereas people tend to notice the rarely observed and salient aspects. As a matter of fact, Mihaly Csikszentmihalyi, W Ed McMullan, Frank Barron, and others defined the most obvious characteristic of creative people as their complex personality. According to these researchers, creative people can bring together all the possible characteristics of humankind in themselves at the same time without any inner conflict. Nonconformity, independence and risk-taking are also characteristics of creative people, but they are exaggerated beyond reality.

Self-Serving Bias

One of the main concerns of attribution theory is people's judgments about their own abilities, feelings, achievements, etc. People usually attribute desirable outcomes to their personality traits and undesirable outcomes to environmental factors. For instance, reasons for acceptance, rejection, or revision of the articles by journals were asked of 230 authors. They mostly

attributed acceptance to internal causes but rejection and revision to external causes. In another study, students who attributed their theses more to themselves than their advisors evaluated their theses as better than their classmates' theses.

Creativity, as a desirable characteristic, is also mostly attributed to internal causes. In a study, ordinary students received the Remote Associates Test, but half of the students received an easier version of the test than the other students. Of the students who received the easier version, and thus got higher scores than the other group, more believed that the test was fair and objective than did the students who received the harder version and got lower scores as a result. Studies showed that self-serving bias rules in brainstorming activities as well. People tend to attribute others' original ideas in the group to themselves.

Like self-serving bias at the individual level, groups can also take credit for their successes, and attribute failures to external causes. This is called 'group-serving bias.' Especially in the environments where teamwork is more important than individual effort, the locus of attribution shifts from individuals to groups. In other words, people try to explain success and failures of the group instead of their own success and failures. For instance, when a football team wins a game, they attribute success to their group cohesiveness, but if they lose, they attribute failure to external causes such as an unfair referee.

Group-serving bias can influence judges' evaluation. Judges usually evaluate the products of members of their own group as more highly creative than the products of members of other groups. This bias occurs when the group members are in or out of their own environment during the evaluation period. For instance, products created by members of one's own sex are evaluated as more creative than those created by members of the other sex. People from the same nationality evaluate each others' products more highly than the products of others. Kasof exemplified Adolf Hitler who believed that all of the technological, artistic and scientific inventions in history were created by Aryan-Germanic people. Corollary to that, if people from other nationalities claimed that they created something, they just stole it from the Aryans, according to Hitler. Also, if a product says negative things about a group, the members of the criticized group evaluate the product as less creative even if it is evaluated as highly creative by experts.

Further Elaborations

There are other factors that can manipulate our attributions. They are general characteristics, status generalization, and social loafing.

General Characteristics

General status characteristics such as gender, race, age, physical attractiveness, or socioeconomic status affect performance expectations for a group of people. A high level of competence is expected from people with certain characteristics even if there is no previous evidence for the relationship between the specific characteristics and task performance. For instance, articles with females as first author sometimes receive lower ratings than articles with males as first author. The results were more dramatic if the female author was not previously known in the

field. For instance, if an essay or art work is attributed to a physically attractive person, people rate the work as more creative than if it is attributed to a physically less attractive person.

This situation is also related to dying young. If a successful creator dies at an early age, he or she becomes more eminent in the future. This is mostly because people remember them at their most attractive ages. Eminent people, like all of us, lose their physical attractiveness and popularity as they become older. Thus, if they die before their success wanes, people remember them as more creative, not because they are really more creative but because people always remember them with their most attractive appearance and most popular products.

Status Generalization

When people come together to achieve a goal, their out-of-group status also affects their inner-group status. In other words, individuals with high social status have advantages in a wide range of areas, even if there is no evidence that such advantages are deserved. High social status is associated with general expectations of talent. Hence, usually the people who are famous out of the group are assumed to be more creative in the group as well. For instance, if a scientist in a group has won a Nobel Prize, it is assumed that this scientist contributed the most to the group, or in a multiwriter article the contribution of the famous scientist is assumed to be higher than that of a Ph.D. student.

A status based bias is known as the *third party status effect*. If the judges know that other people evaluate a product as creative, their probability of evaluating the product as creative is high. How other judges approve of creations influences one's evaluation of the product. However, the third-party status effect has been demonstrated only with domain-specific status characteristics. High status judges are more effective than low-status judges.

Social Loafing

When people work in a group and the individual effort is not identified, people exert less effort than when individuals act alone. This is called *social loafing*, and it affects the attributions. Groups who attribute their creativity to the unique contributions of each individual create more divergent ideas than groups who attribute success to the group as a whole. Attributing creativity to the whole group rather than each individual sends a subtle message that each individual's contributions are not identifiable. When people think that their contributions are not identifiable, they exert less effort to create new things. If people think that they will be held individually accountable, they will be more willing to see the issues from different perspectives. Of course, if groups are not willing to search beyond the obvious ideas, they create less divergent ideas. Hence, it is a common finding that groups generate fewer creative ideas than individuals.

Groups' lowered performance in producing creative ideas can result from conformity pressure. Group focus attributions may increase conformity pressure. When people work in a group, they mostly ignore their own ideas and try to adopt the majority's opinion because groups have a tendency to reject members who do not fit. Thus, individuals can avoid from

introducing their original ideas. Consequently, groups tend to see issues from only one or two perspectives and come up with less divergent ideas.

Like creators, judges are also influenced by the norms and values of their groups. Group norms have obvious influences on people's behaviors including how people recognize creativity. Csikszentmihalyi stated that creativity can only be understood in light of social norms and values. Although creative products should somewhat deviate from the norms, according to Mark A. Runco, if they are much ahead of their time, they might not be recognized as creative in their time. Some of the most famous writers or artists were not recognized during their lifetimes, but they became eminent posthumously. Due to the deviation of their products from their time, no attention was given to them. Hence, the norms and values of the era is one of the most important determinants of people's judgments about creative products.

But group norms and values do not influence every people to the same amount. The level of being affected from the society is determined by individual's relationship with the group. As their personal identities, people also have social identities which internalize values and norms. If the group is important and meaningful for a group member and social identity is more salient than the individual identity; group norms and values become the primary source of the given member's judgments, and members confirm the judgments of the group. But if the judges' personal identities are more salient than their social identities, they can easily express their own judgments in the group.

The influence of social loafing is more visible when the creative products are judged by a group of judges. If judges know that they will be held individually responsible for their evaluations, their evaluations become more positive than when they know that the evaluations are pooled.

Evaluation

Creativity researchers have evaluated attribution theory in different ways. According to Teresa Amabile, attribution theory indicates some ways to develop more comprehensive work-related or school-related creativity enhancement programs. Most creative training programs aim to improve personal traits (such as creative thinking strategies), but with the help of an attribution theory perspective, creativity enhancement programs can also focus on the facilitative and detrimental effects of environments on creativity and can aim to improve environments to help creativity. On the other hand, Amabile criticized attribution theory for its claim that creators notice the environment when the environment prevents their creativity but attribute all success to their personality when the environment assists their creativity. Amabile's and her other colleagues' findings, however, indicated that people mention environmental factors as much as personal factors, a fact which attribution theory overlooks.

Mark A. Runco was the most critical of attribution theory. He objected to attribution theory for several reasons. First, it does not explain what creativity is; instead, it explains individuals' reactions to the creative products. Judgments can be biased. If they are not true, this does not mean that the product

is not creative; instead it can be creative but not recognized. Second, having a creative idea, sharing it with others and convincing others are all different things. Thus, there must be a distinction between inherent creativity and attributed creativity. Attributed creativity is important for reputation because reputations are estimated by others' judgments. But reputation is not creativity, and people's judgments cannot explain inherent creativity alone. Third, attribution theory can explain the creativity of eminent people, but it ignores the daily creativity, known as *little c*. People who are creative in their daily lives but not eminent can sometimes remain unrecognized. Of course, this does not mean that these people are not creative just because they are not reputable. Furthermore, reputations can also be biased. For instance some highly reputable people may gain people's attention, not because of the creative value of their current work, but because of the influence of their previous work. The ability to communicate and convince others is not a good predictor of the ability to generate creative ideas. Fourth, attribution theory can be applied to creative products and performance, but not to creative processes and potentials. Therefore, according to Runco, attribution theory does not seem to be a resourceful perspective for creativity.

Conclusion

Creativity has often been studied in terms of dispositions. Attribution theory attempts to disclose the other aspect of creativity, which is basically about social reception of original ideas. It proposes that social and situational processes can determine the creativity of the ideas because creativity is not independent of the context in which it emerged. Attribution theory deals mostly (even only) with the subjective interpretations as the causes of people's judgments about creativity. However, subjective interpretations are commonly utilized in the evaluation of creative products. Yet, this does not mean that creativity can only be explained by situational factors; or that dispositional factors do not influence creativity. Creativity is a complex process and it cannot be well understood by just one explanation. Attribution theory simply highlights another aspect of creativity's complexity.

See also: The Four Ps of Creativity: Person, Product, Process, and Press; Nature/Nurture and Creativity; Personal Creativity.

Further Reading

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Sri Aurobindo 1872–1950: A Yogi and a Poet

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Introduction and Early Childhood

Sri Aurobindo had a multifarious personality. Though in his later years he was known mainly as one of the most distinguished spiritual leaders of India, he began his public life as a political activist. He was the first one to push the agenda of complete independence of India from British rule, yet he was essentially a scholar, a poet, a philosopher, and above all, a yogi. He was a profound thinker and a prolific writer. The wide range of his achievements made one of his biographers entitle his book *The Lives of Sri Aurobindo*.

Except for a short period of 6–7 years of active public life as a political activist, Sri Aurobindo seldom made public speeches. He was a very private person and rarely entertained visitors. Even to his close disciples he spoke more in silence than in words. He did communicate, however, in thousands of letters. He devoted the second half of his life to a combination of scholarly work and yoga, developing his vision of an ongoing evolution of consciousness and propounding a new school of integral yoga. He was a gifted writer with amazing fluency who, produced poetry of exquisite beauty, plays, essays, and seminal works on a wide variety of subjects, much of which he cultivated through yoga. He ended up writing the equivalent of close to 20 000 printed pages, though much of this work was published only after his death.

Sri Aurobindo was emphatic in stating that only he could write truly about himself. As a man who lived more an inner than an exterior life, he considered it impossible for others to know about it. In spite of his objections, numerous biographies were written, both during his lifetime and in later years. Though Sri Aurobindo did not believe in biographies, he did correct some of the earlier ones for factual errors. During the early years of his stay in Pondicherry, he also maintained a detailed record of his inner development. This *Record of Yoga* came to light more than 25 years after his death, and its 1500 pages shed a fascinating light on his inner development. These records were written in the manner of laboratory notes, using technical terms and abbreviations which are often difficult to decipher. During the later period, he gave an occasional glimpse of his inner life in his letters and in his poems, especially in the later sonnets and in *Savitri*. Together, all this forms quite a rich source of information about his life.

Sri Aurobindo was born in Calcutta, on 15 August 1872. His father Krishna Dhun was a medical doctor, educated in Kolkata and later in London. He was an atheist, a Darwinian, and a thoroughly Anglicized doctor in British Government service. Sri Aurobindo's mother Swarnalata hailed from a family of Bramho Samaj, a religious reformist group of eastern India, who were deeply influenced by Christian theism. As such, the family of Sri Aurobindo was so much Anglicised that he was given a British middle name and was named Aurobindo Akroyd Ghosh. Dr Ghose was so convinced of the

superiority of British culture that he discouraged the use of his mother tongue, Bengali, in his house. There was a butler and a governess in the house with whom Sri Aurobindo used to talk in broken English. Sri Aurobindo grew up speaking, thinking, and dreaming in English. As he mentioned to a friend, till the age of five he did not know his mother tongue, Bengali.

Education in Britain

When Sri Aurobindo was five years old, he and his two brothers were sent to the Loreto Convent School at Darjeeling, a school meant for children of British officers in India. His father wanted his sons to have a solid British education, and when Sri Aurobindo was seven, he sent him, together with his two brothers, to England for further education. The three brothers stayed with the family of Rev. William H. Drewett at Manchester, with the specific instruction that the boys should not mix with Indians and should be kept free from any Indian influence. Sri Aurobindo was too young at that time to go to school and was taught at home. Later he attended what was one of the best public schools in London (St Paul's). The young Sri Aurobindo was a brilliant student who was consistently amongst the best in his class in English and Latin. The school principle Dr Walker personally supervised the education of Sri Aurobindo whom he found weak in Greek initially. He was rapidly pushed to higher classes, which saved him a few years of school education. He won many literary prizes at the school. His teachers found him hard-working and promising; though with time his teachers commented that he was making less of an effort and hardly maintaining his old level of excellence. Sri Aurobindo later recalled that he was by then at ease in his classical studies and did not think it necessary to labor over them any longer. Instead, he read books not assigned in class: English and French poetry and fiction, European history. His English master was struck by the extent of his reading, and commented favorably on his writing style.

Dr Ghose had asked the Reverend Mr Drewett not to give his sons any religious training, but the boys inevitably absorbed much of the intellectual and moral atmosphere of Christianity. Sri Aurobindo later wrote that Christianity was the only religion and the Bible the only scripture with which he was acquainted in his childhood. He knew nothing about India, its culture and history. He and his brothers were understood by their classmates to be Christians, but they had by then become indifferent if not openly hostile to Christianity. For a while Sri Aurobindo considered himself an atheist before adopting an agnostic attitude.

Meanwhile the financial condition of Sri Aurobindo's father deteriorated and the remittances to support his children's education became irregular and ultimately almost stopped.

It created a very difficult and embarrassing financial condition for the three brothers, who had to survive together on Sri Aurobindo's scholarships. For years they lived a very Spartan life, at times having insufficient food to eat and little money to spend on other necessities.

He and his brothers later moved to London where Sri Aurobindo won a scholarship to King's College of Cambridge University. His competition papers were judged to be the best ever seen by an examiner who happened to be a noted writer (Oscar Browning). At Cambridge, Sri Aurobindo set three major goals for himself. The first was to study for his B.A. degree and prepare for the 'Indian Civil Services' (ICS) examination; the second was writing poetry; the third was to participate in the activities of the *Indian Majlis* and to work toward India's independence. Sri Aurobindo's father wanted his son to qualify for ICS, to be one of the top administrative officials in India. In deference to his father's wishes he sat in the exam and qualified. This also earned him a fellowship which he badly needed to support himself and his two brothers at Cambridge. At King's College Sri Aurobindo acquired great proficiency in Greek and Latin and devoted a great deal of time writing poetry. He could read literature in French, German, and Italian and was involved in the literary circles at Cambridge. He wrote a large number of poems during this period that he included in his first collection years later. Before returning to India as a last requirement for an ICS probationer Sri Aurobindo had to take a horse riding test. He decided not to show up and as a result got himself disqualified. He was by now getting more and more interested in India and in the political movement to liberate it from the British rule. The Indian Majlis was an activist group of Indian students studying in England. Sri Aurobindo was its secretary for some time and he used to give fiery speeches to mobilize Indian students. During the last days of his stay in London Sri Aurobindo joined the 'Lotus and Dragger' society. It was a secret society in which each member vowed to work for the liberation of India, even by violent means. This society was, however, still-born. The police came to know about it and this was probably one other reason which went against his final selection as an ICS officer.

Sri Aurobindo started learning his native language Bengali from an Englishman when he was at Cambridge. He developed a sufficient working knowledge to read some Bengali literature, like Bankimchandra, the revolutionary poet. He also acquired a working knowledge of Sanskrit but was otherwise barely familiar with Indian scriptures and history. His knowledge was largely limited to Max Muller's the 'Sacred Books of the East' series. Another source of Sri Aurobindo's information about India was newspaper clippings which his father started sending him. Increasingly hurt by the attitude of British officers, his father's positive regard of the British was diminishing, and he had begun briefing his sons about protest movements in India.

Life in Baroda

Sri Aurobindo returned to India in the beginning of 1893 after staying in England for 14 years. His father who was eagerly awaiting his arrival died under unfortunate circumstances just

before Sri Aurobindo arrived in Mumbai. While still in England, Sri Aurobindo was offered a job by one of the Indian princes, the Gaekwad of Baroda, and after his return, he worked in Baroda for 12 years, as a teacher, as private secretary to the Gaekwad, and finally as the Vice-principal of Baroda College. Though he stayed in Baroda for a long time his heart was in Bengal which he visited frequently. He also used to visit Deoghar where his mother and younger sister were staying. In April 1901 Sri Aurobindo was married to Mrinalini. Sri Aurobindo brought his wife and sister to Baroda to stay with him.

During his sojourn at Baroda, Sri Aurobindo, as a daily routine, was practicing *pranayama* (breathing exercises). As his friends in Baroda observed, he was remarkably simple in his living. He never complained about the heat of Baroda summers or the chill of its winters. Only on the coldest mornings did he throw a shawl over his shoulders; only on the coldest nights did he sleep under a cotton blanket. His bed, a thin mattress on a cast-iron frame was something on which even a man of very simple means would not sleep. Though he was getting a good salary he was hardly concerned about spending it on himself or saving it. He was detached from these mundane aspects of life. He was better taken care of when Mrinalini was around, but she spent more time in Deoghar than in Baroda. Even when she was there, Sri Aurobindo was mostly absorbed in his studies – he would sit reading for hours at a stretch, his eyes glued to the page, his attitude unchanging, like an ascetic rapt in contemplation, oblivious to the world. He also wrote extensively during this period. He would read or write till after midnight, then get up in the morning and resume where he left off. He used to have a cup of tea, smoke, and then sit at his writing table. Once he began, he wrote slowly but steadily, rarely stopping to strike anything out. If someone spoke to him while he was writing, he may have been disturbed but never let the other person know about it.

Only a half-dozen of the poems he wrote in the first six years in Baroda were retained. In 1898 he put together a collection of the poems he wished to preserve from his first decade of writing. *Songs to Myrtilla*, printed privately in Baroda, contains 21 pieces. About a third of them are written about political and literary heroes: Parnell, Goethe, Madhusudan, Bankim; the rest are on love and romance. After publishing *Songs of Myrtilla*, Sri Aurobindo worked on a long narrative poem based on the story of Pururavus and Urvashi. A little later, he completed another long poem, *Love and Death*, which was based on a story from the Mahabharata "in the heat of . . . 14 days of continuous writing." Sri Aurobindo described the main sources of his inspiration in an essay on Kalidasa, written three years after *Love and Death*. He saw his unusual fluency in writing as a specific sort of energy that was behind all genuine poetry.

Sri Aurobindo's admiration for the Indian tradition grew, and it became increasingly clear to him that the Indian civilization could not regain its full stature as long as India was under foreign occupation. Interestingly, at that time, this was not at all a common view: the Indian elite of those days had widely accepted the superiority of the English culture, and Sri Aurobindo would become the first Indian intellectual who dared proclaim publicly that complete independence from Britain should be the primary aim of Indian political parties.

His increasing political involvement embarrassed his employer, so Sri Aurobindo moved to Calcutta where he became one of the most outspoken leaders of the political movement for Indian independence. His writings brought him in frequent conflict with the British authorities but he carefully chose his language and repeatedly managed to escape conviction. Around this time Sri Aurobindo wrote his famous revolutionary booklet *Bhawani Mandir* with a call to prepare revolutionaries for a freedom movement.

This was the time when Sri Aurobindo was intensely pursuing both, political activities on one side, and yoga on the other. Sri Aurobindo knew from experience that yoga could increase one's mental energy and clarity, and he hoped that yoga could develop other psychological powers, which he intended to use for his political work. During a visit to Baroda in 1907, Sri Aurobindo met a yogi, Bhaskar Lele, who agreed to give him lessons provided he could dissociate himself from all political activities for a while and stay with him. Lele asked him to make his mind blank which he could do the very first day. Within three days Sri Aurobindo managed under Lele's guidance to completely and permanently silence his mind. He wrote about this experience.

It was my great debt to Lele that he showed me this. "Sit in meditation", he said, "but do not think, look only at your mind; you will see thoughts coming into it; before they can enter throw these away from your mind till your mind is capable of entire silence." I had never heard before of thoughts coming visibly into the mind from outside, but I did not think either of questioning the truth or the possibility, I simply sat down and did it. In a moment my mind became silent as a windless air on a high mountain summit and then I saw one thought and then another coming in a concrete way from outside; I flung them away before they could enter and take hold of the brain and in three days I was free. From that moment, in principle, the mental being in me became a free Intelligence, a universal Mind, not limited to the narrow circle of personal thought ... (Sri Aurobindo, 1972: 84)

There are two things noteworthy about this experience. The first is that it was not a fleeting experience but a true realization in the sense that the peace and inner silence never diminished. The other is that the experience of the silent, spaceless, timeless Brahman, the Supreme being, was not at all what Aurobindo had expected or wanted from yoga. Furthermore it did not fit either within the mental framework of his instructor, Lele, whose own experiences were with the personal Divine. During the following weeks Lele still taught Sri Aurobindo how to rely both for his outer work and for the rest of his inner development on an inner guidance, but after that, they parted ways. After this Sri Aurobindo never sought the guidance of a teacher and moved on to develop his own system of Integral Yoga. The presence of the silent Brahman never left Sri Aurobindo, though it subsequently merged with other realizations of the Divine. Initially the experience of the silent Brahman came together with an overwhelming sense of the total unreality of the world, but the latter gradually disappeared when he had the realization of the cosmic consciousness pervading all things and all beings. Interestingly, all this happened during one of the busiest periods of his life while he was at the peak of his political influence, and he managed, in his own words, to organize political work, deliver speeches, edit his newspaper and write articles, all from an entirely silent mind.

As a Revolutionary

By that time Sri Aurobindo was getting more and more involved in the underground freedom movement. He preferred to remain in the background, but he was indirectly involved in recruitment of young people arranging their physical training to prepare them for action against the British. He secretly visited many such revolutionary organizations to bring them under one banner and pool their resources. He became the co-editor of *Bande Mataram*, a political paper aiming at national construction, passive resistance, and self-reliance. He also contributed to another paper, *Yugantar*, which preached open revolt against the British rule.

In the meantime, his younger brother Barin got involved in increasingly daring but largely ineffective violent revolt. In May 1908 Barin played a role in the organization of a bomb attack on a horse carriage in which some British officials were presumed to be traveling. Unfortunately two British ladies occupied the coach and died in the bomb blast. Sri Aurobindo was arrested by the police under suspicion that he was behind this violent incident. He was put on trial for 'waging war against the King,' a charge that could have sent him to the gallows if convicted. This case sent shock waves all over India and across the British Empire. Sri Aurobindo's case was pleaded by a well-known Indian barrister C. R. Das. Lack of evidence of direct, active involvement in violent action finally led to his acquittal after one year, much to the discomfort of the British Viceroy, who by that time had come to the conclusion that Sri Aurobindo was "the most dangerous man in the British Empire." His incarceration had one major effect, which the British police could not have foreseen, or, for that matter, understood. Sri Aurobindo took his arrest and year-long incarceration as a God-imposed opportunity to concentrate fully on his inner, spiritual development, or *sādhana*. While in jail, he showed remarkably little concern about the court-case, but made an in-depth study of the *Bhagavad Gītā* and realized the presence of the personal Divine in everything and everybody around him.

By the time Sri Aurobindo was released from the jail the political scenario had very much changed. Almost all leaders of the Nationalist party were either in jail or in self-imposed exile. Everywhere there was depression and hopelessness, though the feelings against foreign rule were becoming stronger. Sri Aurobindo remained in Calcutta using his persuasive skills to unite the moderates and the extremists to a common agenda in order to give the freedom movement a realistic direction. He was now convinced that the political independence of India was only a matter of time, and that he had to concentrate on another important work, the inner growth of his countrymen. He started two journals – *Dharma* in Bengali and *Karmayogin* in English, both focused more on culture and yoga, less on politics.

Even after his release from jail, there was a realistic possibility that he might be rearrested. One evening when Sri Aurobindo was sitting with others in the office of *Karmayogin*, one friend burst in with the news that Sri Aurobindo was about to be arrested. Sri Aurobindo spent some time in Chandernagar before ultimately deciding to escape to Pondicherry, the capital of the French settlements

in India. With great secrecy and meticulous planning, on 1 April 1910 Sri Aurobindo boarded, under a false name, a steamer to Pondicherry.

Settling in Pondicherry

Sri Aurobindo expected initially to stay in Pondicherry for only a few months, or at most a year, to have time for his yoga meditation and inner growth, before reentering active political life. He was not inclined to meet anyone and did not want visitors to disturb his solitude. He was living on the upper floor of a rented house and would come down only to take his bath. A few youngsters who joined him from Kolkata were looking after the household.

Those early years of his stay in Pondicherry were difficult times. There was a perennial financial crisis; British spies kept a tab on all his visitors and activities. There was a warrant against him and there was apprehension that the French Government might deport him. Sri Aurobindo himself remained, however, completely unruffled, fully immersed in his meditation.

In Pondicherry Sri Aurobindo devoted most of his time to *sādhanā*. Though still interested in the large scale political and social developments that shook the world at that time, his concentration was on yoga. His principal study during the early years in Pondicherry was the *Rig Veda*, which he read, took notes on, analyzed, and translated into English. In contrast with his interests during his stay in Baroda, when he devoured works of Indian and European literature in large numbers, during this period his more conventional reading consisted largely of newspapers and a few Indian journals.

Once settled in Pondicherry, Sri Aurobindo decided to call his wife Mrinalini. She had been detained in Bengal by the British police and was staying in Kolkata with some family friend. However, before she could embark on her journey to Pondicherry Mrinalini suffered from some undiagnosed disease and died.

In 1914, a French couple, Paul Richard and his wife, Mirra Alfassa, visited Pondicherry and soon became acquainted with Sri Aurobindo. Paul Richard invited Sri Aurobindo to join him in bringing out a new journal named *Arya*. The objective of the journal in Sri Aurobindo's words was, "to feel out for the thought of the future, to help in shaping its foundations and to link it to the best and most vital thought of the past." By the time its first issue came out, the first World War started and soon after, the Richards had to return to France. This left the task of filling the 64 pages of the monthly journal to Sri Aurobindo, and he earnestly carried on with this responsibility for the next six years. He serialized many of his seminal writings in the pages of *Arya*. By the time he closed down the journal, he had completed almost all his major works including *The Life Divine*, *The Synthesis of Yoga*, *The Human Cycle*, *The Ideal of Human Unity*, *The Secret of the Veda*, *Hymns to the Mystic Fire*, *Essays on the Gita*, *Foundations of Indian Culture*, translations and commentaries on several major *Upaniṣads*, etc. Only a few of these texts, *Essays on the Gita*, *The Life Divine* and the first part of *The Synthesis of Yoga*, were revised and published in book form during his lifetime. Around 1915–1916 Sri Aurobindo started working on a poem, *Savitri*, that would become his most extensive literary creation.

Paul Richard and Mirra Alfassa returned to Pondicherry in 1920. Paul Richard went back to France but Mirra stayed and gradually took up an increasingly important role in the small community that began to form around Sri Aurobindo. Initially she was simply regarded as the most gifted of Sri Aurobindo's disciples, but over time, Sri Aurobindo, as he now came to be known, began to address her as 'the Mother,' in honor of her complete identification with the *śakti*, the Power which mediates between the Divine and the manifestation. In letters to his disciples, he often stressed that their consciousness and realization were essentially one, and that they differed only in their most outer roles and forms of manifestation.

On 24 November 1926 Sri Aurobindo had another major breakthrough in his own *sādhanā*. He had been patiently waiting and preparing for this event for years, but for others it was difficult to understand what actually happened on that day. At the time he only said "the power has descended into the subconscious." Almost ten years later he casually remarked that it had been "the descent of the Overmind into the physical." In Sri Aurobindo's terminology, the Overmind is the cosmic consciousness, way above the ordinary mind, from where, amongst several other things, all the major religions originate. According to the Vedic tradition there is a layer of consciousness still higher than the Overmind, which Sri Aurobindo called the Supermind. The exact nature of the Supermind is obviously difficult to grasp with ordinary human consciousness: Sri Aurobindo described it as more difficult for a person to comprehend than it would be for a monkey to understand the nature of abstract human thought!

The relative place of the Supermind in the Vedic hierarchy of different layers of conscious existence can however more easily be indicated. It is conceived as a link-layer between the upper hemisphere of *sachchidananda* (the unity of divine existence, consciousness, and bliss) and the lower hemisphere of matter, life, and mind. It is described as a world where there is already differentiation into form and function, but no diminution yet of the Divine omniscience and omnipotence. In other words, it is the only type of consciousness in which perfect harmony, knowledge, light, freedom, and immortality are in principle compatible with some form of individual existence. The Vedic Rishis knew about this type of consciousness, and strived to reach it, but considered it incompatible with life in the ordinary physical world. They described the Overmind, just below it, as a 'golden lid,' a layer so light and blissful that nobody could pass through it and return. Sri Aurobindo felt however that the time had come for the Supramental type of consciousness to become more accessible to humanity. He looked at it as the inevitable next step in the evolution of humanity. It is in this light that we have to look at the event that took place on 24 November 1926: for Sri Aurobindo, the "descent of the Overmind into the physical" was a necessary step in the larger project of making the Supramental consciousness a normal part of biological existence. He argued, in his main philosophical work, *The Life Divine*, that just as the human consciousness has come into being as the result of the gradual evolution of mind within other living material forms, the Supramental consciousness might get a natural biological embodiment as the result of a further evolution within humanity.

Self-Confinement

The immediate practical result of the events that took place on 24 November 1926 was that Sri Aurobindo retired entirely to a small, first floor apartment in order to concentrate fully on his inner work. From this time onwards, he left the daily care of the small community that had begun to develop around him, to the Mother, and this was the formal beginning of the 'Sri Aurobindo Ashram.' We know relatively little about what kind of inner work Sri Aurobindo did during the 24 years after his retirement to his rooms. He rarely spoke to anybody and entertained no visitors. Just before the Second World War he broke his leg and needed help for his daily chores. That was the only time when a few of his closest disciples had a chance to know about his daily activities. Otherwise he saw his disciples only 3–4 times a year in a silent 'darshan.' What we know of his inner life during this period is largely from his letters, from his poetry, and from the changes he introduced in some of his earlier writings. During the 1930s Sri Aurobindo answered a staggering number of letters to his disciples, of which over 5000 have been published. The published portion of Sri Aurobindo's correspondence runs to over 2000 pages. For several years, Sri Aurobindo would work till six in the morning to answer the letters he received. Most of them dealt with *sādhanā*, quite a few with literature, and a smaller number with other issues.

Around the same time he also took up the revision of a few of his major works like his *Essays on the Gita*, the first two parts of *The Synthesis of Yoga*, and *The Life Divine*. His poetic writings include sonnets, short poems, and metrical experiments as well as his most important written work, the epic poem *Savitri*. With its almost 24 000 lines and 724 pages, *Savitri* is in a class of its own. Its richness of imagery, beauty of expression, and sheer number of memorable lines could remind one of Shakespeare, but in terms of depth and width of spiritual experience it simply has no equal in the English language. It would not be surprising if posterity would count *Savitri* amongst the most valuable texts ever composed.

It may be noted that in spite of his official retirement from politics, Sri Aurobindo was one of the very few major public figures in India who recognized how serious the consequences of a victory of Nazi Germany and Japan would have been for the future development of human civilization. During the Second World War he gave his full support to the Allied war-effort. He publically supported Cripps' Mission which proposed a gradual transfer of power to Indians. One may wonder whether it was just a coincidence that the day India got its Independence from British rule happened to be Sri Aurobindo's 75th birthday.

Just before passing away in 1950, Sri Aurobindo wrote a few essays for a newly started Ashram journal, *Bulletin of Physical Education*, on the transitional period between our present state and the Supramental stage he envisaged for the future evolution of humanity. He also completed the revision of the first part of *The Synthesis of Yoga* and the whole of *Savitri*. He died on 5 December 1950. For 3–4 days Sri Aurobindo's body did not show any sign of decomposition. His body was finally laid to rest on 9 December 1950 in the courtyard just below his room. The Mother continued his work till her own

passing away in 1973 at the age of 95. The Ashram and the international township, Auroville, which she started in 1968, have continued to thrive as creative spiritual communities.

The Relation Between Yoga and Creativity

Sri Aurobindo was at the same time a yogi and an embodiment of the highest order of creativity. He took an *evolutionary* view of both reality and creativity, and looked at creativity in the context of the transformation of consciousness to higher and higher levels. Creativity is then not seen primarily as tied with productivity in the material sense, but as arising out of spiritual experience, out of purity in thought and action, out of the process of becoming fully liberated. The focus is neither on the creator nor on the product, but on the possibility of overcoming the limitations of one's individuality in order to achieve an increasingly direct, unmediated experience, and expression, of the truth-consciousness from which reality arises.

Sri Aurobindo lived his life in accordance with his own premises about the ascent of consciousness from normal human intelligence to higher levels of consciousness. For him consciousness is not only power of awareness, it is also dynamic and creative energy. As one moves from the ordinary, sensory mind-consciousness into the higher realms of consciousness, one becomes more and more illumined about the nature of reality. In this evolution of mind, the initial step is to elevate one's consciousness to a level where it comes in contact with that region of consciousness from which we occasionally receive insight, intuition, and holistic understanding. There the mind is no longer limited by sensory experiences and personal biases, but capable of seeing beyond fragmented and divisive appearances. As the mind gets more and more 'illumined,' it begins to work more through visions than thoughts, more through direct insight, intuition and inspiration than through 'constructed knowledge.' Ultimately, an illumined mind can get in touch with the spiritual source of inner illumination and creativity, and can then acquire knowledge directly, through intuition. Many of us have occasional moments of intuitive understanding, something which comes in a flash, the source and timing of which remains a mystery. According to Sri Aurobindo, intuition is a power of consciousness that can be developed systematically. It is when the consciousness of the subject comes into direct contact with the consciousness of the object that intuition can leap out like a spark or lightning. When human consciousness further ascends and unites with layers of consciousness closer to the spiritual origin of things and beings, then the sparks or flashes of intuition light up more and more purely till one can have a direct perception (without any mediation) of the truth behind manifest reality. At the highest levels of the evolution of consciousness intuition is not any longer a fleeting presence but stays as the primary source of knowledge. At the highest stage of consciousness, what Sri Aurobindo calls *supermind*, one is in a perpetual state of both cognitive and creative perfection, which at that level are one.

The conception of an evolution of consciousness was elaborated by Sri Aurobindo most extensively in his main philosophical work, *The Life Divine*. Sri Aurobindo starts by

pointing out that the gradual evolution of which Darwin had found his proofs in nature, is not just a matter of increasing complexity, but a progressive manifestation of ever-higher types of consciousness. Nature began its evolution from the seemingly unconscious state of inorganic matter to the half-conscious plant and animal life; then it gradually developed within certain mammals, the mental consciousness which we now see in humanity. Sri Aurobindo argues in *The Life Divine* that it appears *prima facie* unlikely that our present mental consciousness, with all its limitations, confusions, and obvious defects, would be the final end product of this huge, aeonic process of biological evolution. He proposed that there should be further steps in the evolution of consciousness, steps that ought to bring us closer to the consciousness, in which, according to the Vedic tradition, the entire manifestation has its origin. According to Sri Aurobindo, the next stage of this process should be a cosmic truth-consciousness in which the ego and the division between self and other will disappear. He holds that the evolutionary process will continue at least until there will be embodied individuals living in the perfect harmony of the divine consciousness of *Brahman*.

Sri Aurobindo constantly worked on the yogic technology of observation and transformation for the further evolution of himself and his disciples, which he took as samples or prototypes for the wider, collective evolution he saw taking place, more slowly, in humanity as a whole. For him yoga had the same relation to the inner nature and being of man as the natural sciences have to the forces of external nature like, say, steam or electricity. In another monumental work, *The Synthesis of Yoga*, he laid down the detailed processes through which one can successively progress and attain higher and higher states of consciousness. Authenticity and veridicality were the primary concerns of Sri Aurobindo in developing the methodology of this 'integral yoga.' This type of yoga can be considered scientific in the sense that it proceeds by experiments and that it bases all its findings on experience. The processes may as such still belong to the 'subjective' domain, but within that domain, they are rigorously investigated. As one moves further in inner exploration through yoga, many new capacities for knowledge, action and enjoyment are discovered. Inspiration, intuition, and creativity develop as products of these newly emerging capacities.

Substantial support for the validity of Sri Aurobindo's conception of creativity can be found in his own monumental writings, which comprise plays, poems, essays, commentaries and thousands of letters, and particularly in his pristine poetry, which epitomizes in *Savitri*. It is interesting to note in this context that Sri Aurobindo used *Savitri*, in his own words, as

a 'means of ascension.' He began with a passage on a certain mental level, and then, each time he reached a higher level, he rewrote that passage from the higher level. In fact, for many years, he did not regard *Savitri* as a poem to be written and finished, but as a field of experimentation, to see how far poetry could be written from the different levels of yogic consciousness, and how far each of these could be made creative. With each revision Sri Aurobindo tried to lift the level of the poem higher and higher toward what he called 'overmind poetry,' the mantric, revelatory utterances of that highest of the spiritual mind ranges. *Savitri* was published in its complete version only after he left his physical body.

See also: Poetry; Spirituality.

Further Reading

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Awards

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Glossary

Creative achievement questionnaire A measure that gauges creativity using actual accomplishments that vary in the magnitude of creative achievements they represent. The scale includes visual arts (painting, sculpture), music, dance, individual sports (tennis, golf), team sports, architectural design, entrepreneurial ventures, creative writing, humor, inventions, scientific inquiry, theater and film, and culinary arts.

Criterion problem The methodological issue of what criterion provides a valid standard for identifying a person or product as creative. It is what is required when validating an instrument that purports to measure something associated with creativity.

MPAA ratings Evaluations of films by the Motion Picture Association of America: G (general admission), PG (parental

guidance advised), PG-13 (parents strongly cautioned because some material may be inappropriate for children under 13), R (Restricted, children under 17 would not be admitted without an accompanying parent or adult guardian), and NC-17 (no one 17 and under admitted).

Nobel prizes International awards currently bestowed in the categories of physics, chemistry, physiology or medicine, economics, literature, and peace.

Oscars (Academy Awards) Annual awards bestowed in the main categories of cinematic achievement by the Academy of Motion Picture Arts and Sciences.

Unit of analysis The specific nature of the cases that form the sample under investigation. In creativity research these are most often individuals, but the units can also be products.

Introduction

Various cultures and civilizations throughout history have used awards to honor those individuals who best represent highly valued achievements. Perhaps the most ubiquitous and conspicuous are the honors received for heroism in military combat. Examples include the French Croix de guerre, the German Eisernes Kreuz, and the US Medal of Honor. Nevertheless, some societies have also chosen to recognize accomplishments more often associated with peace rather than war. Perhaps the most salient examples are the gold, silver, and bronze medals bestowed on the top athletes every 4 years at the Olympic games. Also in this second category are various ways of recognizing major creative accomplishments. The ancient Greeks allotted annual awards to the best plays shown in the Athenian Theater of Dionysius. Multiple winners of these dramatic competitions include the great tragedians Aeschylus, Sophocles, and Euripides.

In modern times the best known awards of this kind are probably the Nobel prizes for literature and the sciences, the latter category encompassing separate honors for physics, chemistry, physiology or medicine, peace and, most recently, economics. The Nobels are international awards, but many countries feature more regional awards. Thus, the United States has Pulitzer Prizes for newspaper journalism (e.g., international reporting, feature writing, commentary, criticism, editorial cartooning, and feature photography), literary achievements (in fiction, drama, history, biography or autobiography, poetry, and general nonfiction), and musical composition. Many other awards recognize specific domains of creativity. For example, the Miguel de Cervantes Prize is awarded to the most outstanding writer in the Spanish language (but not necessarily a Spanish writer). Of a similar nature are the Goethe (German) and Camões (Portuguese) prizes. Most well-established professions

will support an appropriate set of honors. For instance, research psychologists can receive the Award for Distinguished Scientific Contributions granted by the American Psychological Association.

The most prestigious awards are often bestowed upon creators in impressive gala events. Perhaps the most prominent example are the Oscars given out by Hollywood's Academy of Motion Picture Arts and Sciences in a ceremony broadcast worldwide. Moreover, the recipient might receive the honor directly from the hands of a major celebrity, including royalty. Nobel laureates receive their gold medals directly from the Swedish monarch. At the other extreme, far less eminent honors might be simply announced in some press release or official newsletter.

The first psychologist to use awards to study creativity was Francis Galton in his 1874 *English Men of Science: Their Nature and Nurture*. Galton wanted to study the development factors underlying exceptional scientific achievement so he distributed questionnaires to scientists of sufficient distinction that they had been elected Fellow of the Royal Society of London. Because fellows can only be elected by previous fellows, this group formed a highly elite sample. Among the more than 100 scientists responding to his questionnaire were the mathematician Arthur Cayley, the physicist James Clerk Maxwell, the biologists Charles Darwin and T. H. Huxley, and the evolutionary philosopher Herbert Spencer. Using their responses, Galton was able to show how family background (e.g., birth order) and educational experiences (e.g., dislike for school) can affect the emergence of scientific creativity.

From time to time other researchers have followed in Galton's footsteps, Nobel laureates and Oscar winners perhaps receiving more empirical attention than any other group of awardees. To appreciate why investigators have examined awards let us first examine the distinct advantages of this

approach. Next we shall review some of the actual applications of awards to the study of creativity. In addition, the use of awards can be compared with closely related indicators of creativity. But an encyclopedia entry such as this would not be complete without discussing potential disadvantages as well.

Advantages

Among the oldest issues in the study of creativity is the 'criterion problem.' By what standard do we determine that a person or product is creative? For example, suppose the investigator wanted to study the personality correlates of creative achievement among US psychologists. One plausible solution might be to use awards and honors as an index of creative achievement in psychology. Such recognition might include election to the National Academy of Sciences (NAS) or receipt of the Distinguished Scientific Contribution Award (DSCA) of the American Psychological Association. Such honors would seem to have a *prima facie* claim to validity. After all, expert peers are almost invariably involved in deciding who receives the honors. Moreover, the recipients must normally undergo a rigorous nomination and evaluation process in which a candidate's career is assessed with the aid of supporting documentation, often including nomination letters and complete curriculum vitae. It is reasonable to assume that those who have such honors bestowed upon them are more creative than those who do not.

As a consequence, awards and honors provide a potential solution to the criterion problem. Furthermore, such formal acts of recognition have two other assets as criteria variables.

First, they can be used to assess the magnitude of creativity. In many domains of creative achievement, awards and honors can be arrayed in a hierarchy from the most competitive to the least competitive. In psychology, for example, NAS membership is more selective than getting the DSCA. Furthermore, below the latter are the various career achievement awards offered by the many APA divisions, such as the Ernest R. Hilgard Award for a Career Contribution to General Psychology bestowed by the Society for General Psychology (Division 1). Below that award might be one of the more specialized divisional awards, such as the George A. Miller Award for an Outstanding Recent Article in General Psychology (also Division 1). Lower still would be election as Fellow of APA or the Association for Psychological Science (APS). Needless to say, election to NAS does not have to represent the acme of this scale. A true elite has earned a Nobel Prize in either economics or physiology/medicine. Accordingly, we might array the award hierarchy as follows: Nobel, NAS, DSCA, APA divisional career awards, APA divisional 'best' publication awards, and APA or APS Fellow status. Hence, award criteria do not have to represent dichotomous either-or measures. Instead, it is sometimes possible to define a rank-category scale.

Second, award criteria measures can be applied to different units of analysis. Some honors are routinely assigned to individual creators, whereas others are allotted to single creative products. Indeed, that contrast was already implied in the preceding paragraph. The Hilgard Award recognizes a lifetime of distinguished contributions, whereas the Miller Award honors a single notable contribution. The distinctions can be made even finer. On the one hand, many professional organizations

offer 'early career' awards as well as lifetime career awards. For example, APA's Division of Developmental Psychology annually bestows the Boyd McCandless Award to young promising researchers and the G. Stanley Hall Award to those who are entering the final phase of their careers. On the other hand, some organizations may distinguish between types of creative products to be honored. Besides the Miller, APA's Division 1 also bestows the William James Book Award. Interestingly, these distinctions may be combined to yield an honor like Division 1's Gardner Lindzey Dissertation Award – a kind of integrated early career and best product award.

Researchers tend to use award criteria in two different ways. The first is to introduce a specific award or honor as a sampling criterion. This is what Galton did in *English Men of Science*. Only scientists who were Fellows of the Royal Academy were sent questionnaires. The second usage is to sample individuals with and without the award and then define a dichotomous variable that equals 1 if a person received the honor and equals 0 if they did not. As an example, a number of investigators have compared US scientists elected to NAS to those who failed to earn that distinction.

Illustrations

To appreciate fully the value of using awards in creativity research, extended examples are necessary. Consequently, below are overviews of two rather extensive research literatures. The first concerns scientific creativity and uses the individual creator as the unit of analysis. The second concerns artistic creativity and uses the single creative product as the analytical unit. The specific topics are Nobel laureates and award-winning movies, respectively.

Nobel Prizes

Alfred Nobel was the inventor of dynamite and a major Swedish armaments manufacturer. Having read a premature obituary that condemned him as the "merchant of death," and having never married and fathered a family, he decided to use his vast wealth to leave a more positive legacy after his death, which took place about 8 years later. In his last will and testament, written about a year before his death, Nobel left a huge amount of money to award contributions to physics, chemistry, physiology or medicine, literature, and peace. The first such awards were bestowed in 1901. A prize for economics was instituted in 1968 and first awarded a year later. Because this award was not part of Nobel's original will, some observers contest that it does not count as a true Nobel. Nonetheless, the selection procedures for the economics prize are every bit as rigorous as the procedures for the prizes. Both nomination and selection must meet extremely high standards. For instance, the physics, chemistry, and economics prizes are chosen by five-member committees appointed by the Royal Swedish Academy of Sciences. Nominators are also carefully restricted. It often takes a considerable time for someone eligible for the Nobel to finally receive the honor. For example, Einstein received the prize for physics in 1921. The prize citation specified his work on the photoelectric effect, a contribution he made in 1905. Some potential recipients have even died before they could be appropriately honored.

Some empirical investigators have been content to study the general characteristics of Nobel laureates, often concentrating on some subgroup, such as the scientists or the writers. Although these inquiries can often yield fascinating insights into the constitution of the typical laureate, their value is diminished whenever they lack a suitable comparison group. As a result, the most useful empirical studies will introduce some type of between-group contrasts. These contrasts largely assume two forms: (a) laureates in one domain are compared to laureates in another domain and (b) laureates are compared to nonlaureates.

Laureates versus other laureates

Researchers have often scrutinized whether a Nobel recipient in one category differs from a recipient in another category. Some of this work has concentrated on early developmental experiences. For instance, in comparison to laureates in literature, laureates in the physical sciences are far more likely to have fathers who were academic professionals. Additionally, laureates in literature were far more prone to have lost their father during their minority years in comparison to laureates in the physical sciences.

Other researchers have examined the differential career trajectories of laureates in the various categories. In general, physicists reach their career peak earlier than chemists, who in turn tend to peak earlier than researchers in physiology or medicine. These differences show up in the ages at which the scientists are most likely to receive their highest honor. Physicists are around 49 years old, chemists about 52, and biomedical researchers approximately 55. Nobels in economics are bestowed to even older recipients.

The foregoing results imply that the specific nature of creativity varies across the Nobel categories. Creativity in physics has a different composition than in, say, literature.

Laureates versus non-laureates

Just as interesting are studies that compare Nobel laureates with nonlaureates in comparable disciplines. These investigations have found the following differences: (a) laureates are more likely to have attended prestigious universities and to have studied under previous laureates; (b) despite a strong commitment to their chosen area of research, laureates are much more likely to have many interests and hobbies; (c) laureates implement cognitive processes that are identifiably different from comparison groups; (d) laureates are more prolific, producing many more publications per year than their less illustrious colleagues; and (e) in comparison to nonlaureates, Nobel prize winners move up the academic ladder much more quickly, attaining full professorship at a younger age. These contrasts often hold up even when Nobel laureates are compared to members of the National Academy of Sciences, themselves a distinctive group of scientists. When the comparison group consists of even less distinguished scientists, the contrasts most often become even more dramatic.

It should be noted that far more research is devoted to laureates in the sciences than in literature or peace. Awards in the latter two categories are often viewed as more influenced by political concerns whereas the science awards are seen as more objective. The specific achievements in the non-science awards are also more heterogeneous and controversial. The sciences

have the advantage that a much stronger consensus exists on what counts as a substantial contribution to a given domain.

Movie Awards

Nobel's original intention was that the prize recognize specific achievements within 1 year after their occurrence. At first the prize committee tried to carry out this wish. It was for this reason that Dmitri Mendeleev was denied the prize for chemistry: His famous periodic table of the elements was already too old at the beginning of the twentieth century. Nevertheless, the committee soon realized that this restriction was impractical. Time is necessary to obtain sufficient perspective on the magnitude of an achievement. Accordingly, the award is often bestowed long after the original contribution that inspired the honor. Because of the delay, the Nobel often functions as a career achievement award. When Einstein received the Nobel in 1921, the citation said that he was so honored "for his services to Theoretical Physics, and especially for his discovery of the law of the photoelectric effect." The prize committee knew that Einstein was already better known for his special and general theories of relativity. Sadly, by the time the prize committees began to prolong the period in which eligible accomplishments would be considered, it was already too late for Mendeleev, who died in 1907.

It is interesting, therefore, that awards in the arts often insist on a 1-year time window. That is, each award ceremony recognizes the greatest contributions in a given year. Thus, in the United States, the Pulitzer Awards clearly concentrate on the most recent achievements in its various categories. The same time limitation holds for the National Book Awards, all entries having to be published between December 1 and November 30 of the following year. This temporal focus is especially conspicuous for honors in theater and film, which are invariably confined to productions that appeared in a single year interval. Of the film honors, probably the famous are the Oscars awarded by the American Academy for Motion Picture Arts and Sciences in Hollywood. But these are far from the only film honors. The Internet Movie Database lists over 1500 award ceremonies, albeit the largest number of these represent local film festivals. The number of high-prestige movie awards is much smaller, and so the bulk of the empirical studies have concentrated on the Oscars alone. That will be the emphasis here as well.

Award categories

As will be apparent to anyone who has watched a televised Oscar ceremony, awards are offered in numerous categories of cinematic achievement. The biggest honor is that given for best picture, followed by best director, screenwriter (both original and adapted script), the four acting awards – male and female leads and male and female supporting. Less conspicuous, but no less important, are the honors given for cinematography, editing, art direction, costume design, makeup, score, song, and ending with the more technical contributions of visual effects, sound effects editing, and sound mixing. Admittedly, not all award ceremonies offer honors in all of these categories. Indeed, some will stick to only the first half dozen or so. Furthermore, some organizations will split one or more categories into more specialized achievements. The Golden

Globes of the Hollywood Foreign Press Association give separate best picture and lead acting awards for dramas and comedies or musicals. Finally, it should be observed that most organizations bestow two levels of honors – the nomination and the outright award. Given the competitiveness of these honors, receiving an “Oscar nod” is deemed no mean achievement, even if it is not followed by an Oscar statuette.

Empirical research concerning these diverse awards leads to two major conclusions; first, the awards and nominations bestowed by major organizations display a very conspicuous consensus for most award categories. This agreement holds independent of whether the honors are decided by professionals, journalists, scholars, or critics. The consensus is probably surprising given that some organizations presume that their assessments are truly distinct. For instance, the New York Film Critics Circle Awards were initiated as an anecdote to the Oscars, which the East Coast critics thought were contaminated by studio politics and local tastes.

Second, although the inventory of award categories is quite large, certain honors tend to go together. In particular, if we leave aside the best picture award as representing a global honor, then all of the remaining nominations and awards have been shown to form the following four creative clusters: (a) dramatic – consisting of directing, writing, editing, and acting; (b) visual – cinematography, art direction, costume, and makeup; (c) technical – visual special effects, sound effects editing, and sound mixing; and (d) musical – score and song. Notably, these four clusters do not all correlate in the same way with a film earning the best picture award: the most prominent correlation is for the dramatic cluster, followed by the visual cluster, with only one tenth the effect. The technical and musical clusters, in contrast, are not associated with best picture honors. In other words, great cinema seems to require pretty much the same aesthetic assets as great theater, namely, drama and visuals. Special effects and music are optional.

Award correlates

It is instructive to examine how the movie awards correlate with other aspects of the cinematic product. Such correlations can provide an overall idea of how creativity operates in filmmaking. Below is a summary of the results from a series of studies that looked at films that received at least one nomination for an award from a major organization:

1. *Dramatic cluster*: Films that earn numerous awards and nominations for directing, writing, acting, and editing (a) are more likely to be adaptations of a nonfiction work, to be a true story or biopic, to be a drama or romance, to have a long running time, to receive an R rating from the Motion Picture Association of America (MPAA), to receive critical acclaim, and to earn a reasonably good box office, but (b) are less likely to be sequels or remakes or to receive an MPAA rating of G or PG-13. In short, such films appear to represent more serious, art-oriented cinematic products.
2. *Visual cluster*: Films that earn numerous awards and nominations for art direction, writing, acting, and editing (a) are more likely to have big budgets, to have a long running time, to be adaptations from novels or nonfiction works (especially one of the ‘classics’), to be a true story or biopic, to be a romance or musical, to receive an MPAA rating of

PG, and to earn reasonable box office, but (b) are less likely to be comedies or to earn an MPAA rating of R. In other words, these films seem more aligned to the more show-business traditional Hollywood entertainment.

3. *Technical cluster*: Films that earn numerous awards and nominations for visual effects, sound effects editing, and sound mixing (a) are more likely to have big budgets, to be sequels, to have long running times, to get an MPAA rating of PG-13, and to earn excellent box office, but (b) are less likely to be dramas or comedies, to be adaptations from plays, to have the original author write the adaptation, or to receive an MPAA rating of R. Such films are also entertainment oriented, but with an emphasis on action, adventure, and thrills – the kind of motion picture that attracts lots of teenagers to the movie theaters.
3. *Musical cluster*: Films that earn numerous awards and nominations for score and song (a) are more likely to have big budgets, to have long running times, to be romances or musicals, and to receive an MPAA rating of G or PG, but (b) are less likely to be a comedy, to be an adaptation from a play, or to get an MPAA rating of R. Here the primary function of the film is to provide a vehicle for the music.

Two observations about the foregoing should be offered. First, the only film attribute to correlate positively with all four creative clusters is running time. Longer films have more opportunity to earn a nomination or award in a major category of cinematic achievement. Second, if the goal is to earn critical acclaim, a film-maker should focus on winning honors in the dramatic cluster, but if it the goal is to do an excellent box office, the focus should be on accomplishments in the technical cluster. Put differently, the creative clusters differentiate between film as art and film as business.

Disadvantages

Although award measures have proven useful in research on creative persons and products, such assessments are not without problems. One drawback is that they are clearly confined to the highest levels of creativity – what researchers often style “Big C” Creativity. Everyday “little-c” creativity does not receive conspicuous recognition. At best, such creativity might earn some localized praise, such as someone getting ‘employee of the month’ for a particularly imaginative and useful recommendation placed in the company ‘suggestion box.’ Moreover, even in the population of exceptional creators, certain honors have rather low base rates. At present, a little over 100 writers have received the Nobel Prize for Literature since its inception. When one considers that these writers represent every major literary language and hail from every continent except Antarctica, it is clear that the vast majority of highly creative writers will never receive this award. Although many of these writers will be recognized by more regional awards – such as the Cervantes, Goethe, and Camões prizes – it remains the case that award winners form an elite at the uppermost tail of the creativity distribution.

Even worse, the history of any award will be embarrassed by a certain number of false positives and false negatives. The former represent cases where someone received the honor

even when he or she was undeserving. This was a principal reason why the Nobel prize committees now ignore Nobel's stipulation that the awards go to recent contributions. Even then, the awards sometimes go to the wrong recipients. When it was initially announced that the 1923 Prize in Medicine would go to Frederick Banting and John Macleod for the discovery of insulin, Banting protested that it was Charles Best rather than Macleod with whom he should share the honor. Banting almost refused the award, and when he finally consented, he shared half of his prize money with Best. According to Banting, Macleod's sole contribution was to provide some laboratory space for the experiments that Banting and Best conducted. False positives also happen in the case of awards for creative products. Film critics and historians are fond of pointing out the best picture Oscars that went to the wrong film in a given year. In 1953 Cecil B. DeMille received the best picture award for *The Greatest Show on Earth* when the other four nominees were *High Noon*, *Ivanhoe*, *Moulin Rouge*, and *The Quiet Man*. All but *Ivanhoe* are now considered much better films.

False negatives occur when a deserving person or product fails to receive the appropriate recognition. The history of the Nobels contains many examples of great creators who never received the honor. The literary prize, especially, has snubbed many notables. The false negatives include W. H. Auden, Jorge Luis Borges, Karel Čapek, Henrik Ibsen, James Joyce, Franz Kafka, André Malraux, Vladimir Nabokov, Marcel Proust, Leo Tolstoy, Mark Twain, and Émile Zola. In the early years great writers were often overlooked because of an excessively restrictive application of Nobel's will (which might be taken to imply that the work should be idealistic), but later literary creators were often passed over for political reasons. Also, political factors have probably introduced some false positives among the literature laureates.

With respect to the science Nobels, many false negatives ensue from the requirement that the award not go to more than three persons in a given year. Notwithstanding this provision, some awarded achievements should have been credited to four or more scientists. A case in point is the 1965 Nobel Prize for Physics that was bestowed on Richard P. Feynman, Julian S. Schwinger, and Sin-Itiro Tomonaga for their work on quantum electrodynamics. This left out Freeman C. Dyson, who had made the important contribution of showing that their independent formulations were actually equivalent.

False negatives are particularly likely when an achievement has a narrow time window for eligibility. Because Oscars are only given to cinematic achievements in a single year, the Academy cannot carry over an achievement to the next year if there are too many deserving nominees in a given year. Richard Burton was nominated seven times for a best acting Oscar (six lead and one supporting), but never received the honor before his death. Peter O'Toole has been nominated eight times, most recently in 2007, but has so far only received an Honorary Award not associated with a specific cinematic achievement.

Ironically, the existence of false negatives can sometimes produce false positives. If someone in the film industry has repeatedly received an Oscar nod without any ultimate success – always a bridesmaid never the bride phenomenon – then a “sympathy vote” may emerge that will award a person for an accomplishment that does not represent his or her best work.

Martin Scorsese was unsuccessfully nominated for best director five times before receiving it on his sixth nomination, in the latter case for a lesser directing achievement and against some rather stiff competition. The last illustration shows that awards can often be subjected to various contaminating influences that can partly undermine their validity. To offer another example from the realm of film, a picture nominated for a best picture Oscar will improve the chances of awards for those involved in making the film, particularly the high-profile directors and actors. An even more striking example is seen in those international piano competitions where the order of each pianist's performance is determined by chance. Those who perform first are at a disadvantage relative to those who perform later. In this case, success is literally a matter of the luck of the draw.

Apart from the above problems, award indicators often have limited applicability. Not every domain offers suitable awards, or at least comparable awards. The divisional awards offered by the American Psychological Association provide a good example. There are more than 50 divisions, most (but not all) offering one or more awards. Yet there is no consistency in the number and type of awards. Naturally, some of this inconsistency can be ascribed to the fact that some divisions emphasize pure research whereas others emphasize practice or application. Yet even among the research-oriented divisions, there is no consensus on what achievements to include in the award programs. The division for developmental psychology has an early career award, whereas the personality and social psychology division does not. The experimental psychology division has an early investigator award, but the winning publication has to appear in the *Journal of Experimental Psychology*. Some divisions have dissertation awards, and others do not. And so forth. This means that it would be next to impossible to use division awards to assess creative achievement in American psychology. Whether or not a given psychologist won an award would partly depend on his or her subdiscipline.

Comparisons

Given the measurement problems that can confront application of award measures, one should consider the use of alternative but comparable measures. At the very least, these alternatives can be used to crosscheck the award assessments. In any case, the alternatives differ depending on whether the unit of analysis is the product or the person.

Creative Products

The optimal manner to assess the differential creativity of separate products is often contingent on the domain of creative achievement. In the case of the sciences, many studies rely on the number of citations a given publication receives in the professional literature. Such citation counts have the advantage in that they are less selective. It is less demanding to publish an article or book that is cited by others in the field than to have the publication win a major award. Furthermore, because award-winning work is not necessarily highly cited, citation counts can provide an independent assessment of a product's impact.

In the arts, citations are less meaningful as indicators of quality, and so alternative measures are necessary. For example,

the creativity of musical compositions can be gauged by the frequency of performance or recording. This approach has been used to evaluate the differential aesthetic success of plays as well. In the case of poetry, an indicator might consist of the number of times a particular poem is included in various anthologies or how often lines from that poem appear in compilations of great quotations.

There is one assessment technique applicable to both artistic and scientific products: expert evaluations. Obvious examples are the judgments of professional critics. As noted earlier, the evaluations of film critics have been shown to correlate with nominations and awards received in the dramatic cluster. Critical evaluations are available for many other art products, including theater, fiction, music, and even video games. In a slightly different form, the same approach can work for scientific products. In this application, experts are asked to evaluate journal articles or monographs. For example, some journals have their own 'best article' awards in which members of the editorial board are asked to evaluate various nominees. Curiously, one investigation showed that the articles so honored did not exhibit higher citation rates than those not so honored. It is likely that judges require a longer time perspective than just focusing on the publications that appeared in the most recent annual volume.

Creative Persons

If the goal is to assess persons rather than products, then some of the preceding approaches can be carried over with only minor modifications. Certainly expert evaluations can just as well be applied to individuals. In fact, such assessments were introduced early in the twentieth century by James McKen Cattell. Most commonly numerous experts in a particular domain are asked to identify the top contributors to the field. These survey results are then consolidated into a single ranking or rating. In the sciences, citation counts can be implemented, only in this case the citations involve a creator's total output rather than a single publication.

Two other measurement strategies are unique to individuals; first, creativity can be assessed in terms of productivity, especially total lifetime output. Of course, the specifics of what is counted depend on the domain creative achievement: patents for inventors, journal articles for scientists, films for directors, etc. If the creative domain entails a diversity of products that cannot all be treated equally, then some kind of weighting scheme is applied. For example, in assessing the productivity of composers, more weight must be assigned to a symphony than to a song. Finally, if the creators under investigation are still alive, then some adjustment must be introduced for age. On the average, older creators will have accumulated more output than younger creators.

Second, creativity can be gauged according to eminence. Typically, this might entail a measure of the amount of space devoted to each creator in standard reference works, such as encyclopedias and biographical dictionaries. To maximize reliability, these space measures should use as many sources as possible. In addition, it is often necessary to implement corrections for certain biases that sometimes intrude on such measures. For instance, reference works often devote more space to literary figures and to visual artists. Research has shown that

the differential eminence of creators tends to be relatively stable over time, even across centuries. The most famous painters in the Italian Renaissance remain famous today.

Citation, productivity, and eminence measures invariably exhibit highly skewed distributions with a long upper tail. Award-winning creators are most likely to be found among the individuals in that tail. In fact, citation counts have even been used to predict recipients of a Nobel Prize. Unlike award measures, however, citation, productivity, and eminence measures can discriminate creators at the lower end of the distribution – the individuals who will never earn any major awards.

Integration

Major awards and prizes can provide widely accepted evidence of the highest-level creative achievement. Although the most celebrated awards have very low base rates, these can be combined with lesser honors to create an ordinal scale. Better yet, this scale of acclaim can be integrated with continuous measures, such as eminence and productivity, to generate a composite indicator that covers the full range of what has been called 'Big-C Creativity.' Indeed, it is even possible to extend the measurement down to the lower reaches of 'little-c' or more everyday creativity. This possibility is partially realized in the 2005 Creative Achievement Questionnaire (CAQ). Respondents are first asked to identify the areas in which they have somewhat more "talent, ability, or training than the average person." The specific domains are visual arts (painting, sculpture), music, dance, individual sports (tennis, golf), team sports, architectural design, entrepreneurial ventures, creative writing, humor, inventions, scientific inquiry, theater and film, and culinary arts. Then for each of these areas the respondents address a series of questions that define an 8-point scale, with 0 indicating the absence of any talent. Beyond this zero point are inquiries about low-level creativity, such as taking music lessons or having performed in a play. Higher up come more demanding criteria, including publication, shows, grants, critical reviews, citations, and special prizes. Although the awards are designated as local or national, it would certainly be possible to add a higher point on the scale to allow for the receipt of international awards, such as a Nobel or an Oscar. Such an extended version of CAQ would then span the complete spectrum of domain-specific creativity, from none whatsoever to the highest imaginable.

It is hoped that someday awards will be incorporated into such an inclusive measure of creative achievement. CAQ scores have been shown to correlate positively with alternative indicators of creativity, such as divergent thinking and creative personality. Such scores also correlate with other dispositional traits that are independently correlated with creativity, such as openness to experience and defocused attention. Therefore, high-prestige awards can be used to discern whether these same correlates help account for some fortunate creators managing to receive the highest levels of recognition. To illustrate, does a Nobel laureate differ from a Fellow of the National Academy or Royal Society in the same way that the latter differ from a scientist who received lesser honors? It is conceivable

that a single psychological continuum connects the lowest levels of creativity with those that are the most universally acclaimed.

See also: Divergent Thinking; Eminence; Everyday Creativity; Genius and Greatness.

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- <http://www.nationalacademies.org/> – National Academies.
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Barriers to Creativity and Creative Attitudes

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Glossary

Creative attitudes Dispositions, temperaments, or orientations that influence one's way of feeling or acting in relation to creativity.

Creativity consciousness Awareness and appreciation for creativity, creative innovations, and creative people.

Cultural barriers Conformity pressures rooted in social influence, expectations, and social or institutional norms.

Emotional barriers Aspects of personality or 'emotional upset' that interfere with creative thinking; they may result from temporary problems (e.g., anger, fear, or hate) or more permanent sources of insecurity (e.g., anxiety, fear of failure, fear of criticism or rejection, or poor self-esteem).

Perceptual barriers Habitual ways of seeing and comprehending that make it difficult to see new meanings, relationships, and ideas; perceptual set, mental set, or functional fixity.

Personality Distinctive individual qualities of a person, such as attitudes and ways of reacting, that reflect the person's essential character.

Self-actualized creativity A general form of creativeness, a lifestyle; it includes mental health and growth toward self-realization.

Special talent creativity High, perhaps recognized, creative productivity in a special area; it may or may not include mental health.

The present discussion of barriers to creativity and attitudes that promote creativity is based on a broad conception of creativity. As illustrated on the horizontal axis of [Figure 1](#), a person may be low to high in general creativeness. One high in this trait takes a creative approach to most aspects of life. It is a way of living, growing, and perceiving one's world, as well as a way of thinking and solving problems. Such a person is mentally healthy and self-accepting, and grows toward self-realization. In the 1950s Abraham Maslow called this *self-actualized creativity*. As represented on the vertical axis of [Figure 1](#), a person may also be low to high in recognized creative productivity, or what Maslow called *special-talent creativity*. By definition, a person high in this dimension has achieved recognition for socially judged creative achievement, for example, in art, science, or business. They may or may not be mentally healthy in the self-actualization sense. The reason for noting this distinction, which acknowledges both a general creativeness and creative accomplishment in specific areas, is that several influential writers have argued recently that the word *creative* applies only when one's peers (or society) have judged one's work to be 'creative.' Further, the work must permanently alter the particular field. Such a definition restricts the word *creative* to only those who have achieved creative *eminence*, for example, Sigmund Freud, Pablo Picasso, T. S. Eliot, or Martha Graham. By exclusion, the remaining 99% of everyone would be *not creative*. Vincent van Gogh, for example, would have been judged uncreative until later art critics agreed that his paintings were creative.

For present purposes, a restrictive definition is inappropriate. The current more general and accepted definition acknowledges the obvious – that many, many people think and act creatively, some in just a few areas and some in all areas of their lives, and some achieve at least limited recognition. The broader definition also acknowledges the truism that everyone has an opportunity to live a more creative life and become a more fulfilled, creatively productive person.

Barriers to Creativity

The following five categories of barriers – learning and habit, rules and traditions, perceptual barriers, cultural barriers, and emotional barriers – will help distinguish blocks to creativity in different but overlapping categories. Some scholars argue that everyone is born creative, but early years of social pressures at home, at school, and in the community destroy lively imaginations and promote conformity.

Learning and Habit

The most obvious barrier to creative thinking and innovation simply is habit – our well-learned ways of thinking and responding. It begins early. We learn 'correct' responses, routines, and patterns of behavior. We learn language habits and conceptual

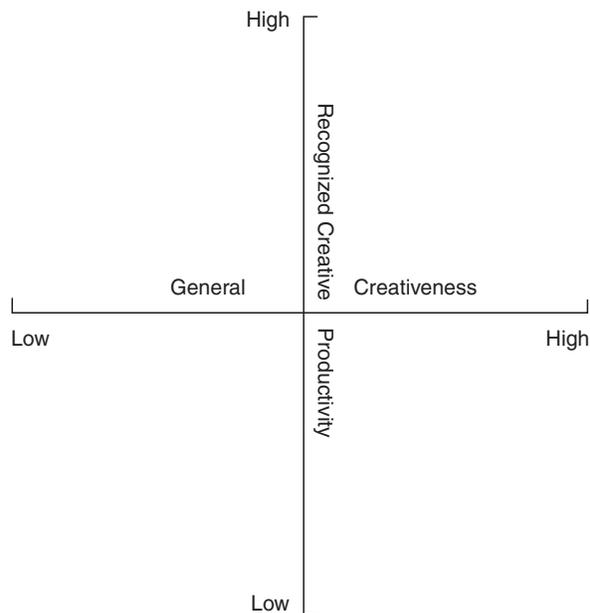


Figure 1 Two-dimensional illustration of personal creativity. A person may be low to high in general creativeness, which is a lifestyle and a thinking style (Maslow's self-actualized creativity), and low to high in recognized creative achievement (Maslow's special-talent creativity).

categories. We learn "the way things have always been done" and "the way things are supposed to be done." Over the years it becomes difficult to see and create new possibilities – to break away from or suppress our creativity-squelching habits.

When did you last try something truly new? An exotic restaurant? A new sport? A college course in an intriguing topic? Do old habits and expectations interfere with new ideas, activities, and possibilities? Consider this puzzle: Remove six letters from ASIPXPLETLTERES. What word is left? (Answer at end of article.) The ability to form habits and expectations is, of course, a necessary capability for humankind, one that directs our daily behavior. However, learning and habit are both a blessing and a curse.

Rules and Traditions

As with learning and habit, social groups – from one's family to educational, corporate, national, and international groups – could not function without the rules, regulations, policies, and traditions that guide personal, social, and institutional conduct. However, 'guide' often means restrict, inhibit, or prohibit. As an example of restrictive rules and traditions, in a 1995 article Don Ambrose criticized the inflexibility of school systems and other traditional organizations. He listed these traits of "dullard, brain-damaged bureaucracies inherited from the old industrial era": myopic and coercive leadership that treats employees as automatons; premature judgment; repressed creativity; anger, frustration, and resentment; inflexible conformity; reflexive ritual; inflexible attitudes; and being habit-bound. Ambrose claimed that the absence of creative flexibility was due to top-heavy bureaucratic structures that

put people into highly specialized roles, limiting employees' concerns to well-defined departmental work at a cost of large-scale visionary thought. Such employees have little reason to take risks beyond the confines of established procedures, particularly since mistakes are routinely punished.

In contrast, suggested Ambrose, "creatively intelligent post-industrial organizations" can improve creative thinking with visionary leadership; critical analysis and judgment; creative thinkers and creative teamwork; excitement, pride, and purpose; and flexibility, sensitivity, responsiveness, and dynamism. The issue is one of attitudes. A person can be inflexibly tied to rules, or can be creativity conscious – open, receptive, and encouraging of new ideas.

Van Gundy also described organizational barriers to creative innovation that are based in rules and traditions. One barrier is the status hierarchy. Lower-status persons are reluctant to suggest ideas to those in higher positions due to insecurity and fear of evaluation. If lower-status persons are routinely excluded from decision-making meetings, it is even less likely that their creative ideas will 'trickle up.' Also, if a new idea threatens to reduce status differences – such as giving every sales representative the title of 'vice president' – the idea is certain to be resisted by persons at higher levels, such as current vice presidents.

The formalization barrier refers to the degree to which following rules and procedures is enforced. If organization members are clearly expected to behave in prescribed ways, and innovation is not prescribed, few new ideas and proposals will appear. On the positive side, when an innovation is accepted, an efficient formal structure will expedite its implementation.

Procedural barriers include policies, procedures, and regulations (including unwritten ones) that slow or prevent creative innovation. Some examples include promoting administrators based on analytic skill, not on their creativity or ability to develop a creative atmosphere, and insisting on the slow, orderly advancement of an innovation early in its development, with excessive creativity-restricting control. Rules and traditions keep the system working. However, like habit, such predetermined guides tend not to promote creativity.

Perceptual Barriers

From a lifetime of learning we are accustomed to perceiving things in familiar ways, often making it difficult to see new meanings, relationships, and ideas. Psychologists refer to our predisposition to perceive things in certain ways as a perceptual set, a mental set, or functional fixedness. It is the reverse of flexible, innovative thinking. Perceptual sets are different for different people, rooted in our unique experiences, interests, biases, and values. Perceptual sets are tied to our tendency to make quick decisions and jump to conclusions, rather than flexibly see alternatives.

Perceptual barriers make us 'kick ourselves' for not seeing a solution sooner. One classic demonstration showed that when a piece of string was needed to solve a problem, the string would quickly be perceived and used if it were dangling from a nail on the wall, but not if it were hanging a 'No Smoking' sign, a mirror, or a calendar. Perceptual blocks also prevent us

from getting a complete and accurate picture of our world; the 'real problem' or 'truth' may be missed. For example, based on symptoms that seem familiar, a physician, auto mechanic, or computer expert may persist in misclassifying a problem and will recommend incorrect treatments. A school teacher who fixates on IQ scores will fail to perceive students who are highly creative, highly artistic, or gifted in a single area such as theater studies or computer programming. An instructor who successfully uses a particular teaching method for many years will not recognize another technique as being even more effective. Old habits interfere with new perceptions.

One creativity recommendation, "make the familiar strange," encourages us to see common objects and situations in new ways, to overcome too-familiar perceptual features, and to look for new and different ideas and perceptions. Much creativity involves a mental transformation – the perception of new meanings, combinations, and relationships that depend upon overcoming perceptual barriers.

Cultural Barriers

Cultural barriers amount to social influence, expectations, and conformity pressures which are based on social and institutional norms. Cultural blocks include habit and learning, rules and traditions, and more. They include conforming to the ways we think others expect us to behave and a fear of being different. The result is a loss of individuality and creativity.

Creativity leader Paul Torrance documented three developmental drops in creativity test scores. The first occurs when children enter kindergarten, an early time when conformity and regimentation suddenly become the rule. A larger decrease occurs in fourth grade, Torrance's infamous 'fourth-grade slump.' Both drops in creativity are social/cultural phenomena, not biological ones. Fortunately, due to increased creativity consciousness and efforts to teach creativity, the fourth-grade slump is disappearing. A third drop in creativity scores occurs in seventh grade as part of strong adolescent conformity. Most dynamics of conformity pressures are not mysterious. It simply is uncomfortable to be different and to challenge accepted ways of thinking and behaving. We learn that it is good to be correct and bad to make mistakes. We learn that being wrong can elicit disapproval, criticism, or even sarcasm and ridicule. Being different or wrong raises fears of being judged foolish, incompetent, or stupid.

Expectations and conformity pressures also work in more subtle ways. The traditionally perceived role of females – overloaded with expectations and stereotypes – is a slow-changing difficulty that is yet to be overcome. There are also pressures to be practical and economical, which can discourage 'idea people.' We learn not to ask too many questions – although curiosity is a core characteristic of creativity. We learn that fantasy is a waste of time, that we should have faith in reason and logic, and that we should not 'rock the boat.' If cooperation is an accepted cultural or institutional goal, many people will temper their creative ideas in order to 'fit in.'

Van Gundy noted such subtle corporate cultural barriers as a reluctance to share ideas, a fear that innovation will change the uniqueness of the organization, a desire to protect the *status quo*, and the attitude that "creative types don't fit in."

Finally, the greatest cultural barrier is the culture itself. Western psychology traditionally ignores monumental cultural differences in creative attitudes and personality, creative productivity, creative opportunity, and general self-actualization. Think for a moment of the anticreative forces of tradition, conformity, and traditional roles of women in Spanish- and Arabic-speaking countries and many places in Asia, India, and Africa.

Emotional Barriers

Emotional barriers interfere with thinking by making us 'freeze.' You may wish to imagine a balance scale with 'emotional upset' or 'freezing' on one side and clear thinking on the other. As one side goes down, the other goes up. Some familiar emotional blocks are anger, fear, anxiety, hate, and even love. Some are temporary states, caused perhaps by problems with peers, parents, partners, or children, or by pressures and worries at school or work, financial stress, or poor health. More permanent emotional blocks include chronic sources of insecurity and anxiety such as fear of failure, fear of being different, fear of criticism or ridicule, fear of rejection, fear of supervisors, timidity, or shaky self-esteem.

While most emotional barriers interfere with the creation of ideas, some will block their adoption and implementation, for example, fear of taking risks and fear of uncertainty. Also, differences in needs and values may produce conflict and block the acceptance of an innovation. While this article is not psychotherapy, one possible avenue for resolving emotional barriers is a two-step creative problem-solving approach: First ask what the problem is, and then ask what we can do about it.

Resource Barriers

Resource barriers may seem a trivial form of barrier to creative thinking. However, they can and do stop creative productivity. As suggested by the name, resource barriers include shortages of people, money, time, supplies, and/or information that are needed for creative thinking, or for the implementation of creative ideas. Conflicts are likely if resources are pirated from one department to develop an innovation in another.

Stimulating Creativity by Removing Mental Barriers

Roger Von Oech's book, *A Whack on the Side of the Head*, addresses the problem of teaching creativity as a matter of removing ten mental blocks – which sometimes requires a "whack on the side of the head." Space permits just a short review.

His first mental block is 'The Right Answer,' referring to the usual assumption that there is just one right answer. Rather, a creative person will look for the second, third, fourth, and so on right answers, which are likely to be more imaginative than the first. The second mental block is 'That's Not Logical,' which stems from our culturally rooted assumption that logical thinking is better than illogical thinking. With creativity, logical thinking is often best suited for an evaluative phase. A third mental block is 'Follow the Rules,' which means

thinking of things only as they presently are, not as they could be. Rule-inspecting and tradition-inspecting may be in order. 'Be Practical' is the fourth mental block, which can interfere with the imaginative asking of that pivotal question, 'What if ...?'

The fifth mental block is 'Avoid Ambiguity.' In fact, ambiguity is a subtle form of motivation that inspires imaginative thinking. Ambiguity is also an essential stage that occurs while we clarify a problem and consider possible solutions. Von Oech's sixth barrier is the assumption that 'To Err Is Wrong.' Innovation necessarily requires making mistakes and even failing, as Thomas Edison did quite regularly. Errors serve as stepping stones. Von Oech noted IBM founder Thomas J. Watson's quote, "The way to succeed is to double your failure rate." A seventh block is the notion that 'Play Is Frivolous.' In creative thinking, the wrongness here is obvious. Countless innovations and discoveries are born via playing with ideas.

Barrier number eight is 'That's Not My Area.' This rich block supplies an excuse for not even trying to solve a problem. Further, such a block prevents a thinker from looking to other fields for ideas and inspiration. 'Don't Be Foolish,' barrier nine, is a cultural barrier rooted in conformity pressures. 'Fooling around' with ideas, like playing with possibilities, is a popular creative thinking occurrence. Finally, the tenth block is the self-squelcher, 'I'm Not Creative.' This one is a self-fulfilling prophecy – if you believe it, you will be right.

Idea Squelchers

There are dozens of attitude-related idea squelchers which we use too often to stifle our own or others' creative thinking. As just a sample:

We've never done that before.
 Are you nuts?
 It's not in the budget.
 It can't be done.
 It's a waste of time.
 It has limited possibilities.
 Too academic.
 This is the last try.
 I'm telling you, it won't work.
 You ask too many questions.
 Don't step on any toes.
 It won't work in our neighborhood.
 We did all right without it.
 Let's discuss it at some other time.
 You've got to be kidding.
 See? It didn't work!
 You don't understand the problem.
 Let's wait and see.
 We can't do it under the regulations.
 It'll mean more work.
 Somebody would have suggested it before if it were any good.
 No adolescent is going to tell me how to run this operation!

A good case could be made for the argument that all of us would be more creative were it not for external and internal barriers, blocks, and squelchers. Because of well-learned habits, an unsupportive or repressive environment, or our fears and insecurities, most people do not use their creative imaginations and abilities.

The challenge to anyone wishing to increase their personal creativeness is to understand, expect, and be ready to cope with barriers to creativity from the environment or from inside oneself.

Creative Attitudes

When we discuss creative attitudes we are also speaking of creative personalities. Decades of research with creative individuals, including persons who have and have not achieved creative eminence, focused on their attitudes and personalities, compared with controls. As noted at the outset, *creativity* is most appropriately viewed as a way of living, thinking, and perceiving one's world. Creativity is rooted in one's attitudes and personality. This section will review recurrent patterns.

Over 200 adjectives and brief descriptions of creative attitudes and personality traits were sorted by the author into 15 intuitively defined categories of positive, socially desirable traits and seven categories of negative, potentially troublesome traits. The 'positive' versus 'negative' judgments were subjective, as were some ambiguous decisions (e.g., whether to place 'adventurous' under 'risk-taking' or 'energetic'). The categories interrelate in the sense that all can be part of the stereotypical 'creative personality.' Of course, not all traits will apply to all creative persons; there are simply too many forms of creativity and creative people. Some traits even are contradictory, for example, 'receptive to new ideas' versus 'sarcastic.' Finally, artistic/poetic creative people may be shy and withdrawn, not high in the energy, confidence, and humor that characterize the stereotyped creative person. The categories of traits reflect the main, recurrent traits of creative people as found in the literature. The 15 categories of positive traits appear in **Table 1**. The traits are mostly self-defining. However, we will comment briefly on each.

- *Aware of creativeness.* Most highly creative people are quite aware of their creativeness. They are in the habit of doing things creatively and they like being creative. Creativity consciousness is a common and important trait among creative people. *In improving our own creativity and in teaching creativity to others, creativity consciousness is the number one trait to develop.*
- *Originality.* The trait of *originality* is so basic that dictionaries often use the term interchangeably with *creativity*. Originality also may be considered a creative ability in the sense of one's capability for uniqueness and nonconformity in thought.
- *Independence, risk-taking.* These two traits interrelate closely, since a person cannot display high independence without the accompanying willingness to take a creative risk. The creative person must dare to differ, make changes, challenge traditions, make waves, and bend rules. Such independence and risk-taking expose the creative person to possible criticism and embarrassment, and the possibilities of failure or looking foolish.
- *High energy.* A defining trait of creatively productive people is their extraordinarily high level of energy, which appears as enthusiasm, driving absorption, passionate interest, and an unwillingness to give up. Paul Torrance called it the *blazing drive*. Psychologist Calvin Taylor once quoted a

Table 1 Sample of recurrent attitudes and traits of creative people

1. <i>Aware of Creativeness</i> Creativity conscious	Values originality and creativity
2. <i>Original</i> Flexible in ideas and thought Challenges norms and assumptions Resourceful Full of ideas	Avoids perceptual sets Sees things in new ways Is a 'what if?' person Imaginative
3. <i>Independent</i> Self-confident Individualistic Does not fear being different	Sets own rules Dissatisfied with the status quo Internally controlled, inner directed
4. <i>Risk-taking</i> Courageous Not afraid to try something new Willing to cope with failure	Does not mind consequences of being different Rejects limits imposed by others
5. <i>Energetic</i> Adventurous High intrinsic motivation Overactive, hyperactive Enthusiastic	Driving absorption Drive for accomplishment and recognition Persistent, persevering Sensation seeking
6. <i>Curious</i> Experiments Wide interests Likes to hear others' ideas	Asks many questions Open to the irrational Seeks interesting situations
7. <i>Sense of humor</i> Childlike freshness in thinking Plays with ideas	Playful Sharp-witted
8. <i>Attracted to complexity</i> Attracted to the mysterious Attracted to the asymmetrical Attracted to ambiguity, incongruity	Attracted to novelty Is a complex person Tolerant of disorder
9. <i>Capacity for fantasy</i> Animistic and magical thinking Had imaginary playmates as a child Mixes truth and fantasy/fiction	Believes in psychic phenomena and flying saucers Theatrical interests
10. <i>Artistic</i> Aesthetic interests Sensitive to beauty	Enjoys art, music, creative dramatics Good designer
11. <i>Open-minded</i> Liberal Receptive to new ideas	Open to new experiences and growth Receptive to other viewpoints
12. <i>Needs alone time</i> Internally preoccupied Prefers to work alone	Introspective Reflective
13. <i>Intuitive</i> Perceptive Sees relationships, implications Good at problem finding	Observant Uses all senses in observing Heightened sensitivity to details, patterns

(Continued)

Table 1 (Continued)

14. <i>Emotional</i> Can express feelings, emotions Sensitive Moody	Has emotional highs and lows Withdrawn Needs attention, praise, support
15. <i>Ethical</i> Altruistic	Empathic Democratic minded

scientist as claiming, with tongue in cheek, that the only way to stop a fellow scientist from working on a problem would be to shoot him. Frank Farley, past president of the American Psychological Association, frequently emphasized the *thrill-seeking* trait of creative people.

- *Thorough.* Of course, high risk-taking and energy are not enough. The committed creative person must finish the projects, preferably in an organized fashion.
- *Curiosity.* Along with originality and high energy, another classic trait is curiosity – a sometimes childlike sense of wonder and intrigue, a desire to understand one's world. He or she may have a history of taking things apart to see how they work and of exploring attics, libraries, and museums.
- *Humor.* Another frequent trait is a keen sense of humor. It relates to one's ability to have a childlike and playful approach to problems. Many discoveries, inventions, problem solutions, and artistic creations are the result of 'fooling around' with ideas, playing with strange possibilities, or turning things upside down, backward, or inside out. A relevant quote is that "the creative adult is essentially a perpetual child – the tragedy is that most of us grow up" (Fabun, 1968, p. 5). Both Freud and Carl Rogers agreed that regression to a childlike state is an important feature of fantasy and creative thinking.
- *Attraction to fantasy, complexity, and novelty.* The creative person's attraction to fantasy, complexity, and novelty may reflect the person's own complexity. A classic demonstration by Frank Barron and George Welsh showed that creative persons preferred smudgy, complex, asymmetrical drawings over simple and balanced ones. While novel ideas and innovations may excite creative people, others habitually may analyze defects and find fault. Tolerance for ambiguity, which relates intimately to complexity and novelty, is essential in the sense that – as we saw in Von Oech's fifth mental block – creative problem solving involves an ambiguous period in which the problem is clarified and solutions considered. One unique twist to the attraction to fantasy, complexity, and novelty is that creative people tend to be stronger believers in psychic phenomena and flying saucers, despite their generally higher intelligence level.
- *Artistic.* Artistic and esthetic interests usually are keen. One explanation is simply that creative people are more likely to have been involved in, for example, music, dance, theater, art, or handicrafts. However, the trait extends to persons creative in science, business, and other traditionally non-art areas.

- *Open-minded*. A creative person, virtually by definition, must be receptive to new ideas and willing to look at problems from various points of view. Open-mindedness includes not fearing the new, different, or unknown and not making up one's mind in advance. The trait relates to Von Oech's creativity barriers of looking for just one right answer, being practical and logical, and avoiding ambiguity, frivolity, mistakes, and foolishness.
- *Needs for alone time*. The need to create demands time for thinking, reflection, solving problems, and creating. Creative children and adults often prefer to work alone, reflecting their creative independence.
- *Perceptive*. Perceptiveness and intuitiveness, whether in art or science areas, are common traits of creative people. There is greater sensitivity to details, patterns, implications, relationships, and 'what should follow.' Intuitive "mental leaps" are quicker.
- *Emotional*. The Dabrowski and Piechowski phenomenon of 'emotional giftedness' or 'overexcitability' usually happens in very high IQ gifted persons. The syndrome includes free play of imagination, vivid imagery, fantasy, paranormal thinking, metaphorical thought, inventions, and poetic and dramatic perceptions, as well as fast talking and extra high energy levels. The syndrome includes having emotional highs and lows, moodiness, and emotional sensitivity.
- *Ethical*. Another trait related to high mental ability and creativity, and one found in Terman's early studies of highly gifted children, is a tendency for ethical thinking and behavior – empathy, idealism, altruism, and simple helpfulness.

Negative Traits of Creativity

A discussion of creative attitudes and personality would be incomplete without acknowledging traits and dispositions that disturb supervisors, parents, teachers, and peers. **Table 2** lists negative, sometimes upsetting characteristics of creative individuals that surfaced in the search for creative traits mentioned earlier. The traits may stem from a creative student's independence, unconventionality, persistence, and perhaps curiosity and humor. The items were placed into the seven categories of *egotistical*, *impulsive*, *argumentative*, *immature*, *absentminded*, *neurotic*, and *hyperactive*. Many are likely to cause personal or social adjustment problems.

Creativity, Psychoses, Neuroses, and Sociopathy

Another aspect of the creative personality that cannot be ignored is the tendency for a small proportion of creatively productive persons to be slightly mentally disturbed, and even to have mentally ill relatives. For example, in their 1950s study of the creative personality at the University of California at Berkeley, Frank Barron and Donald MacKinnon found a tendency for high-level creative people, such as creative women mathematicians, to be rebellious, undependable, irresponsible, and inconsiderate, and to have fluctuating moods. Barron and MacKinnon's creative writers scored in the top 15 percentile on *Minnesota Multiphasic Personality Inventory* measures of psychopathology: *hypochondriasis*, *depression*, *hysteria*

Table 2 Recurrent 'Negative' traits

1. <i>Egotistical</i>	
Intolerant	Snobbish
Self-centered	Claims the rest of the parade is out of step
2. <i>Impulsive</i>	
Acts without planning	Capricious
Careless	Disorganized with unimportant matters
	Tactless
Impatient	
Irresponsible	
3. <i>Argumentative</i>	
Cynical	Defiant
Rebellious	Sarcastic
Uncooperative	Stubborn
Little regard for rules, conventions, mores, law, authority	Autocratic
4. <i>Immature</i>	
Childish	Silly
Sloppy	
5. <i>Absentminded</i>	
Forgetful	Careless
Mind wanders	Watches windows
6. <i>Neurotic</i>	
Aloof	Mildly sociopathic
Temperamental	Unable to control emotions
Low frustration tolerance	Uncommunicative
7. <i>Hyperactive</i>	
Overactive, physically and mentally	

(anxiety, uncontrolled behavior), *psychopathic deviation*, *paranoia*, *psychasthenia* (fears, phobias), *schizophrenia*, and *hypomania*. However, strong *ego strength* scores indicated they could better deal with their troubles. Psychologically, said Barron, they were both sicker and healthier than the average person.

In a 1988 study of historically eminent persons, Herbert Walberg concluded that about a fourth to a third showed definite introversion or neuroses. Also in 1988 Solomon and Winslow reported that a sample of business entrepreneurs showed mild sociopathy and/or were social deviates. A 1995 study of male and female eminent persons by Walker, Koestner, and Hum indicated that the creative achievers were rated significantly higher than average on impulsivity, depression, and general neuroticism. Richards turned the usual procedure around, finding that a sample of manic-depressives were rated higher in creativity than were controls. Concluded Barron, 'mad as a hatter' is high praise when applied to creative people. The relationship continues to be an intriguing one.

Conclusions: Attitudes that Overcome Barriers

We have seen that blocks and barriers – learning and habit, rules and traditions, and perceptual, cultural, and emotional barriers – will interfere with creative thinking and innovation. Again, a common argument is that we all are born creative, but early years of socialization and education create habit- and tradition-based barriers to imaginative thinking and innovation.

We have also seen that all creative people show a relatively recurrent syndrome of creative attitudes and personality traits – awareness of creativity, originality, independence, energy and

motivation, risk-taking, curiosity, humor, attraction to complexity and fantasy, artistic interests, open-mindedness, and perceptiveness.

Of course, creative attitudes and personalities plus overcoming personal and environmental barriers do not present a total picture of the creative person. For example, other important factors discussed in this encyclopedia are intelligence and thinking styles, innate creative abilities related to the specific medium (e.g., art and mathematics), training, an existing body of knowledge, plus such matters as opportunity and chance. Nonetheless, an awareness of necessary creative attitudes and personality traits and a readiness to deal with environmental and personal barriers are central to creative development and productivity.

As to the puzzle in Section II, try removing S-I-X L-E-T-T-E-R-S.

See also: Climate for Creativity; Cross-Cultural Differences in Creativity; Emotion/Affect; Humor and Creativity; Innovation; Mad Genius Controversy; Novelty; Overexcitabilities; Personal Creativity; Women and Creativity.

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The Beatles

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Early Years

In the mid 1950s, British youth was exposed to rock 'n' roll arriving from the United States. The musical excitement inspired a number of British teens to learn an instrument associated with the new musical form. In Liverpool, Paul McCartney, John Lennon, Ringo Starr (Richard Starkey), and George Harrison sought to emulate their American idols Elvis Presley, Little Richard, Jerry Lee Lewis, and Chuck Berry. They were also influenced by American country and western artists.

Building the capabilities for success began in their teenage years with support and encouragement from their families. At the age of 16, John Lennon's mother, who played the banjo, taught Lennon banjo chords and encouraged him to learn the guitar. George Harrison, who was three years younger acquired his first guitar in his early teens, and Ringo was about 16 when he bought his first bass drum. Paul McCartney also benefitted from parental support and instruction. Paul's father was an amateur jazz musician and provided Paul with the best musical education of the four. John Lennon notes that when they first met, Paul could play guitar, trumpet, and piano. By contrast, John could only play the mouth organ and two chords on a guitar. Another important capability Paul learned from his father was the ability to sing in harmony. Defining vocal harmonies would become a key role for Paul in the Beatles.

Although Paul was the better musician, John was developing other capabilities that would contribute to the creative process. He had been composing verses and stories, with a strong influence by Lewis Carroll. Although both Paul and John could write capable music and lyrics, these early differences were to characterize their creative output throughout their careers.

With little in the way of instruction or sheet music, John and Paul studied new records as they came out, noting the words, and analyzing the chord changes. They spent a lot of time trying to figure out the chords, and in so doing, gained an understanding of chord structure and progressions that they would later use in their own songs. The motive for Lennon and McCartney was not just to become rock and roll performers. They dreamed of becoming the next great song writing team and often bunked school to write songs in their living room. Paul McCartney describes their early song writing:

We started off I think with a song called "Too bad about sorrows". They all had simple chord structures but we learned our craft that way ... we'd do some good rhythm on the guitars, and we probably harmonised a little together. ... We just developed the art, gradually, gaining in confidence. So we did this every so often through a number of months. (Miles, 1997: 36)

By analysing the songs of the imported music they expanded their performance repertoire and by 1960 the Quarrymen, as they were then known, could perform over a hundred songs. They gave a number of live performances in the

United Kingdom before gaining employment in Hamburg's Reeperbahn district. For two years, they divided their time between Liverpool and Hamburg, further developing their performance capabilities and methods of working with each other. Their ability to harmonize tightly was one of the skills developed further during this time.

Live performance also increased their motivation to write their own songs. Competition between bands was acute, and the Beatles needed to distinguish themselves from the other acts. Their first response was to play the B side songs from records as these were little known. However, the Beatles only needed to play them once before the other groups became aware and copied them. So they decided they had to find their own identity and write their own material which they began to introduce into their performances.

While playing in Liverpool, the group came to the attention of Brian Epstein who managed a local record store. After hearing them play in the Cavern night-club, Epstein offered to be their manager. He tidied up their presentation, and approached a number of record companies in pursuit of a recording contract. All the companies rejected them, an indication that there was nothing special about the Beatles or their music at this stage. As a last resort, Epstein approached the EMI comedy label Parlophone. The label was managed by George Martin who although, specializing in comedy, was on the lookout for a musical act. Like the other record companies, Martin was unimpressed by their demo-tape, but he felt they had potential and was particularly struck by their charisma. He was not impressed by their song-writing ability as their early compositions showed no indication of what would come. Their best song *Love Me Do* was very simple, and they did not have enough marketable material to fill an album. Their first two albums both needed six covers of American songs in order to have sufficient material.

John and Paul had a strong ambition to develop their song-writing. They often wrote songs together, partly because they enjoyed it and partly because it was more productive. The level of collaboration could vary and some songs could be called 'solo' efforts, even in the early days; however, a common practice was for either John or Paul to have an idea and this would lead to the composition of the first verse, from which the other would help build the rest of the song.

An idea for a song could come at any time, sparked by any item of interest including newspaper articles, circus posters, or fantasy romances. Lennon often wrote about personal issues, the songs being outlets for his emotions. A common pattern was to write a song in imitation of their American idols, for example, John's song *All I've Got To Do* was written as an attempt to emulate Smokey Robinson and the Miracles. Another technique was to pluck lines or phrases from other songs, then take them in different musical directions. For example, the song *Run for Your Life* had its roots in the Elvis song *Baby Let's Play House*. The original idea provided the

foundations on which they would build introductory phrases or theme for the lyrics; the foundations for the first verse.

The first verse would give the tune, tempo, key and subject matter. Once the idea had been converted into a first verse, it was common for the writer to get stuck over what to do next. This is where they would use their cowriter to overcome the block. John Lennon describes how:

... the way we wrote a lot of the time was you'd write the good bit that was easy, like "I read the news today, oh boy" ... And then when you got stuck, ... you'd just drop in and meet each other and I'd sing half and he'd be inspired to write the next bit and vice versa. (Wenner 1971: 115)

Lennon also suggests that writing in this way increased the level of experimentation, because "you tend to be a bit lax with somebody else's stuff – you experiment a bit" (Ibid.). The section where the second composer helped was frequently called the middle eight, even if it had 32 bars. A typical Beatles song had four verses, a chorus that was repeated and a middle eight. So if John had a first verse, Paul would come in "at the second verse, be there for the middle eight and be there for the third and fourth verses, the resolution" (Miles, 1997: 177).

On tour, many songs were written backstage, in tour buses or in hotel rooms. The need to fulfil recording contracts provided a disciplinary pressure that led to highly productive song-writing bouts. They would normally be given two week's notice that the recording studio was booked and this created a deadline to provide new material by. Paul McCartney would go to John's house every day for the week and each day they would write and work on each other's songs. Even when alone, they would run over the other's song to see if they could improve it.

A song once written would be taken to the studio and performed for George Martin to hear. John and Paul sang their song while playing the acoustic guitar. At this stage, Ringo and George would not be involved unless George joined in the harmony. George Martin would make suggestions for improvement and they would try it again, creating what is known as the 'head arrangement.' George Martin notes:

We established the working format that whoever wrote the song generally sang it, and the others would join in. If it were John's song, he would sing it, and when we came to the middle eight – the section in the middle of a song where the tune changes – Paul would sing thirds above or below, or whatever; if a third part were needed George would join in. It was a very simple formula. (Martin and Homsby, 1979: 132)

This simple pattern of production characterized the first phase of creativity, which included the songs *Love Me Do*, *Please, Please Me*, *From Me to You*, *She Loves You*, and *I Want to Hold Your Hand*. Each song had a very distinctive sound underlined by their strong harmonies while their singles were characterized by fast energetic tempo. John Lennon says their distinctiveness was simply due to the fact that they did not sound like the early artists. Songs written in imitation of black American artists would have a different sound when sung by white English men. This could be seen on the song *The Long and Winding Road*, written much later. Paul wrote it with Ray

Charles in mind but noted "It doesn't sound like him at all, because it's me singing and I don't sound anything like Ray, but sometimes you get a person in your mind, just for an attitude, just for a place to be." (Miles, 1997: 539)

By 1963, they had perfected the basic tenets of composition and produced dozens of classic pop songs. They made a conscious effort to develop their writing and their songs and harmonies were becoming more sophisticated. They would look at what others were doing and were keen to integrate improvements. For example, on hearing *Besamo Mucho* by the Coasters (1960), Paul noticed it changed from a minor key to a major key and this created a big moment musically, so on the song *From Me to You*, he changed from a major to a minor key for the first time. Their lyrics also became more sophisticated moving from simple love songs to cover a broader range of issues.

This process of continuous improvement was driven by artistic curiosity, a desire to improve, and a competitive rivalry between John and Paul. They constantly competed to have their songs on the A side of the singles and this put pressure on them to improve. However, it was a co-operative rivalry. They had earlier made a decision that both their names would go on their songs no matter who wrote it. Hence they shared the royalties, as well as performance income. So although they competed, they had a strong incentive to cooperate.

They were also writing songs for other groups. Billy J. Kramer and the Dakotas received four originals including *Do You Want to Know a Secret* which knocked the Beatles off the top of the UK charts. The McCartney song *World Without Love* was performed by Peter and Gordon and it too pushed the Beatles song *Can't Buy Me Love* off the no. 1 chart position. To ensure that the success was not a result of the McCartney name, Paul gave them another song *Woman* under the name Bernard Webb. It went to no. 1 in the United Kingdom and no. 2 in the United States. But not every song was successful. Paul would try to bury his poorer songs but came under pressure from artists wanting material.

Transition

The Beatles fifth album *Help!* contained a song with a dramatic change of form. This was *Yesterday*, a song written solely by Paul McCartney which came to him in a dream. George Martin convinced a reluctant Paul to use a string quartet for instrumentation. George Martin wrote the arrangement with suggestions from Paul. This use of a string quartet on *Yesterday*, and a flute on the song *You've Got to Hide Your Love Away* were the first occasions where, under George Martin's guidance, the Beatles expanded beyond their own rock n roll instrumentation. No longer would they be limited to a bass, two guitars, and drums.

These changes were embodied in the next two albums, *Revolver* (1965) and *Rubber Soul* (1966) which reflected the Beatles transition from a singles band to a studio band. On *Rubber Soul*, greater use was made of the keyboards, while George Harrison introduced an Indian instrument, the sitar on the song *Norwegian Wood*. Much of this broadening in instrumentation can be attributed to expanded capability acquisition. At the same time as George Harrison was learning the sitar, Paul McCartney was gaining greater exposure to classical music, not just from George Martin but also from his

girlfriends, Jane Asher's family who increased Paul's exposure to classical instrumentation. On the *Revolver* album, strings were effectively used on *Eleanor Rigby*, a song written by Paul who was talked into using strings by George Martin who did the arrangement. Not wanting a Mantovani sound, Paul instructed Martin he wanted the strings to sound really biting. George Martin's musical skills were also drawn upon devising complex harmonies for the boys to sing on the album.

Aware that they were EMI's cash cow, at the same time as gaining greater technical expertise, the Beatles started to take control of the studio. In earlier days, they would take what George Martin gave them. Now they were more precise about the sound they wanted on the final product. They often told George Martin what they wanted and this in turn, forced the producer and engineers to be more innovative. Sound engineer Geoff Emerick notes that it "was during the *Revolver* sessions that I realized I simply couldn't rely on textbook recording techniques in terms of mic positioning and placement. The Beatles were demanding more, so much more of both me and of the technology." (Emerick 2006: 128)

Much of the Beatles work could be described as research and development in sound. All four Beatles had bought themselves open-reel tape recorders and this allowed them to experiment at home. Paul discovered that the erase head could be removed, allowing new sounds to be added to existing ones. Although, the tape quickly became saturated with sound, the distorted sounds gave birth to a rush of R&D activity, and the four would often bring in bits of tape in a de facto "weird sound contest" (Ibid.: 111). For John's song *Tomorrow Never Knows*, Paul created a series of short loop tapes which he played to the others in the studio the next day. The four would listen to each and choose the ones they preferred. On another occasion, John Lennon thread the tape backward on his machine by mistake. The resulting sound appealed to the four who then wanted backwards sounds on almost every over-dub on *Revolver*.

George Martin's previous experience producing comedy records was drawn upon for the song *Yellow Submarine*. Experienced at making sound pictures, he and his engineer overdubbed nautical sounds from EMI's sound effects library. Martin gained the distinctive brass band effect by cutting up a recording of Sousa's marches, mixing up the pieces and splicing the mixed pieces together. Initially done to overcome copyright controls, it was a technique he would use again on *Mr Kite* on the *Sgt Pepper* album.

In the earlier albums, George Martin would simply record the songs that the Beatles had performed live, but for the *Revolver* album there had been no prior performance. All the tracks were created in the studio. The complexity of the albums was such that a much longer time was needed to create them. Compared to the early albums that could be recorded in a day, *Revolver* was recorded in just over ten weeks. The song *Here, There and Everywhere* took three days by itself.

The two transition albums were also characterized by a significant contribution to the creative process by George Martin and a change in his role as producer. Although the Beatles gained control of the studio at this time, ironically this meant that George Martin would have greater influence on the music as he sought to bring their images to life. In the early days, Martin's work was not different to any other good producer. He basically reproduced the songs as they were

performed in the Cavern. There wasn't much arranging to do however; new songs would require more work. For example, the song *Please, Please Me* was much slower and in a very different form. George Martin suggested adding harmonies and a harmonica, and lifting the tempo creating the fast Beatles energy we recognize with the early period. The song was also too short so he suggested some structural changes such as singing the chorus twice, along with suggestions on how it should be done. However there was little in the way of arranging. On the other hand, the song *I Want to Hold Your Hand* recorded a year later, needed little improvement on the original apart from some minor changes in tempo and vocal harmony (Ibid.: 71). This changed in 1965 with the song *Yesterday* when he began to score orchestral arrangements, a unique attribute for a producer given his study at Guildhall school of music. Martin differentiates between orchestration and composition saying:

Orchestration is a matter of giving colour to lines that are already there . . . The basic design doesn't change. What orchestration does is to give it life . . . I tend to think of orchestration in terms of painting a picture. An artist can do a brilliant outline sketch in sharp charcoal, Picasso for example. . . . But when it comes to orchestration, what you do is to fill in all the subtle colourings, making the picture into a three-dimensional form. (Martin and Hornsby, 1979: 34–36)

Martin praises Lennon and McCartney for their ability to craft a tune. "A tune is one fingered, something that you can whistle. . . . The ability to create them is simply a gift" (Ibid.: 139–140). However, Martin's emphasis on melody understates his own contribution as harmony, orchestration, and other aspects he provided can be considered aspects of composition.

Technical advances aided the creative process. Multitrack recording meant that instruments could be recorded at different times. The producer could change his mind half way about aspects of composition without starting again. But it was the advent of stereo recording which enabled the producer to become a creative person in his own right. No longer was the producer restricted to replicating a live performance. Now he could introduce artificial sounds and a sense of movement. On the *Sergeant Pepper* album, stereo was used for a number of effects, with instruments floating from side to side, "giving the listener the impression that it was almost flying over head." (Ibid.: 116)

Other technical tools included multispeed techniques like doubling or slowing the music's speed, playing sounds backwards, and other unusual sounds effects. All contributed to the ability to build a sound picture. George Martin's contribution appears to be greatest on songs written by John. Although John was full of ideas about the sounds he wanted it was Martin and his engineers who had to create that vision. Lennon had little knowledge of technology and had trouble giving direction in musical terms. George Martin contrasts his ability to Paul McCartney:

Paul would sit down and ask what I planned to do with his songs, every note virtually. "What do you think the cellos should be doing here George?", and I'd have to describe to him on the piano what it would be. He'd say: "Yeah. OK, but what about changing that note?" Lots of the arrangements to his songs were very much his ideas which I would have to implement.

John would be more vague in what he wanted. He would talk in metaphors about his ideas . . . he'd say for example on "Being for the Benefit for Mr Kite!" – this songs about a fairground. A little bit mystified. I want to get the feeling out of the sawdust and the feel of the ring. Can you do something about it?

Competition with other artists provided another incentive to raise quality. In the mid-sixties, the Beatles had a "curious Transatlantic slugging match" (Martin, 1994: 49) with The Beach Boys, an American pop group who severely felt the impact when the Beatles stormed the US charts. Until that time, The Beach Boys song *Surfin USA* held the sales record, but when the Beatles single *I Want To Hold Your Hand* was released in the United States, it took the record, selling 500 000 copies in less than a week. The Beach Boys next single *Fun, Fun, Fun* could not get above five in the charts because the Beatles held the top four spots. This inspired the Beach Boy's composer, Brian Wilson, to improve and write a string of number one hits, including *Help Me Rhonda*, *I Get Around*, and *Good Vibrations*. By 1966, the *New Musical Express* reader's poll ranked the Beach Boys as the most popular group in England, ahead of the Beatles.

While the groups competed with each other, there was also a strong degree of admiration. Both analyzed each other's output. The Beatles were particularly impressed by the Beach Boy's album *Pet Sounds* with its unusual use of instruments and intricate harmonies. This inspired the Beatles to raise their standards yet again on their next album, *Sgt Pepper's Lonely Hearts Club Band*.

Creative Climax

If *Rubber Soul* and *Revolver* could be described as the transformation stage, *Sgt Pepper* and the songs on the *Magical Mystery Tour* album were the climax resulting from that transformation. By November 1966, the group had an unprecedented string of hits that included 12 singles all going to no. 1 in the charts and seven no. 1 albums. They had the confidence to know they could try anything they wanted and this fostered experimentation and creativity. Success had also given them more resources than any other pop group had available to them, in particular, time in the recording studio.

Paul devised a concept for the *Sgt Pepper* album in which the group would develop an alter ego, the *Lonely Hearts Club Band*. Although the concept was only carried through on two of the songs, the fact that they did not have to project an image from the old group image freed the Beatles from their traditional musical landscape.

The sense of innovation could be seen on the first song of the recording session, *Strawberry Fields* written by John about a place he knew in Liverpool. Lennon brought a new instrument to the studio with him. A mellotron, a keyboard instrument with a number of sound settings. Paul dialled up the flute sound and experimented with the chords to the song. Soon he had a stunning opening arrangement to complement Lennon's vocal line. Another novel instrument was the sword-mandel, an Indian instrument introduced by George Harrison. Towels were placed over the drums to create a muffled tone while the cymbals were recorded and played backwards.

George Harrison experimented with sweeps on a slide guitar he had just bought, and a piano was plucked instead of using the keys. After two versions of the songs were mixed, John then decided he would like to see them joined together even though they were in different keys. This problem was solved by speeding one version up and slowing the other down.

Not all the experiments worked and some did not make their way onto the final recording, but the song embodied an R&D attitude to sound not seen before in popular music. Behind this was a drive for perfection, "it wasn't a question of being 99% happy with something; we all had to be 100% happy with it." (Emerick, 2006: 254)

George Harrison gave the album an exotic flavor with his Indian inspired *Within You Without You*. This song stretched Martin's ability as a producer as he had to combine an orchestra with Indian instrumentation. This aside, George Harrison and Ringo Starr played a small role on these sessions. The album took a long time to produce but required little of these two who were predominantly musicians not composers. Ringo got bored and learned to play chess, while George Harrison's heart was in India. Sound Engineer Geoff Emerick describes *Pepper* as being more like a John and Paul album, than a Beatles album.

By 1967, the Beatles had emerged as a powerful composition team, building musical images that no one else had done before. They were intrinsically inspired by the love of their work and extrinsically inspired by the success they gained. Aspects that contributed to the team's success included the group's cohesiveness which enabled each member to introduce new ideas free from censure by other members. This was underpinned by a high level of mutual trust and respect which facilitated co-operation and collaboration. Each was aware that sharing ideas was important to see them developed. They also valued each other's criticism, a key factor in the analysis and enhancement of their work.

Another key element of their success was the blend of different expertise and creative thinking styles in the team. McCartney's compositions were characterized by lightness, optimism, strong melodies, and an emphasis on the music. Lennon's music was often sad and discordant, often with bluesy notes. While McCartney's melodies danced around, Lennon's were often based on only one or two notes. McCartney's songs were driven by the music. The only song he wrote the words first was *All My Loving*. By contrast, Lennon focused on the words and was more inclined to write about his own feelings and experiences. During *Sgt Pepper*, he was consciously trying to write poetry. Lennon drew on surreal images similar to those that Lewis Carroll inspired in him as a teenager. In contrast, McCartney's lyrics had a reality to them describing characters like novelists, meter maids, and barbers.

The team also benefitted from a breadth of expertise. George Martin had significant expertise in music arrangement and technology while the four musicians possessed the necessary knowledge of rock'n roll. Lennon and McCartney always had an underlying ambition to go in an artistic direction, something that set them apart from other Liverpool musicians. It was George Martin that opened this door to them. Lennon and McCartney possessed what Amabile describes as creative thinking; a propensity to take new perspectives and take risks with little concern for social approval. They were constantly

looking for new sounds and willing to break established norms. This was fuelled by their success which gave them confidence to try new things. Their management and the record company were prepared to accommodate their wanderings because of their success. There were however, times when this creative freedom could go too far. At times, on *Magical Mystery Tour* George Martin felt the group went too far and lacked mental discipline.

Management appears to have a minor, but at times important impact on the Beatles. First it helped determine the initial success, which in turn determined the resources available to them. In 1963, the stable of artists managed by Brian Epstein, recorded by George Martin with music publication, and promotion by Dick James dominated the British charts. Of the 52 weeks of 1963, the Epstein-managed artists topped the charts 37 times. However, Epstein could have a negative effect. He committed the group to the movie *Yellow Submarine*, a project they had no interest in, which they used as a depository for poor quality songs. The record company was not the group's manager but contributed to the organizational framework. EMI may have done a good job at promotion and distribution of the music, but on a day-to-day basis seemed oblivious to the Beatles needs and the Beatles felt no loyalty towards the company.

It is significant that John Lennon makes a direct link to the group's eventual break up to the death of Epstein, stating that the Beatles broke up after Brian died. Management had protected the Beatles from many nonmusical distractions. After Brian's death the Beatles established 'Apple' a company that managed a number of artistic activities, but with extremely limited business skills. The company suffered and the musicians would often arrive in the recording studio carrying disagreements about the company. It was such a dispute that eventually led to the band's break up.

With Epstein's death Paul, took over leadership and is recognized as having saved the band. However, their subsequent projects often lacked the structure of the Epstein years. This could be seen in the Beatles next movie, *The Magical Mystery Tour*. Without directors or script writers, the movie was the group's first flop. Epstein's death also affected their song writing. Previously, Epstein organized recording dates and ensured that Lennon and McCartney's calendar was free of interference leading up to that time, thereby giving them time to write songs together. This no longer happened. Paul now organized the recording times. John Lennon notes that "Paul had a tendency to just come along and say 'Well (I've) written ten songs, lets record now.' And I said give us a few days and I'll knock a few off."

The problem was John was caught without any songs, and it is possible the *Magical Mystery Tour* sessions were begun too soon. But another process was at play; John's productivity was falling at a time when Paul was reaching a peak, a problem made worse by the reduction in cowritten songs. In the early days, John had arguably been the stronger writer. On a *Hard Day's Night*, he had been the predominant writer on seven of the songs, and cowrote three more with Paul, while Paul was dominant writer on only three. After this, Paul and John's contributions were roughly in balance, but with *Magical Mystery Tour* Paul emerged as creative leader. John was well aware of the situation:

You'd come up with a *Magical Mystery Tour*. I didn't write any of that except *Walrus*; I'd accept it and you'd already have five or six songs, so I'd think "Fuck it", I can't keep up with that so why bother. (Miles, 1997: 139)

In his defense, John claimed he had succumbed to marriage and eating, but there are other explanations. First, Paul was now benefitting from his greater investment in capability building. Paul was the workaholic who strived to expand his musical and technological knowledge while Lennon was relatively lazy. The result was Paul had more musical tools and components to work with. He was also more motivated, striving for perfection, an attitude John didn't share. There was one other explanation for John Lennon's decline in output – drugs.

The Beatles had been taking drugs since their days in Hamburg, when the waiters provided pills to keep their energy up during performances. At the time of the *Help* album they dropped the pills and drink and moved on to marijuana, and by *Sgt Pepper*, LSD was commonly used. The Beatles realized that drugs undermined the quality of their performance. A recording session affected by drugs needed to be redone at a later date, so they made a point of staying clean while recording. In terms of composition, drugs provided subject matter for songs such as *Day Tripper* and *Got to Get You into My Life*, but in the long term this probably had a detrimental effect. John Lennon, who took the greatest quantities of LSD and at times used heroin, experienced a significant drop off in output. By contrast, Paul McCartney, who largely restricted himself to marijuana continued to excel. Drugs may have also affected Lennon's ability to function in the group. About this time John's personality was changing and in subsequent years, his behavior would become erratic with frequent severe mood swings.

To the public, John's decline was masked by the heights of composition that Paul was achieving and the rise of George Harrison as a composer. Harrison had songs on Beatles albums as early as 1963 but the quality was marginal. Until this time, his greatest contribution to composition was arguably the Indian sonic textures he introduced. However, by 1968, Harrison was delivering strong songs, and on the Beatles last album *Abbey Road*, his song *Something* became the coveted single.

In February 1968, the Beatles went to India to the retreat of the Mahareshi Mahesh Yogi. This was a period of great creativity, with inspiration coming from the Mahareshi's words, the new experiences and new people, and the interplay with other artists like Donovan who were also on the trip. Paul wrote 15 songs on the trip while John, whose brain was free from drugs for the first time in years, also enjoyed a productive period. Many of the songs written in India made their way on to the *White Album* and *Abbey Road*. However, there was variation in their quality.

Slow Disintegration

The team dynamics that had driven the creative wealth on *Sgt Pepper* were sorely missing on the Beatles last three albums. For the first time, the Beatles were bringing their problems into the studio including business issues related to Apple Corporation. Also coming to the studio was John Lennon's new girlfriend, Yoko Ono. This was a huge intrusion on a group known for its

tightness, but if any of the others expressed their opinion, Lennon would lash at them with his tongue.

The divergent thinking styles that had previously contributed to enhanced creativity had grown bigger, creating a divide epitomized in John Lennon's abstract piece *Revolution no. 9*. The others were not opposed to abstract art. Paul had explored *avant garde* music well before John, however they didn't consider it Beatles music. George Martin and the other Beatles tried to persuade John to leave it off the album, but John was adamant. Under the influence of Yoko Ono, the song was his vision of where the Beatles should be heading. He wanted it released as a single.

The nature of the *White Album* also affected creative exploration. There appears to be a deliberate attempt to make a raw-sounding album, in contrast to the highly produced *Sgt Pepper*. Even the album cover, was simplified, being bland white with the exception of the Beatles name. This meant that George Martin and his engineers played a smaller creative role. The Beatles no longer asked the engineers to do the impossible. They were content with simple acoustic sounds, perhaps a reflection of context in India where many of the songs were written on acoustic guitar.

Co-operation on the *White Album* was at a low ebb with few suggestions passing between the two composers. They didn't seem interested in each other's opinions, and if a suggestion was made, it was normally rejected. They seemed to be saying "I don't like what you're suggesting because I don't like you" (Emerick, 2006: 254). It got to the point where they would not even record together. They split into small groups with their own engineer and worked in separate studios.

The creative team was disintegrating and the recording sessions became a nightmare for those involved. The sound engineers walked out and none of the other engineers at EMI wanted to replace them, an unthinkable position a year earlier. The atmosphere on the next album *Let It Be* was even worse. The sessions were so dysfunctional that George Martin eventually disassociated himself with the recordings which sat on the shelf until Phil Spector finished off production. Given the disaster of *Let It Be*, the Beatles made a conscious effort to be on their best behavior for what would become their last album, *Abbey Road*. Arguments still occurred but not on the scale of the previous sessions. One feature that made arguments less likely was they were rarely in the room at the same time. On previous albums, if one of them was recording, the others would hang around to give input and support, but on *Abbey Road* no one stayed behind. They were no longer working as a team.

The experimental days pressuring Martin and the engineers for novel sounds had long passed. In fact, the Beatles had built up so much experience that George Martin had to take a back seat on production. At times on *Abbey Road*, he contributed intricate harmonies, vocal arrangements, and orchestral scoring including nine part harmonies on John's song *Because*. Despite the situation, the album was driven by three accomplished composers and the industries top producer. It remains a landmark in pop music.

In the latter years, there were still moments when they worked together, for example, John took his *Ballad of John and Yoko* to Paul's house to help finish, and they still had a desire to see each other's songs improved, but the team work of old had long since passed. John wanted to explore conceptual art with

Yoko Ono and had already produced independent recordings. He was also battling drugs. George Harrison was no longer happy to operate in Paul and John's shadow. Ringo seemed exhausted, while Paul, who had offered leadership, was aggravating the others with his bossiness. A business problem at Apple Corp. provided the final spark for the bands demise.

Each of the Beatles went on to develop successful solo careers, and all four were regularly in the charts in the first half of the 1970s. Ringo had five top 40 albums and seven top 10 singles including two no. 1s. John had six top 10 albums including two no. 1s. His sales sky-rocketed after his death, including three chart-topping singles. George Harrison released the biggest selling album of all the ex-Beatles; his *All Things Must Pass* album. He had five top 10 albums in the first half of the 1970s before fading. However, he maintained an intermittent presence in the charts, including time in the group 'The Travelling Wilburys.' He also became a very successful financier and executive producer of films with his company *Hand Made Films*.

The most successful of the ex-Beatles was Paul McCartney. On leaving the Beatles he formed a new band 'Wings' with his wife Linda and Denny Laine. It had a string of platinum albums. In the 1980s, Paul collaborated with a number of artists including Stevie Wonder, Michael Jackson, and Elvis Costello. In the 1990s, he ventured into orchestral music, collaborating with Carl Davis to write *Liverpool Oratorio* performed by the Royal Liverpool Philharmonic Orchestra and the choir of Liverpool Cathedral. In 1997, he was knighted for his services to music. He is listed in the *Guinness Book of Records* as the most successful musician and composer in popular music history.

See also: Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Group Creativity; Music.

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- <http://www.beatles-history.net/> – The Complete Online History of The Beatles.
- http://en.wikipedia.org/wiki/The_Beatles – The Beatles wiki.

Ludwig van Beethoven 1770–1827

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Glossary

Counterpoint The relation between two or more musical melodies that are independent in contour and rhythm, but which are harmonically interdependent. The adjectival form of counterpoint is contrapuntal.

Fugue A type of contrapuntal composition with a fixed number of parts or voices. Beethoven's late style includes a large proportion of fugues.

Opus numbers A numbering system used to categorize Beethoven's most important works. Opus (Op.; plural: Opp.) numbers represent 'official' compositions published during or shortly after Beethoven's lifetime. These run from Op. 1 to Op. 138 and sometimes include several works per Opus number (such as the three piano trios of Op. 1). Other works are usually given WoO (Werke ohne Opus) numbers.

Sonata form A musical structure consisting of three main parts: (1) an exposition in which melodic and harmonic material is introduced; (2) a development section in which the material is elaborated and contrasted; and (3) a recapitulation in which the material is resolved harmonically and thematically. Sometimes these three parts are preceded by a slow introduction. Sonata form is typical of works in genres in which Beethoven excelled, such as symphonies, piano sonatas, and string quartets – though usually the term strictly applies only to the first movement of such compositions.

Symphony A major musical genre, usually in four movements, scored for full orchestra and cast in sonata form. Beethoven's nine symphonies represent probably the highest peak in the development of this genre.

Introduction

Ludwig van Beethoven (16 December 1770 – 26 March 1827) was an enormously productive and influential German composer and one of the supreme creative personalities of all time. He is widely regarded as one among the greatest composers in the Western classical tradition. Informally, Beethoven has been ranked the 45th most influential person in *all* of human history, the only composer and one of only three artistic figures among the top 100. Besides being the subject of numerous biographies and critical studies, he has served as the subject of a case study for psychological inquiry, including historiometric studies in which archival data are used to test hypotheses about the nature of creativity and eminence.

This article is divided into two major sections. The first outlines Beethoven's life, career, and works. The second addresses several outstanding contemporary issues in the psychological study of creativity, where the life of Beethoven is particularly illuminating.

Life, Career, and Works

Beethoven's Life in Bonn and His Earliest Works

Ludwig van Beethoven was born in Bonn, Germany, probably on 16 December 1770, and was the oldest surviving child of Johann and Maria Magdalena van Beethoven. Beethoven adored his mother. His father, a tenor at the Electoral Court in Bonn who also taught piano, was a harsh disciplinarian and an alcoholic, which eventually led to his dismissal from the Court post. However, he began to impart his musical knowledge to his son as early as 1774, and Ludwig progressed rapidly enough to give a public performance on the piano in Cologne on 26 March 1778. The following year, he began lessons with Christian Gottlob Neefe, who became his role model and

taught Beethoven the rudiments of composition, even introducing him to Bach's then largely unknown Well-Tempered Clavier. Neefe, who instructed Beethoven throughout the 1780s, recognized his enormous talent, prophesying as early as 1783 that he could become a second Mozart (who was then only 27 years old!).

While not as precocious as Mozart (who was?), Beethoven excelled as a performer and began composing while still a child. His earliest surviving works, published in 1782 and 1783, were short piano compositions. Beethoven was not a prolific teenage composer, but he explored vocal and chamber forms; perhaps his most ambitious early work is a Piano concerto in E flat, WoO 4, written at the age of 13. A high point of Beethoven's early life was his journey to Vienna and meeting with Mozart in the spring of 1787. There are conflicting reports about whether Mozart actually heard Beethoven play. In any case, Beethoven was soon called back to Bonn because of his ailing mother, who died that July. He was unable to return to Vienna until after Mozart's untimely death in 1791.

In his late teens, Beethoven continued to develop as a pianist and gained experience as an orchestral violist, but wrote very little music – a hiatus that remains unexplained. By 1790, however, Beethoven got the opportunity to compose two cantatas scored for chorus, vocal soloists, and orchestra; one, the Funeral Cantata for Emperor Joseph II, WoO 87, was, at three-quarters of an hour, his longest work to date. These compositions, particularly the *Joseph* cantata, mark a considerable advance and foreshadow many aspects of his later works, especially those of his 'middle' period, 15 years later. Apparently unperformed in Beethoven's lifetime, the cantatas disappeared but were rediscovered in 1884; the great composer Johannes Brahms, one of the first to examine the *Joseph* cantata, exclaimed that it could only have been written by Beethoven. Once he had started, Beethoven was able to sustain, diversify, and develop his compositional output unabated for at least

two decades. Indeed, not too long after resuming regular composition, in 1792, he composed a set of variations for piano trio, later published as Op. 44, now recognized as his earliest contribution to the standard repertoire.

The Works of Beethoven's Early Period and the Onset of Deafness

By November 1792, shortly before his father's death, Beethoven was ready to move to Vienna, Europe's musical capital. There he pursued a career as a pianist and studied composition with Franz Joseph Haydn, then 60 years old and the most eminent musician in Europe, whose greatest successes were yet to come. Interestingly, Beethoven appears to have been deficient in certain aspects of musical technique when he arrived in Vienna. His study with Haydn involved hundreds of elementary counterpoint exercises, wherein Beethoven made quite a number of 'mistakes,' corrected by Haydn – but which in some cases became characteristic features of Beethoven's own style. The relationship between the two was complex and ambivalent. For instance, they disagreed over the merits of Beethoven's Piano Trio in C minor, Op. 1, no. 3. Beethoven once claimed that he never learned anything from Haydn, and did not seem to regard Haydn as a composer quite of the caliber of Mozart, Bach, or Handel. However, Beethoven dedicated his Op. 2 piano sonatas to Haydn and later spoke of him with respect. Haydn clearly recognized the enormous, if somewhat untamed, talent evident in the young Beethoven.

Haydn left Vienna for a long sojourn in London in 1794. Throughout the rest of the 1790s, Beethoven sought out new teachers to complete his musical training. With Albrechtsberger, he reviewed the fundamentals of counterpoint before tackling more advanced topics; with Foerster, string quartet composition; and with Salieri, multi-part vocal composition and Italian word-setting. Beethoven also made a name for himself as a performer, becoming one of the most renowned pianists in Vienna, known especially for his ability to improvise.

Beethoven also absorbed the influence of other composers during his twenties. While Haydn's formal instruction did not leave a strong mark on Beethoven, Haydn's own music did, in virtually every aspect of his composition. Equally important was the influence of Mozart, on whose music Beethoven directly modeled a number of early works, including three early Piano Quartets, WoO 36, the Piano Quintet with Winds, Op. 16, and the Third Piano Concerto, Op. 37, of 1800. For his piano sonatas, Beethoven found models in Clementi, Dussek, Cramer, and others of the 'London Pianoforte School.'

Beethoven's early Viennese compositions included many modest works: piano variations designed to showcase his own virtuosity, dances, songs for voice and piano, and chamber music, particularly for winds. Alongside such ephemera, Beethoven worked hard to master the large-scale genres of which he would eventually become the supreme exponent. By his mid-twenties, he had completed his Op. 1 Piano Trios, Op. 2 Piano Sonatas, Op. 5 Cello Sonatas, as well as his first two numbered Piano Concertos, Opp. 15 and 19 – the latter of which was revised multiple times, probably from an earlier work. Around this time, he also sketched a symphony but then abandoned it. Virtually all of these compositions are on a very ambitious scale – the Op. 1 trios average almost 1100 measures

each – and expanded the scope of the musical argument to the limit of Beethoven's models.

While Beethoven hit his compositional stride later than Mozart, he was by no means a late bloomer. By the age of 27, he was already a major success, and his reputation as a preeminent pianist and rising composer of great note was secure. In addition to the major works listed earlier, by 1798 he had written the Op. 9 String Trios (which he considered his best work until then), the three Op. 12 Violin Sonatas, eight or so more piano sonatas (including the famed 'Pathétique,' Op. 13), and had started on one string quartet of his Op. 18 series. His musical abilities allowed him to move rather freely in aristocratic circles, and he acquired a number of supporters from the nobility. Unlike earlier composers, for whom official patronage was necessary simply to earn a living, Beethoven was able to operate more or less autonomously as a creator and performer – which gave him greater freedom to compose the kind of music he liked.

In the midst of this success, Beethoven showed the first signs of hearing loss. His first mention of deafness dates back to June 1801, when he noted that 'for the last three years my hearing has become weaker and weaker.' The cause has never been conclusively determined. In any case, it took years for his hearing to deteriorate fully, and it was not until his early to mid-forties that he was virtually completely deaf. In that span, encroaching deafness played a major role in shaping the direction of Beethoven's life and career. Obviously, it made socializing with friends more difficult and romantic relationships even more so. His capacity as a pianist would gradually decline to the point where he could no longer give a public performance. In the famous Heiligenstadt Testament, a letter written on 6 October 1802, Beethoven revealed depths of despair verging on suicidal.

Fortunately, given the circumstances, one aspect of his life that did not deteriorate with his hearing was his ability to compose. In the interval between the onset of his hearing loss and the Heiligenstadt Testament, Beethoven's productivity had not diminished. He had completed a number of works on par with the finest compositions by Mozart and Haydn, including his first two symphonies, Opp. 21 and 36, the Third Piano Concerto, Op. 37, the six String Quartets, Op. 18, the ballet *Die Geschöpfe des Prometheus*, Op. 43, five more Violin Sonatas (up to those of Op. 30), more Piano Sonatas, up to Op. 31, plus a host of other major and minor works. Especially in his piano sonatas, by then numbering some 20 works, Beethoven had shown unprecedented audacity of formal experimentation. With Haydn's retirement around 1802, Beethoven was poised to become the preeminent composer of the new century.

Beethoven's Heroic Middle Period and the Transition to His Late Style

Shortly after the catharsis of Heiligenstadt Testament, works on an unprecedented scale began to appear – especially the Third Symphony, Op. 55, subtitled the 'Eroica' (Heroic) and originally dedicated to Napoleon, the 'Waldstein' Piano Sonata, Op. 53, and the 'Kreutzer' Violin Sonata, Op. 47. The time from about 1803 until about 1813 comprises Beethoven's

so-called 'middle period,' during which he was as great as any composer has ever been. Without exaggeration, this decade marks one of the most astonishing periods of sustained creative productivity in all of Western culture. In this span, despite steadily worsening hearing, bouts of ill health, and a rather tempestuous love life, Beethoven produced his Third through Eighth Symphonies, his last two Piano Concertos, Opp. 58 and 73, the Violin Concerto, Op. 61, five String Quartets, Opp. 59, 74, and 95, the first version of his opera 'Leonore' – later revised as 'Fidelio,' Op. 72 – plus a dozen or more masterly piano and chamber works, overtures, incidental music, and some of his finest songs.

While the middle period works opened up new vistas of extended thematic development and intense emotional expression, they built upon the forms and structures of the Classical style Beethoven inherited, rather than rejecting them. This is the case even when the novelty of Beethoven's style is most apparent – as in the enormous scale of the 'Eroica,' which is half again as long as any previous symphony; the famous four-note opening of the Fifth Symphony, Op. 67, whose development gives the work an unprecedented degree of thematic cohesion; and the programmatic depiction of nature in the Sixth ('Pastoral') Symphony, Op. 68, which is nonetheless expressed using standard musical syntax and forms.

Compared to the preceding decade, the years 1813 to 1817 were far less productive, both in quality and quantity. Beethoven wrote only one or two works a year that have since entered the regular repertoire, all on a smaller scale than their predecessors. Alongside these works are a host of ephemera, including Wellingtons Sieg, Op. 91, probably the most vacuous thing Beethoven ever wrote (though he was clear about its meretricious origins) and the bombastic cantata, *Der glorreiche Augenblick*, Op. 136. Throughout much of this time, Beethoven was caught up in legal proceedings to gain custody of his nephew Karl, which surely took away from his time and energy for composition. Meanwhile, his almost total deafness continued to isolate him from most of society.

However, like Beethoven's earlier compositional hiatus, the fallow season of his mid-forties presaged a major creative outburst. At a time when Vienna abounded with gossip that Beethoven was 'written out' and when Rossini's showy operatic music had replaced Beethoven in popular acclaim, he bided his time, studying the music of Renaissance and Baroque composers and groping toward a new style.

Beethoven's Late Period

The first works presaging Beethoven's new style were the two Cello Sonatas, Op. 102 (from 1815), and the Piano Sonata #28, Op. 101 (from 1816), which show an increased involvement with the contrapuntal and fugal treatment of musical material. Beethoven's late style arrived with a vengeance with the massive Piano Sonata #29, Op. 106, known as the 'Hammerklavier.' Written mostly in 1818, it takes 50 min to perform, twice that of even his greatest earlier piano sonatas. The Hammerklavier also has a textural roughness, structural complexity, and contrapuntal concentration far beyond any of his previous works. Beethoven justly considered this sonata to be his finest. Interestingly, months after sending it to the publisher, Beethoven

added a single introductory measure to the long slow movement, an indication of the care he took with the compositions he valued.

Though the Hammerklavier already embodied Beethoven's late style, it took some time for his absolute level of productivity to return to earlier levels. Preoccupied by plans for several major works, including what would become the *Missa Solemnis* and the Ninth Symphony, as of mid-1821 he had managed to complete only one additional significant composition, the Piano Sonata #30, Op. 109. By then, Beethoven's creative process had changed from sketching a main melodic line and only later filling in the other parts to one in which he wrote out numerous voices simultaneously in 'short score' – consistent with his renewed preoccupation with counterpoint and fugues.

By the start of 1822, Beethoven had again got into his stride, finishing what would be his transcendent final two Piano Sonatas, Opp. 110 and 111, the piano Bagatelles, Op. 119, and the Handelian Consecration of the House Overture, Op. 124. The year 1823 saw the completion of two of Beethoven's grandest achievements. One was the *Missa Solemnis* in D, Op. 123, a grand choral mass begun in 1818 or 1819. This was the most direct fruit of his study of earlier composers, and Beethoven himself regarded it as the greatest of all of his works. The second, for piano, was the 33 Variations on the Theme of Diabelli, Op. 120, which he started in 1819 as a relatively modest work. Four years later, it had evolved into an hour-long microcosm of Beethoven's art. Each bears comparison with only one other work in the entire history of music – respectively, Bach's B Minor Mass and Goldberg Variations. The other composition on which Beethoven labored intensively in 1823 and finished early in 1824 had no precedent in all of music history – the Ninth Symphony, Op. 125. In this work, substantially longer even than the *Eroica*, Beethoven introduced for the first time vocalists and a chorus into a symphony. Regarded by Beethoven as his greatest symphonic achievement, his setting of Schiller's 'Ode to Joy' in the finale remains one of his most popular melodies.

After the premiere of the *Ninth* on 7 May 1824, Beethoven focused his energies almost exclusively on the medium of the string quartet. The last quartets (Opp. 127, 130, 131, 132, 133, and 135) are often regarded as the greatest music ever written. In 1826, the last full year of his life, Beethoven's creativity remained at its height, despite the devastating suicide attempt of his ward and nephew Karl on 6 August. He completed the astonishing *Grosse Fuge*, Op. 133 – the most stylistically ahead-of-its-time work of his entire career. He also composed the String Quartet in C-sharp minor, Op. 131 – a work whose seven linked movements represent an unprecedented degree of formal experimentation, which Beethoven probably considered his greatest string quartet. In addition, he completed his enigmatic final quartet, Op. 135, and uncharacteristically wrote a new, more conventional finale for the String Quartet in B-flat major, Op. 130, replacing the *Grosse Fuge*.

The substitute finale was sent to the publisher on 22 November 1826. Around this time, Beethoven began to sketch a String Quintet, WoO 62. On December 4 or 5 he wrote the short canon *Wir irren allesamt*, WoO 198, his last composition. Shortly thereafter, he fell ill with dropsy and jaundice, was confined to bed for the last four months of his life, and endured several painful operations to reduce abdominal

swelling. Still eager to compose, he studied the works of Handel and promised the Philharmonic Society of London an apparently already-sketched symphony (the fabled Tenth) just eight days before his death. During a thunderstorm on the late afternoon of 26 March 1827, Beethoven raised a clenched fist, stared defiantly, and died. Three days later, more than ten thousand Viennese attended his funeral.

Beethoven's Position in Music History

Beethoven's position in music history is absolutely central, both in terms of eminence and the standard chronology. Among composers his reputation is unparalleled. Chronologically, Beethoven is almost exactly in the middle of the historical span comprising the standard classical repertoire. He assimilated much of the earlier music in the tradition he inherited, bringing unsurpassed technical mastery and experimentation to the intense expression of personal emotions, and in the process reaching one of the highest summits of that tradition. His impact on later composers, for over a century, was almost immeasurable. Today, beyond his eminence in music, Beethoven is a universal popular icon: his name, melodies, struggle with deafness, and even his unkempt hair are known to virtually every person in the world with access to print or other media.

Beethoven and the Study of Creativity

How Can Beethoven's Creativity Be Understood?

Ludwig van Beethoven is one of the most amazing creative personalities of all time. How can one explain his almost superhuman creative achievement? As he was the harbinger of Romanticism in Western music, it is tempting to view him as a Romantic or genius, denying that Beethoven's creativity can ever be meaningfully explained or understood. Indeed, the case of Beethoven provides as rich and difficult a challenge to creativity researchers as can be imagined. Without dismissing the question of Beethoven's creativity as unanswerable – or pretending to give a complete answer – I will use Beethoven to illustrate some themes of contemporary creativity research, as he is a particularly illuminating figure.

While Beethoven's creative achievement is unsurpassed, most of the particular factors that contributed to his achievement are not unique. Contemporary research has established the principle that creativity emerges from many factors interacting in complex, multiplicative ways. As some have noted, this yields the typical strongly positively skewed distribution of world-class creative achievement, with the vast majority of people huddled at the bottom, and a few outliers like Beethoven soaring far above them. So while there is no unitary explanation undergirding Beethoven's creativity, its constituents can be identified and understood.

A number of factors contribute to eminence in creative domains. Some of the most relevant presently are the existence of a rich symbolic tradition and socio-cultural milieu which a creator can enter, basic intelligence, the motivation to work hard and overcome adversity, the acquisition of a large body of domain-specific knowledge, the ability to approach a complex problem like musical composition in new and powerful ways,

the productive fluency to generate a large number of ideas, and the ability to judge and evaluate ideas as they are elaborated into finished works. Each is now discussed in turn.

External, Socio-Cultural Factors

Some of the factors influencing Beethoven's creativity lie outside Beethoven himself. Simply put, he was born in a time and place with an extremely well-established and valued musical tradition. The already-rich symbol system of Western music had developed throughout the eighteenth century, particularly among German-speaking composers. The socio-cultural infrastructure for patronage, performance, and publishing was also firmly in place. Beethoven's father was part of that milieu, and Beethoven himself was able to enter it at an early age.

Beethoven's progress through his socio-cultural system echoes that of many eminent creators. Prototypically born away from the main center of activity, they show early talent, are given initial tutelage, progress through a series of increasingly qualified teachers, and come to master their domain, though bristling somewhat at its restrictions. Ambitiously setting out to make a name for themselves, they then move to the geographical center of excellence in their domain, get to know the right people, after at least a decade of intensive work make a revolutionary breakthrough, and thereafter require another decade or so to make additional significant breakthroughs. Beethoven fits this profile quite well, in terms of his birth in Bonn, his early training, his move to Vienna, his networking among musicians and nobility, and the timing of his creative breakthroughs, namely, his first masterworks and the transitions to his middle and late periods.

A key point is the importance of luck and social contacts in facilitating creativity. For instance, his teacher Neefe likely introduced Beethoven to Haydn as the latter passed through Bonn, setting the stage for their Viennese association which helped launch Beethoven's compositional career. Beethoven was also lucky in receiving patronage and support from the nobility, even early on. This basic trajectory reinforces the importance of external, socio-cultural factors for a full accounting of creativity, particularly in getting to know other members of the field and taking advantage of opportunities when they arise.

Intelligence, Expertise Acquisition, and Motivation

Besides such external factors, Beethoven was clearly endowed with a number of personal characteristics that contributed to his creativity. I will focus on three inter-related factors: basic intellectual power, the acquisition of a vast domain-specific knowledge base, and the motivation to work extremely hard and overcome adversity.

Intelligence

Beethoven's basic intelligence was quite high. Estimates of his IQ give a figure around 150, putting him in about the upper one-thousandth of the population (though it should be noted that there is no reliable way of precisely estimating the IQ of deceased historical figures). While IQ and creative achievement appear to be correlated only up to around an IQ of around 120, many eminent historical personalities do appear to have had

very high IQs. Thus, while having a high IQ is no guarantee of being creative, it has been argued that a creative person with a high IQ should be able to accomplish more than a creative person with a lower IQ.

However, IQ is arguably a coarse measure of information processing. Other researchers have proposed other models of multiple intelligences. Of these, musical intelligence is clearly the most relevant to Beethoven. It has also been argued that it is not only one's primary intelligence that shapes a creator, but also the strengths and weaknesses among the other intelligences. Beethoven likely had strengths also in kinesthetic intelligence (e.g., in performing on the piano), intrapersonal intelligence (being adept at self-reflection), and to some extent, verbal intelligence (writing many high-quality letters). In contrast, his often rude manner and difficulty in maintaining social relations suggest a deficit in interpersonal intelligence; quantitative and visual-spatial intelligences are not salient either way.

Expertise acquisition and motivation

However Beethoven's basic intellectual capacity is conceptualized, it would have resulted in nothing without the willingness to channel his energy into the domain of music and work extremely hard at it, even in the face of major adversity, such as increasing deafness (In line with some conceptualizations of high ability, I include motivation as an intrinsic component of expertise acquisition). One vital basis of Beethoven's achievement was his early and continued acquisition in the domain of music. Numerous studies support the view that immense amounts of domain-specific knowledge are critically important for high-level performance and creativity. For instance, individual differences in conservatory-level music performance ability are largely attributable to the total amount of 'deliberate practice' engaged in. Similarly, even the greatest classical composers follow the so-called 'ten-year rule,' whereby even great creators require an apprenticeship of at least ten years of intensive immersion in a domain before producing original works of lasting value. Only three exceptions to the ten-year rule have been found, and each produced their first hit shortly before their tenth year of study.

In Beethoven's case, ten years is a conservative estimate. Rudimentary instruction started at the age of three or four; more rigorous training commenced around the age of eight, after he had already given a public performance; Beethoven began composing at the age of 11 or 12. However, his earliest works that are still regularly played were written only in his early twenties, and only by his mid-twenties did Beethoven begin producing masterworks on a fairly regular basis. Thus, almost 20 years elapsed between Beethoven's initial exposure to the domain of music and the production of the music that would establish his reputation. (Note, however, that this timeline is complicated by his teenage hiatus in composition.) These career landmarks are more or less on par with that of a sample of ten elite composers, including Beethoven.

Importantly, throughout his career, Beethoven continued to learn. Even though he was already composing masterworks in his twenties, he sought out teachers to develop areas that he felt needed work – such as vocal writing and the difficult medium of the string quartet. Later, especially to prepare for the *Missa Solemnis*, he combed libraries for old music and

treatises on liturgical procedures and immersed himself in the religious music of earlier composers – Palestrina, J. S. and C. P. E. Bach, and Handel.

Thus, throughout his entire career, Beethoven worked to develop an almost unparalleled depth of musical knowledge, probably among the highest in the world. This point is worth noting since a contentious issue in the study of creativity concerns the question of whether 'too much' knowledge can entrench a creator in an outmoded way of working and thus interfere with the production of original ideas. In principle, one can imagine an unknown pedantic contemporary having amassed more musical knowledge than Beethoven. Realistically, however, it is hard to think of another composer in Beethoven's time who had studied as much music – even beyond his own contributions expanding the domain itself. Also notable is Beethoven's idiosyncratic knowledge of Renaissance and Baroque styles of composition, which may represent a 'fruitful asynchrony' with his domain at that time.

Beethoven's Creative Process

Despite its importance, domain expertise is a necessary but not sufficient condition for creative achievement, and there are important differences between expertise, viewed as superior reproducible performance on well-defined problems, and the production of original works. Also important in Beethoven's case was his ability to improvise on the piano, indicating not just a mastery of familiar patterns, but also an ability to flexibly and readily deploy them in new combinations. This suggests some of the cognitive processes needed for meaningful creation. These include the ability to approach or represent a complex problem like musical composition in new and powerful ways, the productive fluency to generate a large number of ideas, and the ability to develop and evaluate ideas as they are elaborated into finished works. The first set of processes, on how to approach the problem of musical composition in general, guides ideation and elaboration in important ways. The latter two roughly map onto the two basic regimes of creative thought postulated by contemporary researchers: generating ideas and exploring their implications.

Beethoven's conceptualization of writing music

How did Beethoven conceptualize the problem of writing a piece of music? Interestingly, his approach differed from those of his predecessors and contemporaries in several key ways, beyond his deep, idiosyncratic knowledge base and acquired technical skill. Beethoven regarded art as an elevating force and the artist as attempting to raise mankind upward; thus, works could always be improved, and new works could surpass old ones to create a sense of progress. In line with this attitude, more than any previous composer, Beethoven was willing to rework musical material. He would routinely sketch many variations of a particular theme before selecting one to develop. Interestingly, while many of Beethoven's melodies are very famous, they are also among the least original in the standard repertoire. Thus, while Beethoven's emphasis was partly on generating musical ideas, he seemed more concerned about the potential for elaborating them – an emphasis consistent with the kinds of large-scale 'sonata form' works (like symphonies, piano sonatas, and string quartets) in which

he excelled. Finally, Beethoven also brought to his work extra-musical associations – literary, political, and nature-related – as well as a very strong moral element, in keeping with his ultra-serious sense of the purpose of art. This latter characteristic is most apparent in the exemplary moral message of his opera ‘Fidelio’ and his disparaging comments about the licentiousness of the texts (though not the music) of some of Mozart’s operas.

Idea generation and overall productivity

Beyond this, the origins of Beethoven’s ideas remain mysterious – a more general unresolved issue in the study of creativity. However, his fluency in combining patterns and generating ideas resonates with contemporary theories of chance conceptual combination. The basic capacity to generate ideas has traditionally been seen as a central aspect of creative thought. Indeed, from a historiometric perspective, the construct of creative potential is best approximated by simply examining total output, since great creators are almost always extraordinarily productive of ideas and works.

Consistent with this view, Beethoven’s productivity was quite high in absolute terms. In a recent tabulation of composer productivity, Beethoven was found to have written about 4902 minutes of original music (not counting arrangements or exercises). Over a career span of 45 years, this amounts to an average of 108.8 minutes of music per year – or a minute of music every few days, for almost half a century (though this is something of an underestimate, as it excludes drafts, does not account for orchestration, and includes unproductive years). When Beethoven’s annual productivity is tabulated (as can best be determined, given uncertainty in dating some of his works), his most productive period was between 1795 and 1806, during which he averaged about 216 minutes of music per year. His peak output occurred in 1795 and 1802, with 348 and 306 minutes of music, respectively. Thus, contrary to the stereotype of Beethoven painstakingly reworking his music over protracted durations, he was not invariably a slow worker and could write quickly when necessary: the 15-minute Sonata for Horn and Piano, Op. 17, was written allegedly in one day. Also, the overall career trajectory of Beethoven’s raw output resembles the inverted, backwards J-shaped age curve characteristic of many creators, with an added final upswing at the very end, reflecting the so-called ‘swan song’ phenomenon.

Creating masterworks: Elaboration and evaluation

An important part of Beethoven’s musical legacy was to raise the stakes for each major work; after him, the mass-production of historically earlier composers was simply not tenable. Perhaps partly because he traded quantity for quality, or because he was not hampered by official patronage, he also managed to produce a very high proportion of ‘great’ music. When masterworks are defined by a listing of works comprising the standard repertoire, some 67% of Beethoven’s music (measured by performance time) qualifies; a measure based on citations in a number of music history books yields a figure of 57%. This is far above any earlier composer, and only a few later composers have higher lifetime averages. Moreover, very importantly, Beethoven’s hit ratio (proportion of great music to total music, written in a given age interval) reliably increased over the course of his career, even when the analysis was restricted to the time after he had shown himself able to produce masterworks.

Such results suggest that Beethoven’s ability to judge the quality of his musical ideas and works was strong and likely improved with experience. Recent research has directly examined the question of the accuracy of Beethoven’s self-evaluations. Explicit self-criticisms of 70 compositions were found in Beethoven’s letters or conversations, spanning his whole career and most musical forms. Results showed that his positive or negative assessments were reliably associated with three posthumous citation measures of aesthetic success, and the likelihood of correct decisions strongly increased with age. Beethoven’s comments comparing several similar masterpieces were likewise largely consistent with expert ratings and recording counts. Finally, the ranking of works by listener-hours (number of complete recordings multiplied by performance duration) corresponded closely with his intra-genre preferences. The results suggest considerable self-critical acumen on Beethoven’s part, and they support a view of creativity in which knowledge and experience enable progressively greater creative accomplishments and sounder self-criticism.

Beethoven’s creative wisdom, coupled with the complexity and frustrations of his creative process evident from his sketchbooks, suggests a creative style that might seem self-contradictory. However, such characteristics have been consolidated into a particular type of creator, namely, experimental innovators, who are distinguished from conceptual innovators. Conceptual innovators show great certainty throughout the creative process, revise little, rebel against tradition, and typically produce their best work early in their careers. In contrast, experimental innovators struggle to create through trial and error, revise a lot, build on earlier traditions, and typically produce their best work late in their careers. While Beethoven made major musical innovations by his early to mid-thirties, as expected of a conceptual innovator, he also showed more characteristics prototypical of experimentalists, including creative processes marked by uncertainty and revision and a reliable increase in hit ratio and self-evaluation ability as he got older. Even at his most revolutionary, as in the transition to his middle period, Beethoven built on his and others’ earlier achievements, and a considerable continuity of style and musical concerns runs through his output.

Conclusion

Beethoven is as rich a case study for the investigation of creativity as one can imagine. Awe-inspiring as his creative achievement is, the psychological and social factors that made his creativity possible are not unique or exotic. Rather, it is their simultaneous combination in one person that is unusual. Moreover, available evidence supports the importance of considerable rationality in his creative process – witness his astute self-evaluation and capacity to improve his hit ratio with age. Beethoven’s ability to consolidate and develop the rich musical tradition he inherited, through the relatively novel means of a ruthlessly self-critical and revision-laden creative process, constitutes one of the most interesting studies in the history of human creativity. His success in harnessing the chaos of nascent ideas into an unprecedentedly coherent and expressive musical architecture, despite the burden of deafness, also gives strong cause for optimism in the creative potential of

humanity. No doubt Beethoven will be a touchstone for investigating the nature of creativity for as long as that enterprise persists.

See also: Eminence; Expertise; Historiometry; Intelligence (as Related to Creativity); Multiple Intelligences.

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- <http://www.arkivmusic.com/classical/main.jsp> – Arkiv Music – all currently available recordings of Beethoven's music, available for purchase.
- <http://imslp.org/> – International Music Score Library Project – electronic versions of musical scores available online.
- <http://www.gutenberg.org/etext/13065>.
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Behavioral Approaches to Creativity

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Glossary

Behavior What an individual does. What is done, and how often, depends on the consequences of the behavior.

Constraints Tools for (re)structuring problem spaces. Paired contingencies, one precluding (punishing) and the other promoting (reinforcing) search in separate, specific parts of the space.

Creative behavior Doing something that is new and useful, generative, or (at the highest levels) influential.

Problem spaces How problems are conceptualized by solvers. A problem space has three parts: an initial state, a goal state, and a search space in which to construct a

solution path. If all the parts are specified, the problem is well-structured. If not, it is ill-structured. Creativity is only possible in ill-structured problems.

Punisher A consequence that decreases the frequency of the behavior that produces it.

Reinforcer A consequence that increases the frequency of the behavior that produces it.

Solution by substitution Step-by-step restructuring of a problem space.

Variability How differently something is done. Creative behavior is associated with high variability.

Behavioral is a term associated with classic operant concepts. This article combines operant and problem-solving paradigms that share variation/selection processes and problems. Given creative behavior as a goal, a common problem is getting 'stuck' in successful (because they have been selected) behaviors. Solutions (variability and constraint selection) to this and other creativity problems are proposed.

Behavioral and Problem-Solving Paradigms

The basic behavioral model involves responding that is conditioned or learned. The content of the learning is a three way association between context, response, and consequence. The standard problem-solving model is an analogue with a more accessible vocabulary. This section focuses on parallels between the two paradigms.

Structural Similarities

Operants and operators

As shown in [Table 1](#), the shared structure has three parts: context, behavior, and consequence. In behavioral terms, this is an operant; in problem-solving terms, an operator.

With operants, the context is called a discriminative stimulus (S^d). In the presence of an S^d a particular response (R) leads to a predictable consequence. If the consequence increases the frequency of the response, it is called a reinforcer; if it decreases the frequency, it is called a punisher. Operators take the form of condition-action or 'If . . . then' rules. The context or condition is specified by the 'if,' the action by the 'then,' and the consequence, by the goal or sub-goal. Given a concrete example, the similarities should become clearer. Imagine then a driver approaching an intersection where the traffic light has just turned red. The discriminative stimulus/condition is the red light; the appropriate response/action is stopping the car; the consequence/goal

is not causing an accident. (This kind of consequence is known as a negative reinforcer: something bad (the accident) has been avoided.)

Response classes and default hierarchies

Both operants and operators are organized hierarchically: the most successful response or rule is found at the top. Low probability responses, including creative ones, appear after more likely, higher-in-the-hierarchy, responses. A response class is a set of operants, all of which lead to the same consequence. The response which has been reinforced most often occurs most often. A default hierarchy is a set of operators, all of which lead to the same goal or sub-goal. The default is the rule with the most general condition (which makes it the most successful); exception rules, which are lower in the hierarchy, have more specific conditions. Signaling the direction in which a driver is going to turn at an intersection provides an example here. Assuming that the car's directional signal is functional, the driver turns it on to blink left or right. This is the response that has been most successful most often in the past. It is the default rule. However, if the condition has changed (the blinker is malfunctioning), the driver can open the window and signal with his/her arm. This is the exception rule.

Functional Similarities

Variation and selection

Creativity in both paradigms depends on selection from a variable substrate. In Donald Campbell's operant model, 'blind' variants (arising via trial and error, chance, or accident) 'stumble' into the selection criterion. In Herbert Simon's problem-solving model, creativity involves specifying a novel goal criterion for an initially ill-structured problem. (An ill-structured problem is one in which all the information required for solution is not specified.) In Walter Reitman's and Patricia Stokes' versions, selection focuses on paired constraints that limit and direct search for a solution path.

Table 1 Comparison of behavioral and problem-solving structures and terminology

Models	Context	→ Behavior	→ Consequence
Behavioral	Discriminative stimulus	→ Response	→ Reinforcer or punisher
Problem-solving	If this condition	→ Then this action	→ Goal or sub-goal

In Mihaly Csikszentmihalyi’s model, the selectors (gatekeepers) rather than the selection criteria are specified.

Recombination and restructuring

Creativity occurs when responses/rules are reorganized in novel ways to meet and/or define selection criteria. In behavioral terms, responses are recombined; in problem-solving terms, problem spaces are restructured. This section considers recombination: restructuring is covered later.

Two things important to recombination are context and expertise. Context plays a pivotal part because responses activated at the same time are readily available for recombination. Expertise, in turn, enhances a domain-relevant repertoire: the larger the repertoire, the greater the number of combinatorial possibilities. Expert repertoires include skills (what the individual can do), and styles (what others have done). What-others-have-done become sources that the expert works with (adopts/adapts) or against (rejects/replaces).

Selection and recombination: still-life

To reiterate, available for selection and recombination are skilled and stylistic elements in the expert’s repertoire. The expert here is an unknown artist (Anonimo) who paints realistic still-lives. The context (which cues the artist’s responses) includes, at minimum, set-up (objects), medium (paints), and surface (canvas): the painter’s skill limits the ways in which the three can be manipulated. **Table 2** includes some of these: choosing and combining alternatives from each category (rather like a Chinese menu), the painter stretches a large, coarsely textured, rectangular canvas on which he draws a cartoon of three objects lined up, close-up, and at eye level. **Table 2** also includes two well-known painters whose styles strongly influence his. A cartoon-version of his painting, rigid in composition, but riotous in color, is presented in **Figure 1**.

Selection as Problem

While the above analysis can identify combinations specific to an artist’s style, it cannot tell us how or why they were selected: this is the criteria problem. It is one of three associated with selection. The other two are related to variability.

- **Problem one.** The criteria problem: identifying how and why elements are selected and combined.
- **Problem two.** The variability per se problem: while creativity requires variability, selection reduces it.
- **Problem three.** The successful solution problem: since selected (rewarded) responses increase in frequency, experts get stuck in successful solutions.

Table 2 Combinations in still-life painting

Context	Giorgio Morandi	Wayne Thiebaud	Anonimo
Objects			
Arrangement	In a row	In rows	In a row
Distance	Mid-distance	Mid-distance	Close-up
Viewpoint	Above	Above	Eye-level
Canvas			
Surface	Smooth	Smooth	Rough
Shape	Rectangular	Rectangular	Rectangular
Size	Small	Mid-size	Large
Paint			
Hue	Monochromatic, local	Multiple, expressive	Multiple, decorative
Intensity	Muted, mixed	Bright, mixed	Bright, primary
Value	Low-contrast	High-contrast	High-contrast
Outlines	Blurred	Multipled	Sharp-edged

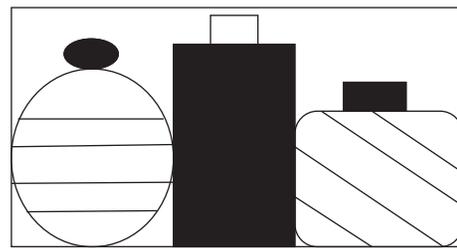


Figure 1 Cartoon version of still-life. (The hues are blue, green, black (shown) and yellow. Imagine that the stripes on the outside bottles are cadmium green; the bodies, ultramarine blue. The middle bottle is black; its cap is ultramarine. The negative space (background) is cadmium yellow.) The drawing was created by the author.

Solutions to the problems are suggested by the variability and problem solving literatures.

Selection as Solution

Selecting Variability Levels

Habitual variability levels

Variability, like other aspects of behavior, is the product of reinforcement history. Levels (high or low) associated with early success (in specific domains) are selectively maintained aspects of skilled responding. Put another way, learning how to do something includes learning how differently to do it. The *how* is the skill; the *how differently* is the habitual variability level, an individual’s preferred performance range in which responses differ from each other. Note that these are the two things (expertise and variability) on which creativity depends.

Importantly, while skills remain malleable (repertoires can be expanded and performance perfected over time), habitual levels do not. Pressure to regain a habitual level arises from the discomfort of either anxiety or boredom: the former when variability requirements are too high; the latter, when they are too low. If boredom or anxiety motivates an individual to regain a habitual level, then variability shifts due to changed contingencies should be – and are – transitory. For example,

variability increases temporarily when new strategies are acquired by children, when novel contingencies are encountered late in training by college students, when novice-to-expert transitions occur in adults. After the new contingency is mastered, variability returns to its 'normal' level.

Training

Protocols known to establish high habitual levels include variability practice, difficult discriminations, and incomplete instructions. In these protocols, early tasks are difficult enough to require trying many things, but not so difficult that high variability is punished rather than rewarded. Compared to their opposites (consistent practice, easy discriminations and complete instructions), acquisition appears less effective (more errors are made, more time is taken), but retention and transfer are superior (high variability facilitates further learning as well as transfer by directing attention to contingency changes). Lag and frequency-dependent schedules function in similar manner. Lags specify the number of prior responses from which a current response must differ. For example, in a computer maze game, college students and fifth, but not first, graders easily master lags of ten. This means that points only accrue for paths through the maze that differ from ten prior paths (the most efficient strategy in this case is to adapt a visual algorithm in which every path shifts in a systematic fashion). Frequency-dependent schedules target less probable/frequent responses for reinforcement. In both cases, whether the effects are short-lived or lasting depends on how early in training each schedule is encountered.

Selecting Constraints

Constraints are search tools; their objects are solution paths in problem spaces. Both are discussed, problem spaces first.

Problem spaces

A problem space is how a problem is conceived by its solver. It has three parts: an initial state, a goal state, and a search space for constructing a solution path between the two. If the problem is well-structured, all parts of the space, including a goal criterion, are specified: the result is a predictable, correct solution. Creativity is only possible with ill-structured problems, which are specified sequentially and strategically. Sequentially means constraint pair by constraint pair; strategically, that the pairs are selected to clarify and satisfy the novel goal criterion.

Constraints

In problem-solving parlance, constraints come in twos: one precludes or limits search in some parts of the problem space, while the other promotes or directs search in other parts. In general, creativity rests on precluding (in operant terms, punishing) reliable, predictable responses, and promoting (reinforcing) novel, unexpected ones. This is, of course, too general to be useful. 'New' is not enough. The to-be-precluded must be particularized, so too its substitute. Thus the focus should be on selecting specific things to preclude (work against) and others to promote (work with) in their places.

Creativity involves four constraint pairings that identify what the individual works with and against. What you work with substitutes for, replaces, what you work against. The four

pairs are source constraints (elements for recombination), goal constraints (overall stylistic criteria), subject constraints (motif or content), and task constraints (materials and their application). An accepted, well-defined style (alternatives to style (applicable to the arts) are model or paradigm (for the sciences)) is typically the initial state of a creativity problem; a novel style with a not-yet-defined criterion is the goal state. **Table 3** simplifies the parts of a creativity problem: subject and task constraint pairs are located in the search space. The initial (the to be precluded style) and the goal (the to be promoted style) states are the pairs that constitute the goal constraint.

Solution by substitution I: drama

Thornton Wilder acknowledged the role of constraints in creativity. 'Form is accepted limitation' is how the playwright put it. **Table 4** presents a small set of Wilder's 'limitations.' The well-defined problem to be restructured was realist drama: its defining characteristics are delineated in the preclude column. Two of its well-known dramatists are Ibsen and Chekhov.

Wilder's initial substitution (abstraction/allegory in place of realism) precipitated, indeed necessitated, the source, subject, and task constraints that followed. Precluding contemporary, realist sources promoted abstract, classical ones: Greek tragedy (the narrator replaces the commenting chorus), Commedia (bare stage, stock characters, pantomime), and Noh (telescoping of time). In *Our Town*, subject and task constraints cascade from a specific abstract/allegorical goal: revealing "the cosmic in the commonplace." The commonplace is the human condition, its unchanging (timeless) cyclical events (the typical) unnoticed (in their particulars) and undervalued (by the

Table 3 Parts of a creativity problem

<i>Initial state</i>	<i>Existing style</i>
Search space	Subject and task constraint pairs Preclude specific elements of the initial state → Promote substitutions
Goal state	Novel style

Table 4 Constraints for Wilder

<i>Category</i>	<i>Constraint pairings</i>
Goal	Preclude realism → Promote abstraction/allegory
Subject	Preclude the particular/limited → Promote the typical/timeless
Task	Preclude climatic form ^a → Promote episodic, didactic form
	Preclude linearity → Promote rearrangement of time
	Preclude illusion, representation → Promote theatricality, presentation

^aClimatic form is linear, multiple pasts to converge at one critical point (the climax) in the present.

living). There is a lesson to be learned, thus the omniscient narrator (informing us of future events, commenting on past and present ones), and the episodic form (focusing, forcing, our attention). (Notice how the pairs produce operators: If the task involves form, then (preclude the climatic and) promote the episodic. Typically, only the promote parts are specified, thus the parentheses.)

Solution by substitution II: art

Max Beckmann’s painting is also mythic and didactic. Its goal was secular: redemption through art. “Autonomy in the face of eternity” is how the artist put it. Redemption precluded realism, identifying features of which appear in the preclude column of Table 5. Substitutions restructured the problem space for realistic painting.

The new mythology was signaled by, cloaked in, symbols of the old. Its sources are sacred (triptych altarpieces; graphic distortions (a good example is Gruenwald’s Isenheim altarpiece); color-saturated, black-outlined, stained glass). Up close, its images (distorted, compressed) are disquieting; from a distance, their saturated colors seduce, their enigmatic figures mystify. Myth requires repetition: a story is told and retold, its variations are recognizable because its elements are limited. Beckmann’s protagonists (king, bellhop, young man, woman), settings (stage, studio, bar) and props (fish, sword, phonograph) appear and re-appear, iconic, ritualistic remnants of the religious.

There are three parallels with Thornton Wilder: first, Beckmann’s pairings (like Wilder’s) are easily interpreted as operators: *if* selecting form, *then* (preclude single panel and) promote/use triptychs; second, Beckmann’s initial substitution (art for religion) directed, dictated, the selection of each subsequent pairing; finally, the scope of Beckmann’s sources, his expertise, like Wilder’s, was encyclopedic.

Summary Conclusion

I conclude by summarizing my proposed solutions to the three problems inherent in selectionist models of creativity. Notice that both are behavioral in the most basic sense, that is, success depends on consequence.

Selecting Variability

If high habitual variability levels are acquired early in skill acquisition, then individual creators will be motivated to

Table 5 Constraints for Beckmann

Category	Constraint pairings
Goal	Preclude redemption through religion → Promote redemption through art
Subject	Preclude the realistic → Promote the mythic
Task	Preclude single panel → Promote triptych
	Preclude naturalism in space, shape, and color → Promote compression, distortion, and saturated, expressive color
	Preclude the individual → Promote the type
	Preclude the obvious → Promote the enigmatic

maintain them. This addresses both problem two (selection reduces variability, unless variability *per se* is selected) and problem three (most experts get stuck in successful solutions, those with high variability levels do not).

Selecting Constraints

Solution by substitution addresses problem one (how and why are elements selected and combined). *How* involves constraint pairs: precluding (punishing) and promoting (reinforcing) specific elements (subject and task constraints) in a to-be-restructured problem space. *Why* involves goal criteria: to be precluded is a currently accepted/successful goal criterion (the initial state) (this is often an artist’s own style: in masters like Monet and Matisse at least three major stylistic shifts occur in a creative career); to be promoted is its not yet specified substitute (the goal state). Subject and task constraints are then strategically selected to specify and realize the new goal. Source constraints provide candidates for the substitution process, which proceeds incrementally, constraint pair by constraint pair.

Returning to our earlier still-life example, the initial state might have been Morandi’s (traditional) or Thiebaud’s (painterly-Pop) style (images of both artists’ painting are easily accessible on Google Images). To replace either, and remain recognizable as still-life, Anonimo’s goal criterion could be characterized as exaggeration. (An alternative would be pattern-making. This would be more convincing if the background were also stripped, vertically). This would be *why* he enlarged the objects, expanded the canvas, painted in primaries. *How* is simple to surmise: select specific elements of existing still-lives (mid-distance, small surface, mixed colors) and their substitutes (close-up, large surface, primary colors).

Concluding Caveat

The preceding ‘solutions’ may seem, to some readers, simple (they are, like all behavioral models, consequential), to others, prosaic (they are, like all problem-solving models, incremental). The caveat is that creativity at the highest levels (at the lowest level, a creative response is appropriate or useful; at the highest, it is influential, altering its domain; in the mid-range, it is generative) depends critically on encyclopedic, domain-based, expertise (look back at Wilder and Beckmann) and high habitual variability levels in the domain of expertise. In this, the gifted are advantaged beyond and by their gifts, which – by accelerating skill acquisition – produce both high variability and expansive repertoires.

See also: Claude Monet 1840–1926; Novelty.

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Alexander Graham Bell 1847–1922

Inventor of the telephone

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ALEXANDER GRAHAM BELL was an inventor best known for the telephone. He was also an accomplished teacher of the deaf who married one of his pupils, Mabel Hubbard. Bell started on his invention career at the age of 11, with a device to remove the husks from wheat. But his major accomplishments were as a telegraph inventor. Initially, he focused on a new form of multiple telegraph, but by 1875 he was working on a device that would produce both speech and musical signals, which he patented in 1876. He spent most of the next decade defending this patent in court; it became the basis for the Bell Telephone Corporation, whose stock made Bell a millionaire. He worked on a variety of other inventions after the telephone, including airplanes, speedboats, phonograph records, and kites, but never again made a breakthrough to equal the telephone. Bell continued to play an active role in teaching the deaf, and also became president of the National Geographic Society and a regent of the Smithsonian.



A portrait of Alexander Graham Bell taken in later life (American Telephone & Telegraph Co.).

Background

Bell was born in Edinburgh, Scotland, in 1847. His grandfather was a teacher of elocution and his father had continued in this business, developing a form of visible speech. Bell and his brothers were trained in this visible speech and gave demonstrations in which their father would write down a sound made by a member of the audience, and the Bell brothers would enter the room and reproduce it. Bell's father also encouraged the brothers to build a model of the human vocal chords. From his family, Bell acquired expertise in speech and audition. In 1866, he became interested in Helmholtz's apparatus for reproducing vowel sounds electromechanically. Bell came to

believe that this device could transmit vowel sounds electronically, a creative error that spurred him to think about using tuning forks to send multiple, distinct tones over the same wire, creating a harmonic multiple telegraph. Unfortunately, Bell's brother, Alexander Melville, died of tuberculosis in 1870. In order to preserve the health of their remaining son, the Bell family moved to Canada that same year. Bell eventually became Professor of Elocution at Boston University in 1873. He continued to experiment with multiple telegraphy, and in 1874 became aware that at least one other inventor was doing very similar work: Elisha Gray. These two inventors each thought the other was stealing his ideas, because their telegraph devices were based on the idea of sending multiple tones over the same wire.

The Telephone

In 1875, Gardiner Hubbard and Thomas Sanders provided funding for an assistant, Tom Watson. On June 2, 1875, while Bell and Watson were trying to transmit multiple distinct tones over a single wire, one of the steel reeds got stuck and when Watson plucked it to free it, Bell heard clearly in the other room a composite tone. He instantly saw that this single reed could be used to transmit speech. This act of serendipity was made possible by Bell's unique background and experience; he alone saw the potential in what for most inventors would have been an annoying error. Bell had Watson construct the first telephone that night. Unfortunately, it did not work very well, but Bell was convinced he had the principle on which speech and telegraphic transmission would be based, and he began to write a patent. The application was filed by Gardiner Hubbard on February 14, 1876.

On the same day, a few hours later, Elisha Gray showed up at the patent office with a caveat for a speaking telegraph. (An inventor could file a caveat to signal his intention to complete an invention and file a formal patent at a future date.) Bell's patent focused on the form of current one would have to use to transmit speech; Gray's caveat focused on a transmitter that used liquid as a medium of variable resistance. Bell's mental model for his device was the human ear; Gray's was a string telephone. The patent and the caveat were thrown into interference, but based on the fact that his patent came in earlier, Bell was awarded a patent on March 7th, 1876.

He did not succeed in transmitting speech until a few days later, and to do it, he used a device that bore a superficial resemblance to Gray's liquid transmitter. This has led to speculation that Bell somehow stole the telephone idea from Gray. Bell did learn from an examiner that his interference with Gray concerned the use of liquid as a resistance medium, and that

may have encouraged Bell to do more experimenting with liquids. In the end, he returned to devices that used a heavy metal diaphragm to induce or alter a fluctuating current in an electromagnet without any intervening resistance medium. It was left for other inventors like Thomas Edison to perfect a superior form of transmitter based on the use of carbon as a resistance medium. Bell spent much of the succeeding decade in court, defending his patent for the fledgling Bell Corporation. He married the daughter of his principal backer, Gardiner Hubbard, on July 11, 1876. She had been one of his deaf pupils. The stock the couple held in the growing Bell Corporation made them both wealthy, even after Bell retired from the company in 1879.

Other Inventions

Bell continued to invent for the rest of his life, although he never scored another success on a level with the telephone. He sought to repeat his earlier success with a device called the photophone, in which light was translated into electricity. He hired another assistant and replicated the kind of intense experimenting that led to the telephone, even experiencing a moment of joy similar to the first transmission of speech. In the former case, Bell uttered the famous words, "Watson, come here, I want you"; in the latter, Bell's new assistant Tainter sent Bell a message to come to a window and wave his hat, and Bell reported doing so with vigor. Bell hoped the photophone would surpass Edison's carbon transmitter: it required no wires, and could be said to anticipate fiber optics. However, the ease with which a beam of light could be interrupted consigned this device to obscurity, even though Bell thought of it as his greatest invention.

When he was awarded the prestigious Volta Prize in 1880 for his invention of the telephone, Bell invested the money in a laboratory to continue the photophone work. But he wanted a project that would pay, and he saw an opportunity to leapfrog his rival Edison, whose phonograph was still a prototype poorly suited to commercial use much like Bell's early telephones. It was Bell's assistants who developed and patented an improved method for engraving phonograph recordings in 1886; Bell had become increasingly distant from the actual research. Bell put his share of profits from the successful invention into a trust fund for research on the deaf. When James A. Garfield was shot, Bell tried to develop a device that would detect the bullet, but it failed because the bullet was too deep. However, his telephonic bullet probe was used by others in the days before x-rays and even after, when x-rays were inconclusive. Bell also invented a crude form of iron lung.

In the 1890s he experimented with flying machines, trying an analogy to his earlier telephone work. If a heavy metal diaphragm was, paradoxically, the most sensitive membrane for a telephone, why not experiment with heavy flying machines? Bell initially teamed up with Samuel Langley, secretary of the Smithsonian. Langley flew a model, but failed with a full-sized airplane. Bell's own interest in flight turned to kites, and his wife Mabel helped him find another Watson: Casey Baldwin. Out of this collaboration came an idea ahead of its time: using tetrahedral supports in construction, Bell founded an Aerial Experiment Association that included himself, Baldwin, and Glenn Curtiss. Bell was one of the independent discoverers of the idea of using ailerons and his group built and flew several successful planes before breaking up.

By now, Bell had settled at Beinn Breagh, an estate he purchased in Canada. Bell and Baldwin also worked on hydrofoils, translating Bell's principle of heavy diaphragm for the telephone and heavier-than-air flying machine into heavier-than-water speedboats. The work was briefly suspended during World War I, because Bell did not want to pursue research with naval implications in a neutral country, but was renewed when the United States entered the war. Bell's final hydrofoil design set a world record in 1919, but by then, the Navy no longer had any interest. Bell also conducted experiments in an effort to breed multinippled sheep.

Teacher and Mentor

Bell was not only an inventor. He continued his important work in teaching the deaf, and he also encouraged creative intellectual work by others. He took over as president of the National Geographic Society during a time when the Society was flagging and hired Gilbert Grosvenor, an energetic young editor who realized Bell's vision for a more popular, accessible magazine and a membership in the thousands. Bell also served as regent of the Smithsonian and used his own money to provide resources for geniuses like Charles Peirce. Bell was a collaborator in his own work and encouraged others in theirs—even competitors like the Wright brothers, whose success he greeted with enthusiasm. Bell died at his beloved Beinn Breagh on August 2nd, 1922, with Mabel holding his hand.

Further Reading

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Bipolar Mood Disorders

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Glossary

Bipolar mood disorders A group of related mood disorders described in the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition, Text Revision (DSM-IV-TR). These can be serious, but they are also often effectively treated. Bipolar disorders are characterized by the presence of an episode of unusually elevated mood, but they typically also involve episodes of depression; these episodes of high and low mood frequently alternate with periods of normal mood. Several types of bipolar mood disorders can be distinguished. Bipolar disorder (sometimes termed bipolar I disorder), formerly termed manic-depressive disorder, is defined by a history of one or more episodes of mania – a severe mood elevation that can be euphoric or irritable but causes serious adverse consequences for an individual, such as becoming psychotic, having to be hospitalized, or experiencing severe occupational or social impairments. Hypomania involves an unusually expansive or irritable mood but is milder than mania. Bipolar II disorder involves episodes of severe depressions, along with one or more episodes of hypomania. Cyclothymia is a chronic disorder in which the person experiences many episodes with hypomanic symptoms, as well other episodes with depressive symptoms that are less severe than in bipolar I or II disorders. Bipolar disorders run in families. A familial liability to bipolar disorder is manifested in a wide range of psychiatric syndromes, from mild to severe. Liability is manifested more frequently as depression than mania. A person who carries liability may not even experience symptoms (although subclinical manifestations, including mood elevations, have been postulated).

Compensatory advantage A biological model of inherited disorders for which a psychological parallel has been suggested. In biology, there are inherited liabilities that run in families and not only increase vulnerability to illness, but are also tied to positive characteristics that run in the same families. An example is sickle cell anemia, a recessive genetic disorder in which individuals who inherit a copy of a mutant gene from both parents experience serious, often fatal, medical complications. However, individuals who inherit only one copy of the mutant gene usually have relatively mild symptoms, and these carriers of the gene gain an important compensatory advantage: resistance to malaria. A compensatory advantage involving enhanced everyday creativity has been suggested in connection with genetic liability for bipolar disorder.

Eminent creativity This term applies to outstanding creators or creative accomplishments where recognition has been given by society or by relevant professional organizations in forms such as prizes, awards, honors, or publication. The quality of originality or novelty is generally part of what is recognized. Eminently creative individuals and their accomplishments are thought to have exceptional qualities or importance in their cultural context.

Everyday creativity This term applies to creators or creative accomplishments that involve day-to-day activities at work or leisure and are characterized by both originality (involving new and unusual aspects) and meaningfulness to others (rather than being completely random or idiosyncratic). Many types of activities qualify, and they can be concrete products, behaviors, or ideas. The creativity has more to do with how a task is done than what it is called. Thus while the painting of a scene would typically involve significant creativity, it may not if it simply involves following 'paint-by-number' instructions. Everyday creativity can be expressed in a variety of activities, including, for example, making home repairs, designing children's activities, reorganizing an office, counselling a friend, doing gourmet cooking, or charitable work – so long as the activities involve significant originality and are meaningful or adaptive.

Inverted-U effect This phenomenon refers to a curvilinear relationship between two variables, in which both high and low levels of a predictor variable are associated with lower levels of the outcome variable, whereas an intermediate level of the predictor variable is associated with the highest, or optimal, level of the outcome variable. Some research suggests that certain psychological characteristics related to bipolar liability, when they are neither too strong nor too weak, may be associated with higher creativity, showing an inverted-U relation between bipolar liability and creativity.

Unipolar mood disorders Unipolar disorders are characterized primarily by periods of unusually low mood, usually alternating with periods of relatively normal mood. Adverse effects of depressed mood on other psychological functions are also typically present, such as disturbances in sleep, appetite, and energy. These mood disorders can range from major or severe depressions to milder ones, and these milder forms can sometimes take the form of more pervasive or long-lasting dysthymias that involve dysphoric mood. These disorders can be extremely serious, but effective treatments for them are often available.

Introduction

Throughout history, one finds the notion of a link between creativity and psychopathology, going back to pre-Grecian myth and Plato's divine madness. As will be discussed, there is scientific support from recent research for this long-standing belief in an association between increased creativity and psychological disturbance. Particularly among eminent creators in the arts, there are very high rates of major mood disorders, both bipolar and unipolar. This evidence from recent research fits with the findings of older studies. Among eminent creators in nonartistic fields, however, the patterns of relationships involving mood disorders are more complex.

In studying everyday creators, researchers have tended to start with samples of subjects chosen for clinical reasons rather than their creativity. This is a key difference from the research design used in studies of eminent creators, as will be discussed. Research evidence to date also supports the presence of a significant advantage for everyday creativity – for originality in everyday life – in individuals with a personal or family history of bipolar disorders. The most creative individuals may not themselves be the most severely disordered, in accordance with an inverted-U hypothesis of the relation between creativity and liability for bipolar disorder. The most creative person in a family with bipolar disorder may often be one who is psychiatrically normal. In the latter case, what may be important is not the presence of psychiatric symptoms in a particularly creative person, but rather some positive and subclinical psychological traits that run in the families of people with bipolar disorder.

Research findings suggest the optimistic view that a creative advantage associated with liability for bipolar disorder is not directly linked to the pain and suffering that can accompany mood disorders, but rather to a more positive psychological factor. Moreover, some research raises the question of whether there are creative advantages that, in themselves, may heal or even protect against development of full-blown mood disorders. Further work on this issue is needed. These issues are important because of the sheer numbers of people affected by mood disorders. By some estimates, as much as 4–5% of people in the general population may end up developing a 'bipolar spectrum disorder,' ranging from rather mild to quite severe in degree. If each affected person has even one nonmood-disordered relative carrying a familial risk, as much as 10% of the population could have a heightened potential for everyday creativity and its benefits.

Finally, a note of caution is in order. We are discussing some serious and painful mood disorders, including major depressions and bipolar disorder. It is important not to romanticize these disorders just because creativity might at times be involved. The problems associated with these disorders are severe and often life-threatening. Without treatment, roughly one out of five people with a bipolar disorder will end up taking his or her life. This outcome is particularly tragic, given that treatment can often be highly effective. Furthermore, it appears that treatment may often increase creative potential and achievement. Treatment options should be carefully investigated by anyone who has, or is at risk for, a mood disorder.

Spectra of Mood Disorders

Mood swings appear to fall along a broad continuum of severity. At some level, they may even affect many people in the population at large, as found in one clinical study in which 40% of the control group showed cyclical mood swings that were milder but similar in periodicity to those of a clinical sample. Another major study found that during colder months of the year a great many people suffer at least a few minor symptoms of winter blues or seasonal affective disorder.

Traditionally, there are two broad classes of mood disorders: major depression and bipolar disorder, estimated by some studies to affect roughly 5–10 and 1% of the population, respectively. Even here, though, there are further spectra, which range into milder variants. The underlying risk for mood disorders displays a strong genetic influence, as shown by the results of adoption and twin studies. However, there is also a large (but poorly understood) environmental component. Bipolar risk or liability involves a more marked genetic component than does risk for unipolar depression. The strong tendency for bipolar mood disorders to run in families is illustrated by one study of over 500 relatives of bipolar disordered (manic-depressive) individuals, in which over 23% of the relatives had a major mood disorder. Even though these relatives were chosen because they had a family member with bipolar disorder, over half of all the mood disorders in these relatives were unipolar depression rather than bipolar disorders. Do these depressed relatives also carry some advantage?

In fact, research suggests implications for enhanced creativity in the relatives of persons with bipolar disorders, even including the psychiatrically normal as well as the unipolar depressed relatives of people with bipolar disorders. Hence, it is important to consider both personal and family psychiatric history.

In defining mood disorders, one should note that there are many more features required for diagnosis than the few given here; these features are listed in the *Diagnostic and Statistical Manual*, 4th edition, *Text Revision (DSM-IV-TR)*, of the American Psychiatric Association. In a family at risk for bipolar disorder, depressive manifestations can range from dysthymias and milder depressions to severe major unipolar depressions (all of these can occur without a history of clinically significant periods of mood elevation). As noted in the glossary, there are bipolar disorders of varying severity. These include bipolar I disorder, bipolar II disorder (which involves milder mood elevations alternating with episodes of severe depression), and cyclothymia (which involves milder mood swings that may be rapidly alternating). Especially in bipolar I and II disorders, there may be long periods of normal mood between such mood swings. A smaller number of individuals in families with a history of bipolar disorder may show 'schizoaffective' disorders, which are characterized by the presence of psychotic features, such as hallucinations and delusions, that occur when the person is experiencing episodes of mania or depression. Thus a bipolar liability can be manifested in a variety of ways.

The course of mood disorders can also vary dramatically, in both quality and quantity. For example, some people may have only one episode of depression in their whole life, whereas

others may experience dozens of depressive episodes. In addition, some people with mood swings may also spend a great deal of their time in a state of relative euthymia, or normal mood. Thus, most individuals with mood disorders do not have an ongoing chronic and unchanging depressed or manic state – a factor that may be important to creativity. Both temporary psychological state factors and ongoing trait factors may be significant.

Bipolar–Unipolar Disorder Distinctions

At this time, research is more plentiful on creativity in families with bipolar compared to unipolar disorders. It is worth repeating that pure unipolar depression is an even more common outcome in individuals with a bipolar family history than are bipolar mood swings, and that such depression may also predict for creativity. One preliminary study suggests, for example, that creativity may be higher in depressed patients with bipolar disorder in their family than in depressed patients without this family history. Perhaps there are subtle and subclinical factors operating – even ones that are adaptive and positive – beyond the more debilitating symptoms. This issue needs careful study. Clinicians can be so intent on sniffing out psychiatric illness and dysfunction that they fail to notice when something is going right, such as unusual creativity.

The several sections that follow concern issues of (a) eminent creativity and mood disorders; (b) everyday creativity and mood disorders; (c) mood disorders, creativity and evolution; (d) biological models in which illness and health may be intertwined; and (e) conclusions and recommendations.

Eminent Creativity and Mood Disorders: Considerations

There is evidence for an association between creativity and bipolar disorders, but the answer depends upon the way the question is asked.

Defining Creativity, Defining the Question

People often identify creative outcomes using a minimum of two criteria involving (a) originality and (b) meaningfulness to others (as opposed to randomness or idiosyncrasy). With eminent creativity, there is the additional criterion of social recognition of the creative activity – the achievements and their creator have been recognized and won acclaim, either from society at large or from people in particular fields or subpopulations. Many think of creativity largely in terms of people with eminent accomplishments – for example, the novels of the best-selling authors, the discoveries of Nobel prize-winning scientists, or paintings that went for millions at an auction. Such creators, or creativity, should have some different ingredients from those associated with everyday creativity.

A critical caution: the question one asks helps determine the answer. The results of research depend on whether one is studying (a) eminent versus everyday creators; (b) people chosen for mood disorders rather than their creativity (the second can be an overall better-functioning group); (c) patterns across families versus within individuals (in families one can find examples of both unusual creativity and mood disorders,

though not necessarily in the same person); or (d) a particular field of endeavour (e.g., the arts versus the sciences).

Are the Rumors About Artists True?

Several modern studies of artistic creativity and mood disorders are notable because they provided more solid support to a range of older and less rigorous studies that pointed in the same direction. For example, in Nancy Andreasen's study of 30 well-known creative writers who were teaching at the renowned Iowa Writers Workshop, a remarkable 80% had a history of a major mood disorder (compared to 30% of controls). In addition, over half of those affected had a form of bipolar disorder, and a little over half of that number had a history of a bipolar II disorder, showing milder mood elevations.

Supportive evidence was obtained by Kay Jamison, who asked 47 highly distinguished British artists and writers if they had been treated for a psychiatric disorder. A full 38% said that they had been so treated, with mood disorders again highly prominent. These percentages are almost certainly underestimates of the rates of mood disorders in these eminent creators, because only about one out of three mood-disordered persons currently tends to seek help at all (a particularly sad fact, given the efficacy of treatment). Furthermore, a full 89% of these eminent persons had had intense creative episodes (of a modal length of two weeks), which showed many of the symptoms of clinical hypomania. Finally, these rates may be compared to the lifetime prevalences of bipolar and unipolar disorders in the population at large, which are substantially lower, in the range of 1 and 5–10%, respectively.

Further support comes from Arnold Ludwig's psychobiographical study of more than 1000 deceased figures whose biographies were reviewed in the *New York Times Book Review* and covered 18 different professional fields. Almost two-thirds of the poets had had bouts of depression, with rates of depression for expository and fiction writers, visual artists, and musical composers in the 40–50% range. Mania occurred in as much as 13% of poets before age 40, and 5–10% of several other artistic groups. Moreover, these eminent creators may have had an even higher rate of more subtle bipolar spectrum disorders, including clinical hypomania and bipolar II disorder, which could not be differentiated by this study's particular biographical and diagnostic methods.

These results support findings from a range of older studies' findings from the nineteenth century to the early twentieth century, which also indicated a creativity–psychopathology connection, particularly in the arts, where most of the work had been done. Despite varied research design flaws, these older studies tended to point in the same direction, supporting a connection between artistic creativity and psychopathology, particularly mood disorders.

A Different Story for Scientists?

An older study that included scientists showed them to be a healthier group than artists on average, with nonpsychotic disorders only about half as common as in artists. More modern research supports this conclusion, including Ludwig's finding that across 18 occupational groups, there was a much

healthier picture for nonartists than for artists – or else, the mental illness in scientists was less obvious or less likely to be reported. Social scientists showed rates of depression in the mid-20% range, and physical scientists showed rates in the low teens. Other groups showing lower rates of psychopathology included businesspersons, explorers, athletes, military figures, and social activists.

More subtle bipolar disorders and family history were not assessed. Still, where overt mood disorders are concerned, the best predictor is not being an eminent creative person but, rather, an eminent creative artist. Note, however, that there are many mood-disordered people who do not become eminent, or even highly creative. What other factors might combine to make the achievement of eminence in Western culture more likely? An experiment by DePetrillo and Winner found that doing creative artwork elevated self-reported mood in college students in whom low mood had been induced by exposure to videos showing distressing scenes. By contrast, simply copying abstract designs or solving challenging verbal puzzles did not elevate mood significantly. The mood-elevating effects of creative artmaking may make artistic endeavors especially attractive to individuals with mood disorders; this may help explain the over-representation of individuals with mood disorders among creative artists.

Eminence Revisited: A Complex Equation

Robert Albert identified a finite number of early personal and family factors that may together yield a ‘multiplier effect’ on eminent achievement. These include parental and sibling characteristics, and family birth order. Many positive forces combine to provide personal strength, support, opportunity, and expertise. Albert also found that long-standing family interests or capacities were frequently made available to the individual, allowing a channeling of interests and a long-term immersion in a subject, with support of family and culture.

Strong motivation is important for creativity, especially for the creator with a bipolar disorder. Ruth Richards and Dennis Kinney have shown a definite preference for work-related over leisure-related creativity among bipolar subjects in a sample of everyday creators. (By contrast, other research by Kinney, Richards, and colleagues found that individuals with schizotypal personality traits, which are elevated in relatives of schizophrenia patients, showed greater preference for leisure-related creativity.) A number of personality factors linked with bipolar mood disorders have been proposed that may raise the chance of eminent recognition when creative talent is already present. These factors include a driven work orientation, an ability to think in broad and ambitious terms, altruistic and socially concerned motives that may accompany mood elevation, a sense of ‘standing apart’ from the mainstream, and a need for external validation.

Here, results have been similar for individuals in both artistic and nonartistic fields. Important personal characteristics associated with creativity have included contrariness, capacity for solitude, physical illness or disability, drive for supremacy, production of work with a personal seal or signature, and a psychological ‘unease’ or drive. Mental disturbance is included in the ‘unease.’ Research on eminent individuals has found that psychopathology was four times as common

in the most eminent as in the less eminent individuals. The same research found that 78% of the most eminent individuals (vs. 55% of the less eminent) developed a psychiatric problem.

Contexts of Eminence: Creative Insight, Systems, and Chaos Theory

Eminence is a pattern in time and space that emerges around a creative person in a context. The eminent creator may be viewed as an open system, in tune with a culture, that can express where it wants (or needs) to go. The creative person may conceivably sit on a real or metaphorical edge of chaos – revealing or facilitating new creative insights about to erupt. This may reorganize the mental field in a dramatic new way (a mental ‘butterfly effect,’ or an irreversible avalanche of new awarenesses and mental reframing). This self-organizing process shows the nonlinear, irreversible, and dramatic sensitivity to initial conditions that is characteristic of chaotic systems. People with mood swings and mild mood elevation might find such an ‘edge-of-chaos’ effect, or mental shift, particularly available, as Richards proposes, for example, in association with tendencies toward overinclusion (or looser associations). Physical illness may also provide an opportunity for creative (and chaotic) reorganization and transformation, as Zausner has proposed.

Here is one societal role for the creator: seeding of culture with new ideas, some to be kept and some to be rejected. Eminence can be conferred on an innovation if a large enough audience has their own productive creative response. The idea can bring on similar mental shifts – avalanches of new ideas, or mental reframings – in an appreciative public. However, a reframing may not always be welcome in a particular era, in which case the creator may be ostracized, and even pathologized. Among those most apt to take risks such as being ostracized may be people who already ‘stand apart’ and are seen as deviant.

Everyday Creativity and Mood Disorders: Considerations

Subjects Chosen Using Clinical Versus Creative Criteria

Let us now turn things around and start with subjects who are chosen because of their psychopathology, rather than their creativity. If all creative writers had mood disorders, one would not expect everyone with a mood disorder to be a creative writer. One still does hear, however, people making these associations of mood disorders with creativity as if the association were (a) always true and (b) reversible. It is not so. We are talking, rather, about associations that are predictive, probabilistic, and directional. Creative writers, or indeed people in any field who have achieved a measure of success, bring together a constellation of intellectual and personal qualities and strengths. This constellation might not be the case for the average person on the street, or for someone with a severe mood disorder. When we focus on eminent creators, we are not at the less-productive extremes of bipolar liability in the inverted-U relationship between symptomatology and creativity, but rather are somewhere into the more functional middle (raised) segment of the inverted-U curve.

Special Abilities or a Way of Being?

One also needs to consider the area of endeavor. Special ability factors may be one ingredient in creativity, and cognitive style another. Researchers at the Institute of Personality Assessment and Research (IPAR) at the University of California, Berkeley, found broad evidence of a preference for originality in well-known creators in many fields. In fact, if a link with mood disorders involves adaptive factors showing genetic influence, one would expect such adaptation to be general, and not to be constrained, for example, to a limited area such as verbal ability.

Studies of families also contribute evidence. Relatives of creative persons in a given field, such as the arts, were not necessarily in that same field themselves, even though they showed higher than average creativity. These findings are consistent with IPAR's finding of a general 'disposition toward originality' that tends to run in families. Whether or not one holds a unitary view of intelligence, or instead leans toward a belief in multiple intelligences, the secret ingredient for creativity may involve a superimposed style of living and working that brings originality to one's efforts. Artistic or other special skills may be necessary for some types of creative work, but they are not sufficient. It is one thing to copy a Rembrandt, but another thing to be Rembrandt.

Compensatory Advantage? A Key Study and Method

The phenomenon of compensatory advantage may be relevant to creative ability. In sickle cell anemia, inheritance of the same recessive mutant gene from both parents leads to serious and often fatal medical disease. By contrast, inheritance of only one copy of the mutant gene (i.e., carrier state) may often result in only a mild anemia, while providing a compensatory advantage of resistance to malaria. In the case of some psychiatric illnesses such as bipolar disorder, while the genetic model may be more complex, it seems plausible that certain genes that increase risk for the disorder may also carry a compensatory advantage involving increased creative potential. The numbers of people affected is important; millions of people are affected by mood disorders, so that the benefit of increased creativity would affect not just the achievements of a handful of highly eminent people, but the everyday lives of millions of individuals. This phenomenon may also involve a more complex variant of genetically based selection, favoring people who may contribute to our memetic (or informational) evolution, as well as genetic evolution. Creative individuals facilitate growth in the units of information (or memes) that reflect creativity in our world, and these may subsequently affect genetic survival, as in the discovery of fire or of penicillin.

Accordingly, an inverted-U association has been hypothesized between creativity and degree of bipolar symptomatology. Richards, Kinney, and colleagues compared the creativity of individuals with bipolar disorder, patients with cyclothymia, and their psychiatrically normal relatives to each other, as well as to psychiatrically normal control subjects, and to individuals with another type of psychiatric diagnosis. The creativity variable involved a measure of the highest or peak level of real-life broad-based everyday creativity manifested in vocational and avocational activities, rated using the Lifetime

Creativity Scales, consistent with evidence of a disposition toward originality. The mean rating for everyday peak creativity was higher among the clinical sample (comprised of bipolar and cyclothymic patients and the normal relatives) than controls, with the cyclothymic group showing higher creativity than the bipolar group. However, another group was also highly creative: the psychiatrically normal relatives of bipolar patients.

This is an important finding, indicating that the severe pain and suffering associated with full-blown mood disorders were not necessary for the hypothesized creative advantage. Nor did psychiatric normalcy explain the high level of creativity in the healthy relatives of bipolar patients, since the normal control subjects were not so distinguished. Interestingly, other researchers have also found advantages on achievement in general in relatives of bipolar individuals. These findings may support the inverted-U effect, if a subclinical hypomania or other mild affect is what produced the elevated creativity in the healthy relatives of bipolar patients. These results are also consistent with other research findings: (a) that increased creativity is linked to intermediate, rather than high or low, levels of Eysenck's psychoticism variable; (b) of subtle findings of thought eccentricity found in the normal relatives of bipolar patients; and (c) of higher mean scores on a clinical hypomania scale in creative college students, in the work of Schuldberg and others.

Notably, studies of overinclusive thinking compared bipolar patients and eminent creators in their styles of thinking. Beginning with Andreasen's work in the 1970s, similarities have been found between writers and bipolar patients in particular, though with some key differences. Patients were less likely than the writers to make *adaptive* use of overinclusive thoughts. Related research found that eminent creators, despite having high mean scores on many Minnesota Multiphasic Personality Inventory psychopathology scales, also showed high scores for ego strength.

Conceivably, with treatment, certain mood-disordered people may show not just decreased symptomatology but increased creative productivity. This research underscores the potential value of eccentricity, and the importance of not prematurely judging creative people as ill. Unconventional thinking styles do not necessarily mean pathology – indeed, sometimes may be exceptionally valuable.

State Effects: Is a Good Mood a Good Thing?

When asked directly, noneminent bipolar patients reported greater creativity during mild mood elevations than during episodes of mania or depression. Their creative periods were associated with characteristics of spontaneous exuberance and cognitive facility, including rapid thinking and fluent associations. Eminent artists and scientists gave similar reports, as the great majority had also experienced intense creative periods associated with many characteristics of mild hypomania.

The prominence in a sample of eminent writers of bipolar II disorder, rather than bipolar I disorder, with its more extreme mood elevations, is also notable. Mechanisms for these cognitive, affective, and motivational advantages of hypomania have been proposed. Other studies have found that even in the general, rather than the psychiatric, population, mild mood

elevation – say, from watching a comedy film – can directly enhance creative problem solving. Mood elevation may also enhance cognitive style factors that can be relevant to creativity, such as unusual associations and the creative style factor of overinclusion. For example, in classifying things as flat, the overinclusive person might mentally stretch a little further, and pull in more imaginative possibilities (or some might say loose, or inappropriate ones). Flat things, then, might include items such as a piece of paper, a dinner plate, a postage stamp, a body of water, the crown of the head of a person with a crew cut, and the nose of a professional boxer. Certainly, thought as well as affect is relevant to this cognitive style factor. Notably, evidence has been found of overinclusive thinking in creative samples, linked with a psychoticism dimension, as Richards has noted in discussing Eysenck's work.

State Effects: What About Negative Mood?

Unipolar patients have reported a heightened sensitivity when depressed. They do not, however, necessarily report advantages ascribed by bipolar subjects to elevated mood states. Despite preliminary evidence that people with a history of depression may show higher everyday creativity if they have a family history of bipolar disorders, one cannot necessarily conclude that it is the episodes of the depression themselves that are conducive to creativity. Rather, it may be associated with sub-clinical hypomanic highs related to a family history of bipolar disorder.

Some research suggests that negative affect does not make a particular contribution to creativity. An inverse relationship has been shown between negative affect and creative personality patterns. However, others have linked negative mood with greater creative problem solving.

Research on children's play has shown that negative affect, experienced as part of a mixed affective state – in which one is overcoming a troubling difficulty and is triumphing – can also carry a positive affective charge. Indeed, much creative work in the arts deals with gaining perspective on, expressing, and transforming hardship and adversity. It has been suggested that the alternation of mood states in bipolar individuals may enhance both (a) creativity ability (enriching the interconnection of positive and negative mood-linked schemas in memory storage – schemas that might otherwise be stored separately in a mood-congruent structure), and (b) creative motivation (where an inevitable succession of negative and positive mood states enhances the conviction that mood will change, and activity may help, as with a hypomanic response to depression). Hence, faced with adversity, one is able to learn a style of approach and creatively solving a problem, rather than a style of avoidance.

State and Trait Effects: What About the Normal Relatives of Bipolars?

Of great importance, for manic, schizoaffective, and schizophrenic patients, related (though very much muted) forms of thought disorder were found to be more common in their respective first-degree relatives, even those relatives who were not themselves clinically ill. This is consistent with the finding of elevated creativity in, for instance, the normal relatives of

bipolars, and in depressed individuals with a bipolar family history, and it suggests operation of some subtle cognitive factors associated with the liability for bipolar disorder. In fact, there are particular qualitative patterns of unusual thinking that differentiate mania from schizophrenia, patterns that might yield higher creative potential in the former. For bipolar disorders, this involves combinatory thinking, with incongruous combinations of ideas and playful confabulation, as described in Philip Holzman and Mary Hollis Johnston's Thought Disorder Index. These patterns involve loosely tied together ideas and often have a playful quality to their production. These styles produce novel combinations of ideas and unconventional perspectives that may be valuable in generating innovative solutions to problems that would not occur to other people.

Evolutionary Significance

In October 1996, an invitational conference in New York, on Manic-Depressive Illness: Evolutionary and Ethical Issues, was convened by Kay Jamison of Johns Hopkins and Robert Cook-Deegan of the National Academy of Sciences. Participants came from around the world to discuss the genetic and environmental factors, social costs, and adaptive value of bipolar disorder. The participants, who included distinguished scientists and clinicians, urged caution, in this burgeoning era of genetic engineering, against any precipitous efforts to remove from the population gene(s) that increase liability for bipolar disorder, given that this liability is complex, not fully understood, and may have creative advantages for individuals and society.

Everyday Creativity and Survival

Multiple authors have noted that a link of bipolar risk with creativity (and perhaps also with leadership) could help explain why genes that contribute to bipolar disorders have not been selected against, given the increased rates of mortality and morbidity in these disorders. A compensatory reproductive advantage would presumably help keep bipolar disorders (and genes that help cause them) around. According to Robert Albert, (a) any form of human development and behavior with a substantial degree of heredity may well involve an evolutionary process, and (b) both genetics and environment are apt to be involved, providing flexibility toward changing environmental conditions.

One must ask whether such an advantage of genes for bipolar disorder liability would operate at the level of eminent or everyday creativity. This is a critical point. A handful of eminent people, however dramatic their reproductive power, could not maintain bipolar spectrum disorders at a rate as high as 4–5% of the population. Everyday creativity could be key in this regard. The liability for bipolar disorders must play out in everyday life in order to maintain an adaptive value and reproductive advantage great enough to compensate for the higher mortality associated with bipolar disorder. The prevalence of eminent creativity may be related to this, however, since the receptive ground for everyday creativity may provide (a) greater openness to the innovations of our eminent and

exceptional leaders, and (b) the ability to produce more such leaders than would a conservative culture – individuals who symbolize for all of us new trends and innovative ideas.

Candidates for a reproductive advantage include traits related directly to mood elevation, or even a sometimes associated hypersexuality, as well as the creative behaviours themselves and associated traits. This explanation demands that one ask not only about genes, or biological units of heredity, but also about memes, or units of information in culture. Examples of memes are an equation, an idea, or a song. Indeed, we know that the producers of ideas help the survival of society, both at the everyday and at the eminent level, and that society may help such contributors to survive. Here is a critical interaction between biological and cultural evolution.

When Illness Yields Creativity: Two Models

There is more than one way in which illness and health may be intertwined, so as to have immediate, as well as ongoing, evolutionary effects. We first present a five-part general typology of direct and indirect relations between creativity and psychopathology, which is summarized (see [Table 1](#)) using examples from mood disorders. Next, this typology is used as a framework for two biological models, showing how creativity and illness can be intertwined.

Creativity and Psychopathology: A Five-Part Typology

Factors connecting creativity and psychopathology can involve biological, psychological, and social factors – and not

surprisingly, the patterns can be complex. A classification scheme can help. Factors affecting both ability and motivation for creativity occur, as do direct and indirect effects. (Factors affecting motivation can be classified as indirect – as background enhancers of the application of creative abilities.) There are also directional issues – for example, times when creativity can lead to psychiatric problems, and ways that illness can impact creativity. These relationships can be multiple and overlapping. The letters P and C are used for psychopathology and creativity, respectively (or some aspect of these). T refers to a third factor (or factors) that may independently influence aspects of both creativity and psychopathology. Examples relating to mood disorders are given below (see [Table 1](#)) for each pattern.

Biological Models and Psychological Applications

Two biological models follow that may be linked to mood disorders and may also be viewed in terms of a combination of categories in this typology.

Compensatory advantage

The existence of a genes for a medical problem – If present at an attenuated level – can carry an advantage and a low-enough cost – benefit ratio that there may be adaptive, and even evolutionary, advantages overall in a population. The example of this in sickle cell anemia, both in the disease state (with two copies of a mutant gene) and the carrier state (one copy), was mentioned earlier. The more numerous carriers suffer relatively little but obtain a compensatory advantage: resistance to malaria.

Table 1 Typology of creativity and psychopathology with applications to mood disorders

1. *Direct relationship of pathology to creativity ($P \rightarrow C$)*. Aspects of psychopathology (P) can contribute directly to creative outcomes or processes (C). Consider Kay Jamison's *An Unquiet Mind*, a remarkable first-person account of bipolar disorder by an internationally known expert on mood disorders. Personal experience is relevant both to the content of the book and to aspects of creative process in writing it.
2. *Indirect relationship of pathology to creativity ($P \rightarrow T \rightarrow C$)*. Here, a third factor (T) intervenes between pathological and creative factors. Consider a person who does journal writing about mood states or conflicts, for personal reasons of catharsis, but comes to discover a greater creative potential and rewards. Novelist John Cheever, who suffered from depression, did youthful writings about family and school situations that are thought to have helped him personally. Such expression can free one up psychically and enhance one's perspective, empowerment, and general health. At best, it can put one in touch with more universal themes and altruistic motives. Individuals like Cheever may end up writing or creating for the benefit of others.
3. *Direct relationship of creativity to pathology ($C \rightarrow P$)*. Humanistic psychologist Rollo May, among others, wrote about the anxiety that may at times attend creative expression. Especially in the arts, one must be open to whatever comes up. The heightened sensitivity reported by people with unipolar or bipolar mood disorders could raise the odds at times of distress. In the best circumstances, such psychological discomfort and anxiety during the creative process can be an important step along the way to a more healthy and open personality. Hence, if creativity sometimes leads to such pathology in the short term, it can still ultimately lead to greater creativity and health.
4. *Indirect relationship of creativity to psychopathology ($C \rightarrow T \rightarrow P$)*. Here, the third or intervening factor is the emergent conflict that comes to consciousness during the act of creation. Consider, for example, problems with substance abuse as a less healthy response to conflict than the working through just described in paragraph 3 above. Substance abuse occurs more often with individuals with mood disorders than in the general population. Another example is the creative and outspoken schoolchild who is ostracized by peers, and misunderstood by teachers. Sometimes a seeming hyperactivity is an early indicator of later bipolar disorder. Reticece, withdrawal, or clowning around and behavior problems may occur in creative children, and should the child have familial tendencies toward depression, this too might become activated under stress. With more supportive environmental conditions, however, a better outcome can be possible.
5. *A third factor can affect both creativity and psychopathology ($C \leftarrow T \rightarrow P$)*. An important potential third factor is a familial liability for bipolar or manic-depressive illness. Having this liability may increase the odds of (a) problems related to mood swings, but also of (b) positive qualities related to creativity or leadership. These outcomes may occur separately or together in individuals, or across different family members, as found for instance by Andreasen, and by Richards and Kinney. This third factor could involve cognitive, affective, and/or motivational factors – thus bringing along with mood elevation, for example, a more overinclusive cognitive style (original thinking versus thought disorder), heightened emotional sensitivity (depth of appreciation versus emotional instability), and inspired motivation (energetic confidence versus grandiosity).

In the psychological model, creativity is the compensatory advantage. In the typology, familial liability (which includes genetic risk) is the third factor, which stands between the pathological and creative effects ($P \rightarrow T \rightarrow C$). This may be manifested in terms of cognitive, affective, and/or motivational effects.

Acquired immunity

This biological model is exemplified by infectious illnesses such as whooping cough. Childhood infection is relatively mild compared to the adult form of the illness. Early exposure (and immunization) is therefore useful as protection against adult illness. A resilient capacity can be developed, in this case through one's immune system. In the typology, this situation connects first to the mediated relationship ($P \rightarrow T \rightarrow C$), in which pathology leads to personal strength which enhances healthy function.

The psychological parallel is the large number of people, particularly eminent creators in the arts, who have suffered early adversity and high rates of mental illness. As one factor, when a child has a mood disorder, a parent is more likely to have one as well, and this can lead to many sequelae, including emotional distance, inconsistency, and early stress. When there is creative coping, this can be very important. Yet a great many people with early difficulty do not thrive. The important question is to find 'what makes the difference' – what intervening or 'third factors' (with $P \rightarrow T \rightarrow C$) may further a resilient outcome or a creative coping and survivor strategy.

Conclusions and Recommendations

Links with Mood Disorders: Yes, but They Are Complex

There is support for links between creativity and bipolar and unipolar mood disorders, and perhaps more importantly, with psychiatric family history and the underlying risk one carries, which might manifest in different ways. The manifestations of this risk differ in nature and intensity between eminent and everyday creators. For eminent creators, there is a high prevalence of mood disorders in the arts in particular, especially of bipolar disorders. Mild mood elevation seems particularly conducive to creative insight, potentially offering cognitive, affective, and motivational advantages. Outside of the arts, major mood disorders are less common, although more information is needed about mild or subtle mood swings or possible family psychiatric history. Perhaps aspects of a familial liability to bipolar disorder also help influence a drive toward eminence.

For everyday creators, it appears that relatively well-functioning individuals are most apt to display higher creativity at work or leisure, showing more *intermediate* levels of bipolar pathology, and sometimes even *normalcy*, against the background of a bipolar family history. Do note that eminent mood-disordered artists may also represent relatively well-functioning persons within the group of people with a particular diagnosis – although, of course, there are always exceptions. One must again differentiate psychological states from traits, noting, for instance, advantages of the *state* of mild mood elevation. Then there are potential benefits for creative ability and motivation. These benefits may involve, for ability, a more mindful awareness of one's own personal states and one's world, including the ability to link and access diverse affects

in memory storage. In the case of motivation, benefits may involve a growing sense – at least for some people who are properly 'immunized' – that one can face adversity and transform it creatively, rather than defend against it.

Resilience and Creative Confrontation – Some Special Roles?

There are interesting people – and interesting families – for whom psychological problems are more apt to occur, but perhaps with some freshness of vision as well. There is support for an evolutionary basis for this, and the suggestion of some adaptive value for society (if not always for individuals) potentially linked to a compensatory advantage.

Regarding personal or family history of bipolar disorders, the following points are partly supported and worthy of further study. Some individuals may be more apt to (a) stand apart from the mainstream, due to differences that include identified illness and its effect; (b) come up with new ideas as a behavioral norm, as well as to challenge old ones, and to do so often in the world of work and social contributions; (c) be more aware at times of what is going on in their immediate environment or in the world; (d) be more sensitively attuned to input in general; (e) for a subset of people, be more willing and able to face certain adversities head on, as per the model of acquired immunity; and (f) at times be more altruistically inclined in their creative intentions.

Evolutionary Shift – and Broadening the Acceptable Limits of Normality

The evolutionary hypothesis – that the spectrum of bipolar disorders (including unipolar disorder where there is a family history of bipolar disorders) have been favored through evolution – could draw on multiple advantages, as related to a reproductive advantage. With compensatory advantage, a genetically influenced advantage may relate to, and in evolutionary terms compensate for, the morbidity of mood disorders. With acquired immunity, the creative twig may be bent in a positive way for later personal resilience and creative coping.

A memetic shift may be necessary for successful survival in a changing world. We may need a different form of valuing human behavior that will embrace deviant seers and creators, and tolerate ambiguity in a rapidly evolving culture that must welcome new ideas. One should not assume that unconventional ideas and behaviors are pathological, simply because they are different – when they may actually lead to creative and healthful outcomes.

See also: Cognitive Style and Creativity; Contrarianism and Creativity; Creativity in Science; Definitions of Creativity; Eccentricity; Eminence; Intelligence (as Related to Creativity); Multiple Intelligences; Writing and Creativity.

Further Reading

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Relevant Websites

- <http://www.saybrook.edu/> – Support site for a graduate program on creativity.
- <http://www.narsad.org/> – Support site for information about bipolar disorder.

Birth Order

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Glossary

Birth order The sequence by which children are born into a family. The most important birth-order positions are eldest, middle, and youngest. As a rule, birth-order differences in personality arise as a result of how children are raised (functional birth order, or rearing order) rather than the sequence in which they are born.

Five Factor Model of Personality A model based on the analysis of psychological questionnaires and natural language. Derived from factor analysis, this model posits the existence of five basic personality dimensions

(conscientiousness, agreeableness, openness to experience, extraversion, and neuroticism – also known as “the Big Five”).

Parental investment The nurturing that parents give to offspring, which can be emotional as well as physical. In Darwinian theory, parents are expected to invest differentially in offspring based on criteria such as age, sex, birth order, and cues of phenotypic quality. Parents make these discriminations in an effort to maximize their reproductive fitness – that is, the number and quality of offspring they successfully rear.

Birth Order and Evolutionary Psychology

In order to understand the association between birth order and creativity, it is first useful to review the relationship between birth order and personality, which owes itself to biological as well as environmental influences. Because there are no genes for being a firstborn or a laterborn, birth-order effects represent one of the best demonstrations of the power of the environment. Nevertheless, birth order interacts with other influences on human behavior, including genetic predispositions, that are known to be under biological control. Biological influences on personality may be separated into ultimate and proximate causes. Ultimate causes are those that are attributable to evolution by natural selection. By contrast, proximate causes encompass those physiological influences operating during the lifetime of the organism. Proximate causes also include environmental influences, which typically interact with genetic and physiological processes.

Viewed in these terms, sibling rivalry provides an ultimate cause of some aspects of personality development. Darwin's theory of natural selection offers an explanation for this part of the story, because it tells us that siblings are biologically driven to compete for parental favor. On average, siblings share half of their genes. In the early 1960s, William Hamilton recognized that natural selection acts to maximize what he termed ‘inclusive fitness.’ This form of Darwinian fitness is defined as an individual's own reproductive success, together with his contribution to the reproductive success of close relatives, discounted according to their coefficient of relatedness. Based on Hamilton's theory, siblings are expected to compete for scarce resources whenever the benefits of doing so are greater than twice the costs. In general, an offspring's idea of fairness is to keep two-thirds of any scarce resource for him- or herself and give only one-third to a sibling. Competition for parental investment is the main cause of sibling rivalry.

By itself, competition among siblings does not lead to birth-order differences in personality. But birth order provides a

powerful proximate (and environmental) source of sibling strategies. These tactical differences arise because birth order is correlated with differences in age, size, power, and status within the family. These physical and social disparities cause siblings to experience family relationships in dissimilar ways and to pursue differing ways of optimizing their parents' investment in their welfare.

Competition for parental love and favor has been an important driving force in human evolution, just as have parental decisions about how to invest in their offspring. Before 1800, half of all children did not survive childhood, and even minor differences in parental favor would have increased a child's chances of reaching adulthood. Children who lived long enough to become the eldest in a family were often a better Darwinian bet for their parents, because they had survived the perilous years of life and were more likely than their younger brothers and sisters to reach the age of reproduction and to pass on their parents' genes. In every society surveyed by anthropologists, eldest children are accorded higher status. For example, many traditional societies condone infanticide, especially when a child is deformed or when a slightly older infant is still breast-feeding, but no society condones the killing of the older of two siblings.

Parental investment strategies tend to be variable because birth order is only one of many relevant factors in these decisions. Besides taking into account the relative quality of their offspring, parents may invest differently in children based on such factors as the parents' age and the resources available to them. Primogeniture has generally been practiced by affluent parents in agrarian societies, where wealth is tied to land; but this inheritance system is much less common in mercantile societies where wealth can be acquired rapidly through entrepreneurship. Under these conditions, parents tend to hedge their bets by investing equally in all of their offspring.

Even if parents do not favor one child over another, sibling rivalry influences the dynamics of family life because competition serves to limit favoritism. Such competition typically

involves the cultivation of family niches that correspond to differences in birth order. That families provide offspring with a series of niches is a conclusion supported by research in behavioral genetics. One of the most remarkable findings in psychology during the last two decades is the discovery that brothers and sisters raised together are almost as different in their personalities as people who grow up in separate families. Based on studies of twins raised together and apart, behavioral geneticists have concluded that only about 5% of the variance in individual personality traits is attributable to the shared environment – that is, growing up in the same family – whereas 35% can be assigned to the nonshared environment. About 40% of the overall variance is believed to be genetic, and the remaining 20% is attributable to errors of measurement. These findings have begun to reshape the understanding of personality development by suggesting that the family is not a single environment, but rather a collection of microenvironments or ‘niches.’ The main reason why the shared family environment does not have a greater impact on personality is that very little of the family experience is actually shared. For example, brothers and sisters are at different ages when they experience the same events, and siblings often interpret shared experiences differently. Two particularly important and systematic sources of non-shared experiences are gender and birth order.

Birth Order and Personality

Psychologists have investigated the consequences of birth order ever since Charles Darwin’s cousin Francis Galton reported, in 1874, that eldest sons were overrepresented as members of the Royal Society. After breaking away from Sigmund Freud in 1910 to found a variant school of psychoanalysis, Alfred Adler highlighted social influences on personality, including birth order. A secondborn, Adler regarded firstborns as ‘power-hungry conservatives.’ He characterized middleborns as competitive, and youngest children as spoiled and lazy.

During the half-century since Adler’s speculations, psychologists have conducted more than 2000 studies on the subject. This literature has often been faulted, and critics have rightly argued that the findings conflict and that most studies are inadequately controlled for social class, sibship size, and other background influences that correlate with birth order and can lead to false conclusions. The reality of these reported differences is nevertheless supported by meta-analysis – a technique for aggregating findings from different studies in order to increase statistical power and reliability. Considering those well-designed studies that adjust for social class or sibship size, meta-analysis reveals consistent birth-order differences for many personality traits. These findings may be summarized in terms of the Five Factor Model of personality.

Controlled studies generally report that firstborns are more *conscientious* than laterborns, a difference that is exemplified by their being more responsible, ambitious, organized, and academically successful. Laterborns appear to be more *agreeable* than firstborns, in the sense of being more tender-minded, accommodating, and altruistic. Laterborns are also more *open to experience*, as expressed by their being more adventurous and unconventional. Differences by birth order

are more restricted for the two remaining dimensions of the Five Factor Model. Firstborns appear to be more *neurotic* than laterborns, in the sense of being temperamental and anxious about their status. In addition, firstborns are more *extraverted* than laterborns, in the sense of being assertive and dominant, whereas laterborns are more extraverted in the sense of being sociable and fun-loving. Dominance and sociability are substantially different personality traits, even though they are classified together within the Five Factor Model. Firstborns tend to have higher IQs than laterborns, but this difference is small, especially after being controlled for differences in family size. On average, IQ falls one point with each increase in birth rank within the family. (Proponents of the Five Factor Model consider IQ to be a sixth factor, largely independent of personality.)

The personality differences that I have just reviewed are generally consistent with a Darwinian framework, albeit with an emphasis on adaptation through learning. Unlike the propensity to compete with one’s siblings, which is an ultimate cause of sibling conflicts, personality is a product of innumerable proximate causes that spur individuals to adapt themselves to the surrounding world. Firstborns often seek the favor of their parents by acting as a surrogate parent toward their younger siblings. As a result, firstborns tend to be parent-identified, conscientious, and respectful of authority. Laterborns cannot baby-sit themselves, so they look for an unoccupied family niche, in part by cultivating latent talents that can be discovered only through experimentation. For this reason, they are often more exploratory and open to experience. Another reason for the divergent personalities of siblings is the different strategies they employ in their relations with one another. These strategies involve behaviors that are typical of mammalian dominance hierarchies. Because firstborns are bigger, they are more likely to employ physical aggression and intimidation, and in general they are more likely to boss and dominate their younger brothers and sisters. Laterborns tend to use low-power strategies, such as whining, pleading, cajoling, humor, social intelligence, and, whenever expedient, appealing to parents for help. Two or more laterborns may also join in coalitions against the firstborn.

A Darwinian approach also leads to specific predictions about middle children, who lack the advantages of being either first or last. When resources are scarce, parents are expected to invest preferentially in firstborns because they are the first to reproduce. Older parents are expected to invest preferentially in lastborns because these offspring are the most vulnerable to disease and, after parents have ceased reproducing, are the last children they will ever have. As Catherine Salmon and Martin Daly have shown, middle children often respond to their Darwinian handicap by becoming peer-oriented and independent of the family. Compared with firstborns and lastborns, middle children are less closely identified with the family, less likely to turn to their parents for help in an emergency, and less likely to report having been loved during childhood. Compared with their siblings, middle children typically live farther away from their parents. In addition, they are the least likely sibling group to visit, and to encourage their own children to visit, close kin. Consistent with their greater allegiance to the peer group, middle children also are the most inclined to diplomacy and cooperation, strategies that may reflect

their proclivity for mediating disputes between their siblings. Martin Luther King, Jr., the middle of three children, got his start as a champion of nonviolent reform by trying to prevent his younger brother from teasing their older sister.

Only children represent a controlled experiment in birth-order research. Because they experience no sibling rivalry, they are not driven to occupy a specific family niche. Like other firstborns, they are generally ambitious and conform to parental authority, because these attributes are valued by parents. Contrary to psychological folklore, only children do not appear to be more neurotic or less sociable than other children. There is often a greater difference between a firstborn and a secondborn child, or between a secondborn and a thirdborn, than there is between the firstborn and the thirdborn. The reason is that sibling competition promotes mutual differentiation in order to minimize direct conflicts, and children who are farther apart in age have less need to compete. This process of sibling differentiation, which is sometimes called deidentification, extends to relationships with parents. When a firstborn identifies more strongly with one parent, the secondborn is likely to identify more strongly with the other parent.

Some of these contrasts are striking. Voltaire, the third of three children, had an acrimonious relationship with his elder brother Armand, who became a follower of the Jansenists, a fanatical Catholic sect. Voltaire was particularly repelled by Armand's belief in the need to forgo life's pleasures in order to win God's grace. As a leader of the French Enlightenment, Voltaire was especially noted for his relentless attacks on the Catholic Church. He chose literature as a profession partly to spite his brother, whom he had repeatedly bested in impromptu poetry contests devised by his family.

A different example of sibling contrasts involves the consumer rights advocate Ralph Nader and his three older siblings. In early adolescence, the Nader children took a globe of the world, divided it into four equal portions, and assigned one part to each child. Thereafter, each specialized in the history, culture, and languages of his or her own quarter of the globe. By minimizing direct competition, the Naders were also cooperatively pooling their resources as a family unit, collectively enabling them to learn more about the world. As Darwin recognized in the *Origin of Species* (1859), diversification is an effective way to reduce competition while also realizing the benefits stemming from the division of labor.

Direct Sibling Comparisons

Birth-order differences in personality vary in magnitude and sometimes even in direction, depending on how they are measured. When assessed by self-report questionnaires, birth-order effects are typically modest and nonsignificant. Yet systematic differences by birth order are generally found when parents rate their own offspring or when siblings compare themselves with one another. In a recent study by Frank Sulloway, 660 business leaders were surveyed. In self-reported ratings, firstborn CEOs did not differ significantly from laterborns on ten of the 11 personality traits included in the survey. After providing these self-assessments, respondents were asked to compare themselves with their siblings, using the same 11 personality scales. A comparative method of assessment possesses several advantages over more customary methods of

self-report. In particular, direct comparison anchors the scales. Additionally, comparative judgments among siblings eliminate any confounding effects associated with differences between families. Using such comparisons, eight of the 11 traits included in the survey elicited significant differences by birth order. Relative to their older siblings, laterborn business leaders were more tender-minded, cooperative, flexible, submissive, empathetic, liberal, unconventional, and even-tempered. Overall, comparative ratings resulted in birth-order differences that were five times as large as those previously obtained without using direct comparisons.

A follow-up study involving 6053 individuals aged 8 to 95 (mean age = 36.8, $SD = 17.1$) has yielded similar results for a broad array of personality traits. Subjects rated themselves on nine-step bipolar scales using adjective pairs that were chosen to represent the 30 facets of the NEO PI-R, a comprehensive personality inventory based on the Five Factor Model. Firstborns were asked to rate both themselves and their next younger sibling, whereas laterborns were asked to rate themselves and their next older sibling. Based on direct sibling comparisons, 23 of the 30 bipolar adjective pairs yielded significant differences, and 26 of the 30 adjective pairs produced correlations in the expected direction. As anticipated, firstborns were judged to be more conscientious than their younger siblings, whereas laterborns were judged as being more agreeable and open to experience. For neuroticism, a dimension for which birth-order differences were expected to be mixed, firstborns were predicted to be more anxious and quicker to anger – expectations that were both confirmed. Laterborns were predicted to be more depressed, vulnerable, self-conscious, and impulsive, but only the last two predictions were confirmed. As anticipated, results for extraversion were also mixed. Laterborns were more affectionate, fun-loving, and inclined to seek excitement. Firstborns were more energetic and dominant.

Controlling for age, sex, sibship size, and social class, the partial correlation between birth order and a scale score of predicted differences was 0.20, with birth order accounting for 4.1% of the variance. Two other family background variables – sibship size and social class – account for less than 0.1% of the variance in this scale score of predicted differences, as also does age. By comparison, sex explains 2.1% of the variance. (Laterborn personality traits resemble those observed in females.) Controlled for the linear effect of birth order on the scale score, there was also a significant quadratic trend: middle children scored higher than last-borns on some personality scales, particularly those related to agreeableness (Table 1).

Measured in terms of an overall scale score that reflects predictions about birth order, age and sex account for substantially less variance in personality scores than does birth order. It is important to note, however, that age and sex explain considerably more about personality as a whole than they do about birth-order-related traits. Sex differences in my study account for 8.3% of the variance in dimension scores for the Big Five, and age explains another 2.6% of the variance. In accounting for 4.1% of the variance in these same dimension scores, birth order is substantially more influential than age, but less so than sex. Still, on two dimensions of the Five Factor Model (conscientiousness and extraversion), birth order has greater influence than either age or sex.

Table 1 Birth-order effects in scale scores for the big five personality dimensions based on direct sibling comparisons

Personality dimension ^a	Partial correlation with birth order ^b	N	p <
Conscientiousness ● Firstborns are more <i>deliberate, dutiful, effective, energetic,^a hardworking, organized, self-disciplined, and under control^a</i>	-0.18	4507	0.0001
Agreeableness ● Laterborns are more <i>acquiescent, cooperative, easygoing,^a modest, straightforward, unassertive/submissive,^a tender-minded, and trusting</i>	0.10	4510	0.0001
Openness to experience ● Laterborns are more esthetically inclined, <i>prone to fantasy, attentive to inner feelings, untraditional, attracted by novelty, and drawn to ideas^c</i>	0.08	4484	0.0001
Extraversion ● Laterborns are more <i>affectionate, excitement-seeking, fun-loving, and gregarious</i>	0.14	4404	0.0001
Neuroticism ● Firstborns are more <i>anxious</i> , as well as more prone to depression and feelings of vulnerability	-0.04	4278	0.001
● Laterborns are more <i>self-conscious</i>	0.05	3548	0.005
Scale score for personality differences, as predicted ^d	0.20	4177	0.0001

^aEach of the 30 bipolar adjective pairs, representing the 30 facets of the NEO PI-R, is classified under the Big Five dimension on which it has its highest factor loading. Four of the 30 adjective pairs have their highest loading on a personality dimension other than the one for which they were selected. 'Assertive (dominant)/unassertive (submissive)' has its highest loading on Agreeableness (-0.54) rather than Extraversion (0.32). Similarly, 'quick to anger/easygoing' has its highest loading on Agreeableness (-0.55) rather than Neuroticism (0.47). 'Impulsive/under control' has its highest loading on Conscientiousness (-0.59) rather than Neuroticism (0.24). 'Energetic / leisurely' has its highest loading on Conscientiousness (0.47) rather than Extraversion (0.28).

^bA positive partial correlation denotes a higher score for laterborns. For each bipolar trait, a sibling difference score was calculated using z-scores and then used to compute each scale score in terms of predicted differences. Italicized traits exhibit significant birth-order differences. (All statistical tests are two tailed.) All partial correlations are controlled for age, sex, sibship size, and social class. All dimension scale scores except Neuroticism exhibit a significant quadratic effect, controlled for the linear trend, indicating a higher score for middleborns. For one dimension (Agreeableness), the quadratic trend is larger than the linear trend. Excluded from these statistical results are 548 only children, 71 twins, 112 subjects reporting an age gap of more than 9 years between themselves and the sibling they also rated, 86 subjects whose biological and functional birth orders do not coincide, and 726 subjects who did not provide information on one of more of the dependent or independent variables.

^cBeing 'drawn to ideas' was predicted to be a firstborn trait.

^dSome respondents made ratings on fewer than 30 bipolar adjective pairs. In these cases, scale scores have been computed from the observed data.

One should bear in mind that birth order is only a proxy for the real causes that lie behind sibling differences in personality, namely, disparities in age, size, status, and power within the family system. Not all firstborns adopt the role of a surrogate parent toward younger siblings, and some firstborns are less bossy than others. Individual differences in physical size, temperament, and opportunities for surrogate parenting help to explain why some individuals deviate from the patterns of personality that are generally expected by birth order. In the study summarized in **Table 1**, individuals were asked to what extent, during childhood, they acted as a surrogate parent toward their siblings, and also to what extent they bossed their siblings around. High scores for surrogate parenting behavior and bossiness reflect typical firstborn behaviors and are strongly correlated with birth order ($r = -0.56$ for the composite measure). This indicator of family niches also accounts for 10.5% of the variance in personality scores, making it considerably better at predicting personality than any other variable in the study. The predictive success of this variable lies in large part in its ability to account for exceptions to predictions based on birth order. For example, laterborns (often eldest daughters) sometimes report having done substantial surrogate parenting with respect to their younger siblings. These individuals also tend to describe themselves as having firstborn personality traits.

Other studies using the NEO Personality Inventory and comparable instruments have generally yielded null results,

although most of these studies have possessed only moderate statistical power and none have employed the method of direct sibling comparison. Based on similar discrepancies between self-report ratings, which often yield meager results, and significant differences as judged by family members, some researchers have argued that birth-order effects are parent specific and do not hold up outside the family.

When assessed meta-analytically, however, studies involving nonfamily members exhibit significantly more findings of a confirmatory nature than are expected by chance. Confirmatory findings are also especially likely to occur whenever studies involve real-life behavior. In addition, if birth-order effects are specific only to childhood (and the family milieu), one might expect these differences to diminish with age. In the study reviewed in **Table 1**, birth-order effects do decrease modestly with age for conscientiousness, but they increase modestly for agreeableness. Overall, there is not a significant diminution in the scale score for predicted birth-order effects by age.

The method of direct sibling comparison does not prove that birth-order differences in personality exist outside the family milieu. Direct sibling comparisons may also be susceptible to 'contrast effects,' whereby small but real differences between siblings are magnified, exaggerating the variance explained by birth order. However, when the scores in **Table 1** for direct sibling comparisons are transformed into binary outcomes (i.e., being higher or lower than a sibling on each trait), birth-order effects are only slightly reduced.

Another possibility is that these comparative measures reflect shared stereotypes about personality, rather than true differences. In an effort to determine whether birth-order differences are recognized by people other than siblings, study participants were asked to rate their spouses. Significant birth-order differences emerged in the expected direction, although the mean effect size for the Big Five personality dimensions is somewhat smaller than for direct sibling comparisons. Controlling for age, sex, sibship size, and social class, the partial correlation among spouses between birth order and a scale score for predicted personality differences is 0.12, which accounts for 1.4% of the variance ($N = 822$).

An analysis of the scores for individual traits reveals that spouses are detecting the same birth-order differences that they reveal when they compare themselves with a sibling. A convenient way of demonstrating this point is to compare the effect sizes for birth order, on a trait-by-trait basis, with the effect sizes for the same traits as judged by spouses. These two sets of effect sizes are substantially correlated ($r = 0.61$, $N = 30$ traits, $p < .001$). In other words, those traits that are strongly associated with birth order in sibling relationships are the *same* traits that are strongly associated with birth order in married couples. Relative to firstborn spouses, for example, laterborn spouses are perceived to be less conscientious, but more agreeable, extraverted, and open to experience. A similar pattern in birth-order effects is found among college students who rated both a sibling and a roommate ($r = 0.72$, $N = 30$ traits, $p < 0.001$; for roommates, the partial correlation between birth order and a scale score for predicted personality traits is 0.16, $N = 165$, $p < 0.05$). Thus birth-order differences are not restricted to family members or the family milieu, as some psychologists have claimed. Rather, these differences tend to manifest themselves in intimate living situations.

Gender, Age Spacing, and Other Moderating Influences

Birth order is only one influence among many that contribute to the development of personality. Accordingly, there are exceptions to any generalization on this topic. The largest source of exceptions are those arising from genetic differences, which collectively explain about 40% of the variance in individual traits. Additionally, as children grow up and spend more time outside the family, they are increasingly influenced by peer groups and by life experience more generally. Some of these extrafamilial influences may nevertheless reflect differences that already exist between siblings.

There is growing evidence that some birth-order differences in personality are influenced biologically by the prenatal environment. Among males (but not among females), laterborns are more likely to become homosexuals. Unlike other behavioral effects associated with birth order, the operative factor is number of older brothers rather than relative birth rank from eldest to youngest child. In other words, a lastborn male who is the eldest of his sex is no more likely to become a homosexual than is a firstborn. These findings can be explained by assuming that a small proportion of mothers develop antibodies to one of the male-specific minor histocompatibility antigens.

It has been hypothesized that such immunological responses prevent subsequent male fetuses from being fully transformed from female to male.

These findings about male homosexuality suggest that other aspects of personality – specifically, those involving gender-related traits such as tender-mindedness – might also be influenced by the prenatal environment. If such biological effects exist, they appear to be very small in normal populations. For example, meta-analysis of the birth-order literature reveals no significant difference in the frequency of birth-order effects by sex, including for behaviors specifically related to agreeableness and extraversion, which include many gender-related traits. In the study reviewed in [Table 1](#), birth-order effects were just as substantial among women as among men. For males, moreover, number of elder brothers had no relationship with gender-related traits, with birth order being controlled. In short, the link between number of elder brothers and gender-related traits appears to reflect a developmental outcome of nonpsychological origin that is confined to male homosexuals.

Gender also contributes to personality, doing so in ways that parallel the influence of birth order on some personality dimensions – particularly extraversion and agreeableness. These similarities arise because birth order and gender have comparable effects on the strategies siblings use as they jockey for position within the family. Partly for genetic reasons and partly because of socialization, females tend to be less aggressive than males, just as laterborns tend to be less aggressive than firstborns. Gender also modifies the forms taken by aggression. Firstborn males are more physically aggressive than laterborn males, whereas firstborn females are more verbally aggressive. In addition, males and firstborns tend to be more assertive and tough-minded, whereas females and laterborns tend to be more affectionate, tender-minded, and cooperative. Women tend to be conscientious, whereas laterborns do not, so these behavioral parallels do not apply across the board.

Birth-order effects are modified by age gaps as well as by the sex of siblings. The influence of birth order is muted when the age gap is so small that the relationship between siblings is nearly equal, and also when the age gap is so large that they do not compete for the attention of their parents. When middle children have a large age gap between themselves and their next older sibling, but a small gap between themselves and their next younger sibling, they are more similar to firstborns in their personality.

Although laterborns tend to be more socially liberal, as well as more adventurous and unconventional than their older siblings, there are exceptions to these generalizations that are attributable to other aspects of family dynamics. Firstborn children of socially liberal parents tend to become liberals themselves because they generally conform to parental values. A laterborn child of liberal parents may become a conservative just to be different. Furthermore, firstborns sometimes become social or political radicals because they are in conflict with their parents instead of identifying with them. Mao Zedong, the eldest of four children, was radicalized by conflict with his father, a cruel and tyrannical man who mistreated his wife, his children, and the workers on his farm. Mao once said that

there were two political parties in his family, and that he was the leader of the opposition. In general, laterborns are likely to rebel even if they do not have Attila the Hun for a father or the Wicked Witch of the West for a mother. They have elder siblings to induce them to identify with the underdog.

The consequences of birth order are often strongly dependent on the behavioral context, which is one of the most important moderators of human behavior. In different situations, the same person may behave quite differently, and the relevance of birth order likewise varies with the situation. For example, a firstborn may act in a dominant manner toward a younger sibling or a spouse, congenially toward peers, and in a subordinate manner toward authority figures – a behavioral style that constitutes a ‘pecking order personality.’

Social categories such as age, gender, and socioeconomic status entail standards of behavior that can influence personality. In connection with the study summarized in [Table 1](#), respondents assessed the personality of a close friend ($N = 1002$). Significant birth-order differences emerged, but they did so in interaction with other variables. Upper-class respondents, as well as older respondents, saw their best friends as exhibiting the traits generally expected by birth order. In contrast, college students – especially those from lower-class backgrounds – did not perceive these same birth-order differences. For example, college students did not describe their firstborn friends as being particularly conscientious or conventional, whereas older respondents did.

These seemingly contradictory results are best understood in terms of the attributes that are important for success within each socioeconomic class, and during different stages of life. College-age students, especially from lower-class backgrounds, are likely to prefer friends who are sociable and who know how to have a good time. Because firstborns are more socially assertive and inclined toward leadership roles than are laterborns, they respond to these behavioral norms by projecting a gregarious and outgoing ‘persona.’ When people graduate from college, take a job, and marry, they assume new life roles and greater responsibility. Within such older populations, birth-order effects in personality increasingly conform to the expected pattern. Firstborns, who tend to be more conforming than laterborns, are especially affected by such life transitions. Compared with other individuals, firstborns are significantly more variable in terms of how their personalities are perceived across the social categories of age, class, and marital status. The more responsibility and status firstborns have acquired – for example, by getting married – the more they are judged by their friends as manifesting a typical firstborn personality.

These findings make sense from the perspective of evolutionary psychology, which is also a form of social psychology. The personality traits that are typically associated with birth order develop in the service of competition for scarce resources, principally parental investment. Adolescent individuals do not generally command scarce resources, so their behavioral priorities tend to be different from those of adults. A firstborn who aspires to social approval may be dutiful at home (especially during childhood), agreeable and gregarious during adolescence, and competitive and self-disciplined as an adult member of the workforce. The expression of personality traits related to birth order is likely to be sensitive to these transitions

in the life course. In short, birth-order differences are not parent specific, but they are often situation specific. Research on birth order and creativity strongly reinforces this important conclusion.

Birth Order, Openness to Experience, and Creativity

As Robert R. McCrae has demonstrated, the various facets of openness to experience can be divided into two contrasting groups. One group reflects ‘intellect’ and is typified by adjective labels such as *intelligent*, *perceptive*, *curious*, *creative*, and *cultured*. The second group is defined by adjective labels that are closely associated with ‘nonconformist’ thinking, including *daring*, *unconventional*, *original*, *independent*, and *liberal*. Not surprisingly, the ‘intellect’ component of openness is more strongly correlated with IQ and years of education than is the second, or ‘nonconformist,’ component. Because firstborns tend to have higher IQs than laterborns, and because firstborns also tend to excel at academic pursuits, they are expected to express their creativity most strongly via openness in intellect. By contrast, laterborns are expected to express their creativity in ways that exemplify the nonconformist bent of their personalities.

Much of the existing research on birth order and creativity is marred by two shortcomings. First, investigators have generally failed to distinguish sufficiently between differing types of creativity; second, researchers have not usually studied creativity in real-life terms. In their monumental review of the birth-order literature from 1940 to 1980, Cécile Ernst and Jules Angst summarized the results of 28 relevant studies. 11 of these studies, which included such measures as the need for autonomy and the frequency of unusual word associations, showed no differences by birth order. The other 17 studies produced significant findings, but these results were largely contradictory. For example, three studies indicated that firstborns were more likely to prefer complex polygons (interpreted as a sign of greater creativity), whereas another five studies showed that laterborns preferred complex polygons. Even if these eight studies of visual preference had yielded consistent results, it may be questioned whether a partiality for gazing at complex polygons is diagnostic of creative achievement in real life. After all, a preference for parsimony and simplicity, not complexity, lies at the heart of modern science.

Research on divergent thinking is another area where birth-order findings have tended to conflict. Inasmuch as divergent thinking correlates substantially with IQ (a firstborn trait) as well as with unconventional thinking (a laterborn trait), this construct conflates these two different forms of intellectual ability. In fields such as literature, architecture, invention, and science, studies of creative achievement are generally limited by a failure to consider the nature of the creative act. It should come as no surprise that research in these various intellectual domains has generally yielded inconsistent results.

Some of the most compelling evidence for birth-order differences in creativity comes from intellectual and social history, especially in areas where the nature of the creative act is sufficiently public to be classified by experts in terms of differing forms of openness to experience. Considerable

research indicates that laterborns are more inclined than firstborns to change their views during times of radical political, social, or scientific change. This is because radical revolutions tap the nonconformist component of openness. During the Protestant Reformation, laterborns gave their lives to serve rebellion and firstborns to preserve orthodoxy. Laterborns were proportionately nine times more likely than firstborns to suffer martyrdom in support of the Reformed faith. In countries that turned Protestant, such as Henry VIII's England, firstborns were five times more likely than laterborns to become martyrs by refusing to abandon Catholicism. (These statistics are corrected for the greater number of laterborns in the population.)

The responses of scientists to radical conceptual transformations show similar differences. The Copernican revolution challenged church doctrine by asserting that the earth rotates around the sun. During the first half-century of this debate, laterborns were five times more likely than firstborns to endorse this heretical view. Nicholas Copernicus himself was the youngest of four children. George Joachim Rheticus, the young colleague whose zealous efforts finally prodded the 70-year-old Copernicus into publishing his unorthodox theory, was also a lastborn. In Darwin's own era, younger siblings were ten times more likely than elder siblings to become evolutionists. Darwin himself was the fifth of six children, as was Alfred Russel Wallace, codiscoverer of the theory of natural selection (Figure 1).

During other notable revolutions in science, including those led by Bacon, Descartes, Newton, Lavoisier, and Einstein, laterborns have been two to ten times more likely than firstborns to endorse the new point of view. This trend holds true even when the initiators of revolutions, such as Newton and Einstein, happen to be firstborns. Laterborns are more likely to endorse radical revolutions even after their scientific stance has been controlled for social attitudes (which are themselves a good predictor of the acceptance of such events). Accordingly, birth-order effects cannot be reduced to attitudinal

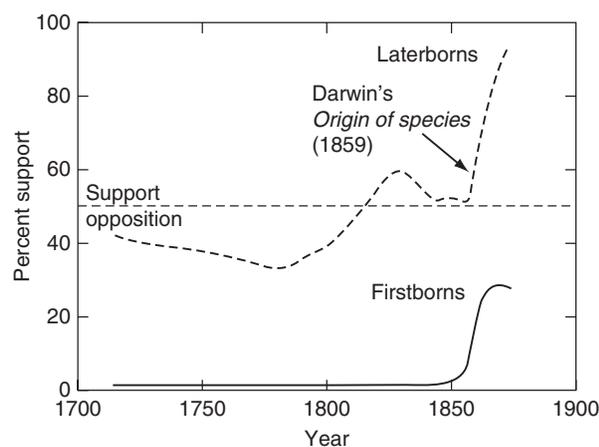


Figure 1 The reception of evolutionary theory from 1700 to 1875 by birth order ($N = 448$). During the long period of debate preceding publication of Darwin's *Origin of Species* (1859), individual laterborns were 9.7 times more likely than individual firstborns to endorse evolution. These group differences are corrected for the greater frequency of laterborns in the population. (From Sulloway, 1996, p. 33.)

differences, although birth order does influence social attitudes, which in turn influence openness to radical innovations.

Social Desirability Effects

Birth order exerts substantially more influence on behavior during radical revolutions than it does on self-reported personality traits, including those directly related to openness to experience. Radical revolutions typically constitute struggles over who controls valuable resources. It should come as no surprise that revolutionary challenges to the status quo provide a better test of personality differences (including those associated with birth order) than do self-report questionnaire data. In the study whose results are summarized in Table 1, firstborns claimed to be significantly more open to experience than their own younger siblings ($d = 0.16$, equivalent to a correlation of 0.08). But laterborns claimed to be even more open to experience than their own older siblings ($d = 0.33$, equivalent to a correlation of 0.16 in the opposite direction). The significant net difference between these two correlations strongly suggests that laterborns are more open to experience than are firstborns, despite firstborns' claims to the contrary. That the judgments of firstborns were generally incorrect about this aspect of their personalities is corroborated by their responses to an open-ended question. Subjects were asked, "What would your friends consider to be the two or three most unconventional or rebellious things, if any, that you have done during your life?" In answering this question, the number of words that respondents wrote down was significantly correlated with their total score for openness to experience. Relative to firstborns, laterborns tended to produce longer responses and to list a higher proportion of truly unconventional behaviors, as assessed by independent judges.

Other findings from this study reinforce the conclusion that social desirability influences self-reported judgments about personality. For example, older respondents believed that they were just as open to experience as younger respondents ($r = 0.00$). Yet these same respondents claimed that their siblings and friends were significantly less open to experience with age (mean-weighted $r = -0.14$). Both answers cannot be correct, and real-life evidence helps to arbitrate this issue. During radical revolutions, age is a reliable predictor of responses to change. As I have documented in a study of 121 major controversies in science and social thought, older individuals generally oppose radical changes (mean-weighted $r = -0.21$, $N = 4505$). In my questionnaire study, people appear to have correctly recognized in others what they failed to acknowledge in themselves, namely, a reduction in open-mindedness with age.

When we consider the fact that social desirability biases can produce correlational discrepancies as large as 0.3, and that most birth-order effects are about one third this magnitude, it becomes more clear why self-report data might tend to underestimate birth-order differences. On every dimension of the Big Five, social desirability effects dwarf those associated with birth order. Unfortunately, we cannot assume that such social desirability biases cancel themselves out with the use of direct sibling comparisons, because research has consistently shown that firstborns are more likely than laterborns to conform to social expectations. Because the degree to which

self-ratings are embellished in a favorable direction is probably different for firstborns and laterborns, it is difficult to know what is the true influence of birth order for any particular personality trait. For these reasons, real-life behavior remains the best test of the magnitude of birth-order differences in personality.

Age and birth order are only two of many significant predictors of individual responses to radical change. Being socially liberal is another substantial predictor. So is parent – offspring conflict, which disrupts birth-order effects among firstborns and makes them into ‘honorary laterborns’ in terms of openness to experience. Multivariate models that include these and other predictors of openness to radical innovation are significantly more powerful than predictions based on single variables. In general, people who are the most likely to endorse radical changes are also more likely than average to *initiate* such changes. Hence a willingness to endorse heterodox viewpoints is a necessary, but by no means a sufficient, condition for intellectual discovery. These findings do not mean that young people, laterborns, and social liberals have a monopoly on scientific creativity or truth. For example, laterborns run the risk of accepting new and radical viewpoints too quickly, just as firstborns run the risk of resisting certain kinds of necessary changes. Laterborns were nine times more likely than firstborns to support Franz Joseph Gall’s false theory of phrenology – the notion that character can be read by tracing bumps on the head. Firstborns correctly rejected this theory as pseudoscientific. (They also disdained phrenology because of its materialistic implications.)

During everyday ‘normal’ science, firstborns have a small but consistent advantage over laterborns. They are more successful academically and are more likely to become scientists in the first place. In addition, firstborns tend to win more Nobel prizes, which are generally awarded for creative puzzle solving (openness in the sense of ‘intellect’) rather than for revolutionary innovations (openness in the sense of ‘nonconformity’). Einstein revolutionized physics with his theories of special and general relativity. The Nobel Prize committee was wary of these theories and honored him instead for his discovery of the photoelectric effect. Owing to publication of the *Origin of Species*, Charles Darwin lost a knighthood that he had previously been slated to receive. A good indicator of a radical scientific revolution is the widespread opprobrium, not the accolades, that initially befall the instigators.

When scientific innovations involve ideologically conservative implications – as occurred, for example, with vitalistic doctrines during the seventeenth and eighteenth centuries – firstborns possess an even greater intellectual advantage over laterborns than they do during ‘normal’ science. Historically, firstborns have repeatedly championed new theories that bolstered God’s role in the Creation. Assessed jointly in terms of birth order and the ideological implications of innovations, four classes of innovation are possible, but only two have ever been documented. For example, laterborns have generally led radical revolutions, such as Copernicanism and Darwinism, that strongly challenged social and religious authority. Firstborns have generally backed innovations, such as eugenics and spiritualism, that also appealed strongly to religious and political conservatives. By contrast, there has never been an instance of a firstborn-backed radical revolution; nor has there ever

been a case of a conservative revolution that was advocated by laterborns and opposed by firstborns. In sum, the relevance of birth order to scientific innovation is strongly dependent on the nature of the innovation (Figure 2).

Birth Order and Achievement

Controlled for social class and sibship size, firstborns are overrepresented as scientists. Among laterborn scientists, middle children are particularly underrepresented, as they are among eminent individuals. These findings accord with the evidence that firstborns are more conscientious than laterborns, and that parents, especially under conditions of limited resources, tend to invest preferentially in firstborns and lastborns. On closer examination, evidence from the history of science indicates that firstborns and laterborns tend to achieve eminence in dissimilar ways. Firstborns have generally excelled in the physical sciences, where intellectual problems tend to be more clearly defined than in the life sciences. By contrast, laterborns have gravitated toward the biological and social sciences, where success often depends on knowing what the most important problems really are. The scientific achievements of laterborns have been facilitated by their tendency to pursue multiple research interests, a strategy that has been particularly fruitful within the life sciences where unsolved problems often transcend disciplinary boundaries. Charles Darwin distinguished himself in geographic exploration, geology, zoology, botany, ethology, and psychology. His knowledge of these diverse disciplines was crucial to his ability to develop his theory of evolution by natural selection.

Laterborns often achieve distinction in those walks of life that allow expression of their tender-minded qualities. For instance, laterborns are overrepresented among winners of the Nobel prize in literature and peace. Among participants in the abolition and Black Rights movements – who were mostly laterborns – middle children were the most likely group to employ nonviolent methods of persuasion. By contrast, firstborns and lastborns advocated militant strategies. During the French Revolution, firstborns such as Maximilien Robespierre rose to power within the National Convention by supporting the Reign of Terror. Younger siblings (particularly middleborns such as Georges Jacques Danton) opposed these extreme political measures and were ultimately responsible for the overthrow of Robespierre’s Montagnard (and largely firstborn) political party.

The relationship between birth order and creative achievement has not yet been studied with sufficient rigor for many intellectual domains, including music, art, literature, and business. When undertaking such future studies, researchers should bear in mind the differing kinds of openness to experience and their potentially distinct relationships with birth order. Studies also need to be controlled for other covariates – especially sibship size, social class, parent – offspring conflict, and social attitudes – that are required either for methodological reasons or because these variables moderate the influence of birth order. Ordinal position is only a proxy for differences in family niches (such as acting as a surrogate parent), and these proximate-causal mechanisms of personality development need to be investigated in greater detail. Finally, the nature of the behavioral situation is often a powerful moderating variable. In radical revolutions, birth-order effects tend to fade over time, as

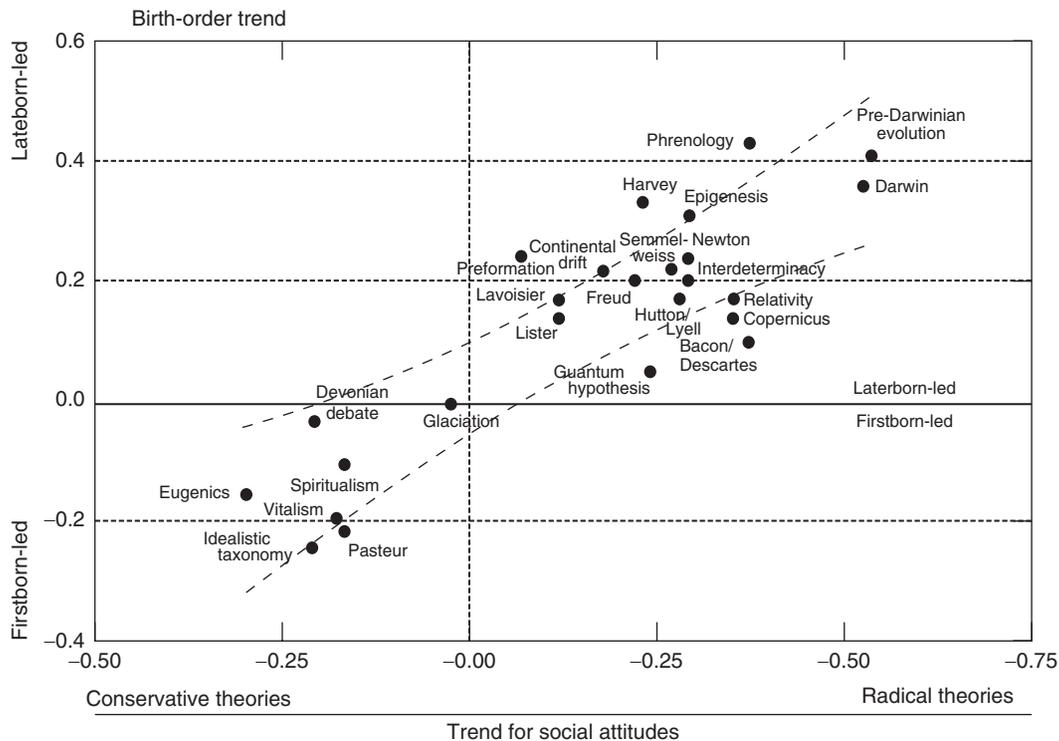


Figure 2 Birth-order effects in science, as they relate to the religious and political implications of 28 different innovations. The vertical axis depicts the correlation of birth order with support for scientific innovation ($N = 2013$). All events above the horizontal line (0.0) were endorsed by laterborns and opposed by firstborns, whereas all events below the line reflect greater support by firstborns. The horizontal axis indicates the correlation of social attitudes with support for each innovation. Events to the left of the vertical line (0.00) were endorsed by social conservatives and rejected by social liberals. Events to the right of the same line reflect support by social liberals and opposition by conservatives. Determinations of social attitudes involve more than 19 000 ratings made by expert historians, who judged the religious and political attitudes of participants in these 28 debates. The dashed lines indicate the 99% confidence limits for the regression line. This analysis establishes a simple generalization: *The more socially radical the innovation, the more it was supported by laterborns and opposed by firstborns*. Missing from the history of science are two classes of potential events. There are no radical revolutions that are backed primarily by firstborns, just as there are no conservative theories that are backed primarily by laterborns. (From Sulloway, 1996, p. 332.)

new and initially controversial ideas become more widely accepted. In addition, some new ideas are more controversial than others and tend to elicit correspondingly larger birth-order effects. National differences sometimes mediate these effects. Given their allegiance to Descartes' rival theory of celestial mechanics, French physicists – especially firstborns – manifested strong opposition to Isaac Newton's theory of universal gravitation. British scientists, including firstborns, welcomed Newton's ideas. Ultimately, the relationship between birth order and creativity needs to be approached in meta-analytic terms that include explicit roles for the nature of the innovation, as well as the social and intellectual contexts in which such innovations arise.

Conclusion

Birth order provides one important source of personality differences, which in turn underlie differences in creative achievement. Disparities in birth order cause siblings to experience the family environment in dissimilar ways. In addition, birth order introduces the need for differing strategies in dealing with sibling rivals as part of the universal quest for parental favor. This is a Darwinian story, albeit with a predominantly environmental twist. Siblings appear to be hardwired to compete

for parental favor, but the particular strategies they adopt within their own family are determined by the specific niche in which they have grown up. As children become older and leave the family, they modify their behavioral strategies – both competitive and cooperative – as they adapt themselves to new life roles. The enduring imprint of childhood learning, and its manifestations in adult personality, is nevertheless discernible in those abilities that come to us most naturally and that owe themselves to prior niche partitioning within the family. Through its context-sensitive relationship with birth order, creative achievement represents a case in point. Evidence from intellectual and social history highlights the conclusion that firstborns and laterborns do not differ in overall levels of creativity. Rather, brothers and sisters are preadapted to solving disparate kinds of problems, which they generally tackle using differing kinds of creative strategies.

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See also: Divergent Thinking; Eminence; Innovation; Intelligence (as Related to Creativity).

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David Bohm 1917–1992

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David Bohm was a physicist and thinker who proposed an alternative approach to the conventional version of quantum theory, as well as proposing that a new *Implicate Order* lay behind what could be thought of as our surface perception of reality. Bohm's ideas extended beyond theoretical physics and included reflections on the nature or creativity and the order of society and the individual. He also proposed a dialog process where a group of 3–40 people would meet together over an extended period. This process has since been continued by a number of groups. While viewed in certain quarters as something of a maverick, his ideas remain influential.

Childhood

David Bohm's creative life involved a weaving together of many different threads and pathways, and so I will leave a discussion of Bohm's own views on creativity until the end of this article, where they will be seen to integrate with his life.

David Joseph Bohm was born on 20 December 1917 in the coal mining town of Wilkes Barre, Pennsylvania. His brother Robert was born four years later. His father Shmul Düm came from an orthodox Chasidic family in the Hungarian town of Munkács. He emigrated to the United States where an immigration official changed his surname to Bohm. Shmul worked at first as a peddler before settling in Wilkes Barre at the home of the Popky family, where he eventually married Frieda Popky and opened a used furniture store.

Bohm's childhood was not particularly happy. His father appeared distant and at times sarcastic to his eldest son while his mother began to show increasing signs of mental disturbance. It was left to David's maternal grandmother to run the household. The young boy was physically uncoordinated and remained on the fringes. While his school companions played together, he would wander away in the woods. While home life was less than ideal he discovered the world of science fiction at the age of ten when he came across the magazine *'Amazing Stories.'* Soon his imagination was fired with visions of aliens and space travel. Always those other worlds and their inhabitants proved far more ideal than the Earth he had left behind. Soon the boy was composing stories of his own and writing to the editors of his favourite science fiction magazines.

He also began to have compelling fantasies of light so intense that it would penetrate matter and probe his own brain. Soon he was carrying out scientific experiments and became enthralled by such things as the gas fluorine that could etch glass and the metals potassium and sodium that would ignite in contact with water.

David did well at school, particularly in mathematics and, after reading a story about a boy who threw a ball into the fourth dimension, began to work out the geometrical consequences of a four-dimensional world. This caused him to wonder if the world around him was less substantial than

people believed and to speculate that maybe we were all living in a higher dimensional reality. Dreams of ideal worlds and higher dimensions may well be the childhood seed out of which his *Implicate Order* was later to develop.

With a home that was chaotic, oppressive, and at times violent, David had a desire to seek security. This extended to his own body – he would carefully plan each physical movement when, for example, climbing a tree, so that he was always in control of his body. One day his friends were crossing a river by means of a series of rocks. As usual Bohm planned out each move, but as he jumped onto the first rock he realized that he could only continue to cross by being in constant movement, rather than moving between a set of fixed positions. This appears to have been an important revelation to him; to learn that security could lie in movement. Later, in the world of his physics, Bohm would focus on the notion of 'holomovement,' or movement of the whole. Thus in Bohm's mature view, the electron itself was no longer a particle but a process that constantly unfolds and enfolds out of the *Implicate Order*.

Towards the end of his time at high school Bohm was reading about Niels Bohr and developed his own approach to quantized orbits by proposing that the electron has tides and that the interval between successive tides is equal to the time the electron takes to orbit around its nucleus. He was also working on a 'general theory of the cosmos' which would also include the existence of mind.

Bohm and Oppenheimer

After high school Bohm studied physics at Penn State University where he felt free to pursue his own studies, and then at Cal Tech, where he became unhappy because of the amount of coursework that was demanded. Bohm already realized that his creativity lay in following his own pathways. A friend suggested he should speak to J. Robert Oppenheimer who had established a school of theoretical physics at Berkeley. The interview went well and Bohm was offered an assistantship that would cover his living expenses. Later in his life Bohm was to become friendly with the psychiatrist, David Shainberg, who noted that Bohm had always been in search of approval and in particular from one who could act as a father figure. Oppenheimer at first appeared an ideal person to fulfil that role; however, in addition to his somewhat arrogant attitude Oppenheimer had what he called his 'beastliness.' This behavior pattern involved drawing a new student very close to him and then suddenly rejecting him leaving the individual hurt and confused. Bohm's rejection was to come later.

Oppenheimer gave Bohm his first research problem, a theoretical description of proton–deuteron scattering. Bohm had already established his characteristic mode of research which involved taking long walks so that he could think. After several months he was invited to give a seminar on his work and for

two days prepared his talk, working up a great 'charge of mental energy.' The talk went so well that he reached the point where he began to feel that he had moved from physics into something almost mystical, so that the individual consciousness of the audience had been transcended and the room was filled with intense light. A psychiatrist would probably diagnose that Bohm had experienced a psychic inflation, and indeed the inevitable letdown was a period of depression that lasted for a year.

Transformation of Society and the Individual

Ironically under the Manhattan project Bohm's work was classified and so, without clearance, he was not even in a position to defend his Ph.D. thesis! External forces were also at work in other ways. Bohm had earlier been concerned about the rise of Nazi Germany and the anti-Semitism he had noted in his own country. Now he learned about the Soviet Union and read Marx and Engels. He had always been concerned about the fragile nature of human society but it now appeared that, through dialectic materialism, society could change in a radical way and that, within such a new society, the individual would also transform. But, Bohm wondered, how could there be individual freedom within the collective, a question that was to resonate with his next research topic, the theory of plasmas in metals. It was a particular characteristic of Bohm's life and creativity that his scientific, social, and personal concerns were always part of a greater whole.

Plasmas in Metals

A plasma is a gas of electrically charged particles and can be found, for example, in the sun. But plasmas also exist in metals since, while most electrons are bound to the atoms in the metal lattice, the outer electrons are free to move through the charged lattice. Bohm established his theory by using two sets of variables; one described the movement of individual electrons, the other the collective motion of the plasma. By expressing a relationship between the two sets of variables Bohm was able to obtain an accurate theory of plasma behavior in a metal. What is more, while the electrical repulsion between two electrons normally falls off quite slowly – meaning they can feel this repulsion at great distances – in the case of the plasma this repulsion falls off rapidly. Bohm's conclusion was that to the extent that the individual contributes to the collective, that individual becomes relatively free.

The United States was now at war and Oppenheimer was essential to the running of the Manhattan Project. However the security services were uneasy with his left-wing sympathies and he was subject to investigation. When questioned, Oppenheimer was willing to name names and discuss his students' political sympathies. One of those whom he termed 'politically suspect' and possibly 'dangerous' was David Bohm. It would be some years before Bohm learned that his father figure had betrayed him. Not having security clearance for the Manhattan Project Bohm moved to Princeton where he developed a strong friendship with Einstein. He continued his work on plasmas but also began to write a text book on quantum theory, one that would present a clear expression of Bohr's Copenhagen interpretation.

Quantum Theory

The original quantum mechanics was created by Heisenberg, and a year later an alternative wave mechanics approach was proposed by Schrödinger. However it was necessary to give a coherent interpretation of these theoretical advances. This was done by Bohr in Copenhagen in discussions with Heisenberg, Schrödinger, Pauli, and others. In particular they discussed the 'meaning' of the theory, which Heisenberg proposed lay in the mathematics itself. But Bohr pointed out that when physicists discuss equations they use ordinary language which contains all manner of assumptions about space, time, and causality. His conclusion was that physicists are 'suspended in language' and that attempts to define the ultimate nature of quantum reality would end up running into paradox and confusion.

Hidden Variables

Bohm began to see that in a certain sense Bohr's approach was almost tinged with mysticism. Bohm believed for dialectical materialism to work, matter must be rational all the way down to the subatomic, yet Bohr seemed to be saying that there is a limit to what can be said about the quantum world. Inevitably Bohm felt the need to create a totally realistic causal account of the subatomic world. His theory is often referred to as 'hidden variables' and suggested that in addition to the ordinary electrical potential experienced by an electron there was a new 'quantum potential' at work. It is this quantum potential that is responsible for all the new features of the quantum world.

While engaged in this research Bohm was summoned before the House Un-American Activities Committee where he refused to name names. On 4 December 1949 he was arrested on a charge of Contempt of Congress and went to stand trial in Washington. While he was acquitted he had already been forbidden to set foot on the campus of Princeton University. Despite being the leading expert on the theory of plasmas, Bohm could find no university position in the United States or Europe, and therefore his only option was to move to the university at São Paulo in Brazil; and so his period of exile began.

Exile

This exile coincided with the publication of his 'hidden variable' paper. Bohm had expected it to create a stir of controversy and initiate debate on the quantum theory but, with the exception of de Broglie and Pauli, the world of physics ignored him. It was only later that Bohm learned that Oppenheimer had organized a seminar on Bohm's paper at Princeton. Oppenheimer's aim had been to discover a flaw in the theory, but when this could not be done he announced that "if we can't disprove Bohm we must all agree to ignore him."

Bohm moved to Israel where, with Yakir Aharonov, he discovered an effect whereby an electron is affected in a region where the electrical and magnetic field is zero. While the Aharonov-Bohm effect was controversial at times, it soon demonstrated that nonlocality was an essential feature of the quantum world. Later, several experimental groups were able to demonstrate that parts of a quantum system that had

initially been entangled together remained correlated even when separated by many meters. Of course ordinary systems can remain correlated by exchanging signals, limited by the speed of light, but nonlocal effects did not involve the exchange of signals. Bohm met his wife in Israel, a British medical volunteer named Sara Woolfson.

A New Order for Physics

In 1957 Bohm moved to England to take a position in the theoretical physics department at Bristol University. At Bristol Bohm focused on the inconvenient fact that, despite several decades of hard work, physicists been unable to reconcile quantum theory with Einstein's relativity. For Bohm this was not simply a matter of requiring a clever addition to a theory, or applying new mathematics, but rather proof that a radically new 'order' was required in physics. In 1957 Bohm wrote *Causality and Chance in Modern Physics* in which he offered an alternative to quantum theory.

The development of Bohm's approach to this new order for physics also gives some clues to the nature of his creativity, which was never narrow, nor focussed in one channel. Bohm had become engaged in a long correspondence with an American artist, Charles Biederman who had written *'The New Cézanne,'* a book that discussed Cézanne's desire to find a new order in art, one that would combine all the discoveries of the Impressionists with the rigor of a Poussin. Through this correspondence Bohm learned of Cézanne's approach and, in particular, how within each part of the canvas is implied the whole, and the whole is implicit in each of the parts. How much of this Bohm consciously absorbed is not clear; however he was now on the way to creating his own notion of an *'Implicate Order.'*

In a sense this notion goes back to Bohm's school day visions that the universe in which we live is only a part of something much larger; maybe, he thought, one of higher dimensions. The world of well defined objects in space and time, described by classical physics, Bohm termed the *'Explicate Order.'* Behind this order lies something deeper, the *Implicate* (or *enfolded*) *Order.* As aspects of the *Implicate* unfold they appear as the *Explicate.* This means that elements that are far apart in our *Explicate* world are in fact intimately connected and enfolded together within the *Implicate.* By way of an analogy Bohm compared a normal photograph, where points that are distant from each other on a person are also distant on the photograph, with a holograph where each part on the image of the person is enfolded over the entire holograph so parts distant on the figure are folded together in the holograph. Break off a part of the holograph and the entire figure can still be seen, admittedly with less definition.

Krishnamurti

Bohm's long term associate, Basil Hiley, suggested that Bohm's thinking was like a helix. He would focus on some particular concern or theory then appear to move away to some other area of thinking but eventually return to his starting point but in a more advanced way of thinking.

Thus while one area of focus remained the *Implicate Order,* with hidden variables very much in the background (but to return later), another was to begin a series of discussions with Jiddu Krishnamurti. In his general reading he had learned of the teacher Krishnamurti who had been discovered as a boy by Annie Besant and brought up to be the next great World Teacher. A meeting was arranged between the two men and at one point, when Bohm used the word 'totality,' Krishnamurti jumped from his chair and embraced him. A strong relationship soon developed between them – Bohm became a trustee of the Krishnamurti school at Brockwood Park.

Bohm believed that Krishnamurti's physical brain was unique in that it was not subject to the normal conditioning of other people, but could remain silent and free from thought so that something else could operate. He also felt that this mutation of his brain could also occur within himself when he was in the presence of Krishnamurti and that this change was permanent. While he had earlier pictured the transformation of the individual via the transformation of society, he now believed that a personal transformation was possible through Krishnamurti.

Their discussions together were audio taped and later some of these were transcribed for publication. Bohm took these discussions so seriously that he once remarked to me that maybe he should give up physics in order to focus all his energies on the exploration with Krishnamurti. Bohm also continued these investigations on his own, and was exploring such areas as the relationship between thought and the physical body, in which the property of proprioception would extend to thought itself. He told me, "I have seen some of the things Krishnamurti talks about. I have looked at reality and seen that it is an illusion."

He was also exploring the role of language and the way in which the subject-verb-object structure of European languages reinforces the Newtonian world view of well defined objects in space interacting via forces and fields. Later this interest inspired him to develop what he termed the *'rheomode,'* or *flowing mode,* an artificial language rich in verbs that he felt would be appropriate for a discussion of the quantum level.

The Quantum Potential

Bohm moved to Birkbeck College, University of London where he collaborated with the physicist Basil Hiley. One of Hiley's students, Christopher Philippides, read Bohm's earlier *'hidden variable'* paper and used a computer program to calculate the shape of the quantum potential, as well as the paths taken by electrons in the famous *'double slit'* experiment.

Seeing these electron trajectories was a revelation for Bohm and he plunged back into physics and what he now termed *"the ontological interpretation of quantum theory."* The shape, or *'form,'* of the quantum potential was quite detailed and was an expression of the experimental surroundings experienced by the electron. It was in fact *'in-form-ation'* about the experimental background, and the electron was responding to this information in selecting its particular path.

While the effect of the potentials of everyday physics – electricity, magnetism, or gravity – depend on their size, the

effect of the quantum potential depends on its 'form.' This implies, Bohm argued, that the electron is able to 'read' this information so it possesses 'proto-mind.' The seeds of mind, in Bohm's opinion, had been present from the very beginning.

In parallel with this work, and his investigation of the nature and limits of thought, Bohm was also looking at what he termed 'pre-space' – the underlying structure out of which space-time and matter emerged. In collaboration with Basil Hiley he was using noncommutative algebras, in particular those of Hermann Grassmann and William Kingdon Clifford. This work continued until Bohm's death and was pursued by his colleague Hiley, who made a major breakthrough in 2008.

Clearly Bohm's creativity covered a wide spectrum with different preoccupations informing and enhancing each other. His interests included mathematical work in theoretical physics, his search for new orders in physics, his concern with thought and the nature of consciousness and its relationship to the physical body, as well as the transformation of the individual and society, and the relationship between language and our conception of reality. Again the theme of wholeness was ever-present. Since mind and matter could not be separated he preferred to use the term signa-somatic and soma-significance to express their essential unity.

He returned again and again to the theme of fragmentation. Fragmentation for Bohm involved not only taking apart what properly belonged together, but also attempting to put together what did not belong together. He found fragmentation not only in the discipline of physics, but in many other fields of knowledge and within society itself. Naturally when he chose a title for his next book, published in 1980, it was '*Wholeness and the Implicate Order*.'

In 1980 Bohm experienced chest pains and was found to have two blocked coronary arteries with a third almost blocked. The result was a by-pass operation, but after the operation Bohm's blood pressure collapsed and he was in a coma for two days.

Creativity

Following Bohm's recovery he began to work with me on a book, '*Science, Order and Creativity*,' a task that gave me some direct insight into his creativity and method of working. I would arrive at his Edgware home in London for morning tea and we would then read over the notes I had made the previous day. The next step was to go for a walk together, for Bohm thought best while walking, and discuss the material we had already written and explore new ideas. This would continue over lunch until it was time for his afternoon rest. For the remainder of the afternoon I would make notes on our discussions. At times Bohm would become animated about a new idea which seemed to appear to him as a whole gestalt which he then felt he had to explain and explore as fast as possible. Sometimes what he said did not seem to make sense, but this did not appear to matter to him since he was attempting to sketch out the wider pattern of how all this fitted together. And so the notes I made appeared to reverse a position or even appear contradictory. But all that would be discussed on the following morning during our walk together.

Dialog

Bohm's investigations with Krishnamurti had been among the most important encounters of his life but now he began to have concerns that Krishnamurti was not giving attention to the tensions that were arising at the Brockwood Park and Ojai schools. He also felt that the nature of his discussions with Krishnamurti were not as fruitful as they had been in the past and he decided to confront his friend while on a trip to Ojai in the spring of 1984. This did not go well and it appeared that a break was developing. Around the same period Bohm was becoming increasingly depressed and consulted a Jungian analyst. The therapy was not fruitful and he turned to a Freudian, Patrick de Mare.

In addition to one-to-one therapy, de Mare also worked with encounter groups. De Mare felt that such groups could play a positive role in social therapy and suggested that early hunter-gatherers, who travelled in groups of thirty to forty, would engage in regular discussions of this nature and so deal with any problems or tensions that came up. Despite his mental agony Bohm was attracted to de Mare's theory for it offered the possibility of transformation. Earlier he had believed that transformation would come via a Marxist revolution of society, then through a mental transformation in the presence of Krishnamurti. But now he saw yet another possibility, transformation via dialog. One weekend, during a visit to a group hosted by Peter Garret and Donald Factor, Bohm proposed that they attempt to move towards a dialog. Soon he was running dialogs in Israel, Sweden, Denmark, Geneva, and the United States as well as a regular group in London.

According to Bohm each of us has one or more 'non-negotiable' positions and when we encounter a person with the opposite position we either avoid that area, or risk rupturing the relationship. However within the group there will always be some who take an intermediate position, and their presence can help to slow down a person's reaction. Faced with a harsh word or unpleasant idea we tend to react quite rapidly with a feeling of internal bodily discomfort, a gesture or word. But if this can be slowed down then we will begin to develop a felt understanding of how all of this is structured within the body. Thanks to proprioception we know the location of our hand when we cannot see it, but now Bohm saw that through dialog people could develop a form of proprioception for 'how' they think.

Yet another function of the group is in regard to language. Language had always been of great importance to Bohm and he felt that it had become 'polluted' by the manipulation of politicians and other special interest groups who used language in specialized ways. Dialog, he believed could help 'clear up the pollution' in language.

The Super Implicate Order

Bohm was also extending his notion of the *Implicate Order*. Aspects of the Implicate unfold and manifest as the Explicate. But in this sense there was nothing new emerging, since all was already copresent in the *Implicate*, and so Bohm proposed another level – the *Super Implicate*. When the *Implicate* manifests an aspect of itself into the *Explicate* this manifestation is

observed by the *Super Implicate*, which then feeds back into the *Implicate*. By way of an illustration Bohm pointed to a video game. The computer program (*Implicate*) unfolds into the *Explicate* (the screen with the spaceships) and the whole process simply iterates. But with the addition of a player it is possible to observe the spaceships and, by moving the joystick, to feedback into the computer and modify the program. In this way, Bohm said, creativity is introduced.

Bohm also met with me at the Bailey Farm Institute near Ossining, New York to discuss our next book. Initially it was to be called *'The Order Between'* but in our discussions we touched on the notion of mediation, that was often used as a way of resolving disputes rather than arguing them in court. Bohm suggested that this approach could lead to compromise and an 'order between' was not always the best solution. What was needed was an 'order beyond.'

By 1991 Bohm's arteries began to clog again and his depression was more severe. By May of that year he confessed that he was feeling suicidal and was admitted to the Maudsley Hospital in London where he was given a course of 14 bilateral ECTs. Following this treatment he was released from the hospital at the end of August and put on a course of cognitive therapy. While he did appear to be cured of his depression he was troubled by memory loss, and his colleague Hiley noted that he did not have the same energy with which to engage in their research in physics.

Bohm and Language

The following spring Bohm visited Ojai in California and then the Fetzer Institute in Kalamazoo, Michigan where he had been made a Fetzer fellow. This coincided with a circle of Native American elders and Western scientists. The meeting was important to Bohm for several of the participants spoke the strongly verb-based Algonquin family of languages and they discussed their world view of constant flux and change. Bohm had long considered the role that a verb-based language would play in the way we perceive the world, and was now able to see it in action and in particular held a number of discussions with Leroy Little Bear of the Blackfoot confederacy.

Later that year Bohm was diagnosed as having suffered a heart attack and was also treated for viral pneumonia. On 27 October, while working at Birkbeck College he telephoned his wife to say he would take the underground back to Edgware and from there a taxi home. 'You know it's tantalizing,' he said, "I feel I'm on the edge of something." By the time the taxi arrived at his front door he was dead.

Bohm on Creativity

Creativity for Bohm was something innate. There was no need to 'foster' or 'encourage' creativity, but rather to avoid the blocks that prevent it from operating naturally. During his undergraduate years he had been happiest and felt most creative when he was free to pursue his own reading and explorations. Yet later, when he attended Caltech, he became depressed with the demands of the curriculum, the constant problem solving and quarterly examinations. At that time the only pleasure he obtained from physics came from his own independent reading

of Dirac and Eddington. Indeed Bohm believed that one of the serious blocks to creativity arises out of the educational system itself. He noted that when children are praised or rewarded for their work, the nature of their learning changes from that of free creative play into seeking rewards or avoiding punishment. In this way, Bohm felt, creative energy is diminished.

On one occasion Bohm had been offered a fellowship in one of the Oxford colleges. He made an informal visit, looked at the portraits hung on the walls of the dining hall and remarked "too much tradition." He did not accept the fellowship. Similarly he felt that conventional education gives too much weight to authority and fixed knowledge. This in turn can lead to a lack of self confidence. Above all what is required is a free play of the mind: one that can throw up new perceptions. Yet he also acknowledged that it is necessary to retain a sensitive perception towards the role of certain forms, for example to the structures of a fugue or sonnet.

And as to creativity within science? The mind has a tendency to hold on to what is familiar and this includes the tacit infrastructure of science, a tendency of thought which extends outwards into society at large. Bohm was aware that, with the discoveries of quantum theory, Niels Bohr had devoted his energies to establishing the orthodox 'Copenhagen Interpretation' of the theory. In his own work Bohm would not accept this orthodoxy and for some physicists he was seen as something of a maverick. Likewise he viewed the conventional approaches to seeing a unity between relativity and quantum theory as simply involving 'new mathematics' or 'new ideas' while his own vision was that a radically new order to physics was required. Bohm felt the present state of affairs was a result of individual scientists lacking the courage and energy to examine the whole structure of science. In turn, such an attitude encourages fragmentation whereby a topic can be studied in a more limited context. In particular, he felt that while the great scientific figures of the early decades of the twentieth century had been interested in philosophy, most contemporary scientists did not bother to explore the metaphysical assumptions of their positions.

Bohm also felt that a scientific discovery can be equated with a poetic metaphor, such as 'all the world's a stage.' To see the world and a stage as being the same is to exercise a radical perception of the mind. For Bohm this would be accompanied by great creative energy. An example from physics is William Hamilton and Carl Gustav Jacobi's discovery during the nineteenth century that it is possible to describe the movement of material bodies not only via traditional Newtonian mechanics but also in terms of waves. Thus the scientific metaphor becomes 'the particle is the wave.'

It is well known that visual perception is an intentional act involving the overall disposition of mind and body. Bohm himself was aware of the role of the body in the creative nature of his scientific perceptions. For example, while working on some equations he experienced a combination of movements within the body. He remarked on this to Einstein who told him that he would squeeze a ball while working on the field equations of general relativity. And just as perception involves not the mind but also the body, perception within science takes place not only within the mind but also within a larger social context. For this reason communication is important; not only in terms of an internal dialog but also at the social

level. Indeed Bohm argued that perception and communication cannot be fragmented but form a whole – ‘perception-communication.’ This was yet another area in which creativity had become blocked. As with other professions, such as law and medicine, science uses language in specialized and restricted ways. It was Bohm’s feeling that during the twentieth century communication in science had become compromised in subtle ways to the point where at times it was almost incoherent. He argued, for example, that differences in the way language was being used had led to the breakdown in communication between Einstein and Bohr, two scientists who had earlier dialogued extensively. Likewise he felt that the tensions between Heisenberg’s and Schrödinger’s approaches to the quantum theory had been resolved too rapidly. If those tensions had been allowed to continue then a new creative insight could have emerged. In short, it was Bohm’s view that science has to be carried out in a radically new way. He often would say that the aim of science should be the desire “to pursue truth no matter where it takes us.”

See also: Collaboration; Creativity in Science; Imagination; Innovation; Problem Solving.

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- http://www.vision.net.au/~apaterson/science/david_bohm.htm – Lifework of David Bohm.

Brain and Neuropsychology

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Glossary

Electroencephalography (EEG) EEG represents the electrical activity recorded along the scalp produced by synchronous firing of groups of neurons within the brain.

Emergenesis A process whereby novel or emergent properties arise from the interaction of more elementary (and partly genetic) properties.

Functional magnetic resonance imaging (fMRI) fMRI measures neural activity based on relative changes in blood flow and oxygenation in the brain.

Neuroanatomy Neuroanatomy is the study of the structural and anatomical organization of the brain.

Neuropsychology Defined narrowly, neuropsychology is the study of brain lesions and their effects on mental function. Defined broadly, neuropsychology is the study of correspondences between brain structure, mental function, and behavior.

Introduction

Creativity is an emergent trait. A trait is deemed emergent if its expression is brought about by the *simultaneous* presence and *interaction* of a set of constituent factors (e.g., intelligence, mental flexibility, working memory, etc.). In turn, many of creativity's constituent factors have been shown to have biological bases, supported by genetic, neuropsychological, and neurobiological evidence. In this article I shall review empirical evidence that sheds light on the neural underpinnings of the constituent components of creativity. I shall do so in relation to (a) the neuroanatomy of creativity; (b) the neurobiology of creativity in relation to *task-independent* resting-state brain activity; and (c) the neurobiology of creativity in relation to *task-dependent* cortical function. First, however, I shall begin with a description of the conceptual framework that motivates this neuroscientific approach to studying creativity.

Hierarchical Model of Creativity

Much like other higher-order mental activities such as reasoning and planning, there appears to be no unitary brain 'module' for creativity. In contrast, at the brain level complex higher-order mental activities appear to be based on distributed networks, built upon component neural systems that are reconfigured dynamically in relation to task demands. In this sense the neural architecture of creativity is clearly hierarchical. An important feature of complex hierarchical systems is that they tend to be 'nearly decomposable' into component systems. This means that under certain circumstances scientists are able to isolate and study the components of interest within larger complex systems.

A hierarchical functional organization for complex systems makes sense from an evolutionary perspective because it is more efficient for the brain to reconstitute component systems to serve multiple complex activities than it would be to create separate systems for each complex activity. For example, given that cognitive inhibition has been shown to be an important process in both reasoning and creativity, it would be advantageous to engage the same brain system to serve inhibition in

both mental activities. In fact, the same prefrontal system known to underlie inhibition is engaged in both mental activities. This approach has demonstrated that higher-order mental activities that appear different at the 'macro' (i.e., behavioral) level (e.g., creativity, reasoning, planning, etc.) are frequently built on largely shared cortical infrastructures at the 'micro' (i.e., neural) level. To the extent that one is capable of isolating the relevant structural and functional components of this architecture, one can use knowledge gained in one domain (e.g., reasoning) to test hypotheses in other domains (e.g., creativity).

Given that this hierarchical approach is based on the isolation and study of component factors, the key question to ask at the outset involves what those factors for creativity may be. Although currently there is no agreed-upon set of component factors that are individually necessary and jointly sufficient for creativity, most researchers agree that creativity is influenced by the interaction of a host of social, developmental, cognitive, and emotional factors. However, given that mental processes – conceptualized as cognitive processes and structures – are considered to be the "essence and engine of creative endeavors," my focus here will be on the neural underpinnings of *cognitive* factors relevant to creativity. Where appropriate, to the extent that they shed light on cognitive processes and structures, I shall also discuss the relationship between self-report measures of creativity and brain structure and function. Given the nascent state of this field, some caveats exist. For example, most studies have involved small sample sizes and await replication. Furthermore, most studies have mapped a single cognitive process (e.g., novelty detection/perception) onto a single measure of brain function, based primarily on functional magnetic resonance imaging (fMRI) or electroencephalography (EEG). Nevertheless, some convergence can already be noted across studies; a necessary requirement for the emergence of a preliminary cortical model of creativity. I shall end by noting what some of those points of convergence may be.

Neuroanatomy of Creativity: Cortical Structure

Structural imaging studies of the human brain have shown a moderate correlation between total brain volume and

psychometric measures of intelligence ($r=0.3$). However, recently there has been a trend toward focusing less on total brain volume and more on cortical thickness within specific brain regions. This is because developmental studies have demonstrated that the trajectory of the thinning of the cortex within frontal and parietal cortices constitutes an index of maturation for brain organization. Specifically, studies have shown that among children cortical thinning is fastest in those with the highest level of intelligence. However, cortical thinning does not occur at the same rate or stage throughout the brain. For example, while the parietal lobes exhibit the most thinning in early adolescence, the frontal lobes exhibit the most thinning in late adolescence. Although currently the nature of the underlying cellular events causing variation in cortical thickness are unknown, one possibility is that the formation and usage-dependent selective elimination of synapses may help sculpt the neural circuitry that underlies or supports cognitive abilities. This is consistent with movement away from plasticity toward usage-dependent specialization and efficiency in development.

Armed with this knowledge, Rex Jung and colleagues tested the hypothesis that creativity in young adulthood is related to cortical thickness. Associations would be evidence of the degree of linkage between creativity and maturation for brain organization. While the correlations between creativity and cortical thickness have been shown to form a complex pattern, here I shall focus on the link between creativity measures and cortical thickness in the right angular gyrus. In structural and functional studies this region has been associated repeatedly with intelligence, and hypothesized to play a role in the formation of (distant) semantic associations necessary for abstraction and understanding metaphors. Given that creative people have been shown to be faster in judging relatedness between concepts regardless of modality, the involvement of the right angular gyrus is evidence of its potential role in associational processes in creativity. Importantly, creativity measures have been linked to higher and lower cortical thickness depending on the brain region, suggesting that to the extent that cortical thickness constitutes an index of maturation for brain organization, higher creativity is not always linked to more maturation. Furthermore, despite focus on the right angular gyrus here, the associations have occurred in both hemispheres, suggesting that creativity is not a right-hemisphere syndrome, as previously believed. While interest in the link between neuroanatomy and creativity is not new, studies investigating this issue constitute a necessary step toward building a converging biological model of creativity, as has been shown to be the case with intelligence.

Neurobiology of Creativity: Resting-State Brain Activity

The four-stage theory for the creative process involving preparation, incubation, illumination, and verification, is well known. Insight – defined as the sudden appearance of a solution to a problem that one has been working on without any conscious sense of progress – has been historically linked with illumination, especially following transition from the incubation stage. However, the role ascribed to insight in creativity is

complex, ranging from central to irrelevant. The majority view suggests that insight is a small but necessary component of the creative process. Note that this description is consistent with a view of creativity as an emergent trait where individual components are necessary but not sufficient for the expression of the trait. This view opens up the door to studying insight as a component of the creative process.

Although the focus of this section is on *resting-state* brain activity, the empirical journey begins with task-dependent brain activity. John Kounios and Mark Jung-Beeman have conducted the most systematic series of studies on the neural correlates of insight solution. Given that so-called ‘insight problems’ can be solved either analytically or with insight, coupled with the fact that subjects can reliably judge which of the two processes led to the solution, retrospective verbal reports on a trial-by-trial basis have been used to categorize solution strategies. Two general sets of findings characterize this line of work. First, EEG evidence has shown that activity corresponding to insight solutions is associated with a burst of high-frequency activity (i.e., 40-Hz gamma-band) in the right anterior temporal lobe starting about 300 ms prior to indicating that a solution had been found. The corresponding fMRI signal has been localized in the right anterior superior temporal gyrus, located underneath the electrodes showing the EEG effect. The involvement of the right anterior temporal lobe has been linked to a weakly activated problem solution, in line with the role of this region in semantic association. Second, prior to the burst of gamma-band EEG activity in the right anterior temporal lobe a burst of slower activity (i.e., 10-Hz alpha-band) has been measured over the right occipital cortex. This activity has been linked to ‘sensory gating’: given that alpha-band oscillations are the brain’s dominant rhythm and reflect idling or inhibition of brain areas, activity in right occipital cortex could reflect a reduction in the amount of visual information passed from visual processing areas to higher areas that perform more abstract computations with that information. Therefore, insight solutions are believed to occur as a function of the weak activation of a problem solution in the right anterior temporal lobe coupled with sensory gating in the right occipital cortex that enables the subject to report it.

A reasonable question to ask is whether it would be possible to find the source of insight solutions even further back in time by examining brain activity *prior* to the display of each problem. In other words, brain activity already present upon the display of a problem may bias cognitive processing, increasing the likelihood of either insight or analytic problem solving. For problems solved by insight, EEG has revealed greater neural activity over the temporal lobes of both cerebral hemispheres. This activity has been attributed to the priming of brain areas that process lexical and semantic information, a function ascribed to the temporal lobes. Furthermore, insight problems have been shown to be associated with activity originating in the anterior cingulate. This area is involved in error monitoring, attention switching, and cognitive control. In this context its involvement has been attributed to readiness to detect and switch to weakly activated solutions.

Having demonstrated that brain activity at the time immediately prior to a solution can distinguish between analytic and insight solutions, a natural next question to ask is whether such dissociation can be linked to resting-state brain activity prior

to engagement in the task altogether. In fact, it has been shown that subjects who are more likely to solve problems with insight exhibit more right-hemisphere activity (and/or less left-hemisphere activity) relative to low-insight subjects in the low-alpha, beta-2, beta-3, and gamma bands under eyes-closed and eyes-open conditions. The involvement of this region is consistent with the view that solution of anagrams is facilitated by the formation of remote or loose associations between ideas, given the right hemisphere's role in the processing of remote associates. It appears that individual differences in resting-state brain activity influence the deployment of specific cognitive strategies for problem solving. It is known that resting-state EEG is fairly stable and has a genetic basis, further suggesting that fundamental properties of the nervous system can have far-reaching influence over components of creative thinking. Furthermore, given that personality traits such as extraversion have been associated with individual differences in resting-state brain activity and with creativity, findings linking resting-brain activity to creativity raise the intriguing possibility that resting-state brain activity may underlie those individual differences in personality that are linked to creativity. This possibility remains to be examined.

Neurobiology of Creativity: Task-Dependent Brain Activity

Having discussed the link between task-independent resting-state cortical activity and creativity, I shall now turn my attention to discussing studies of task-related cortical function. This section will be organized based on three component processes of interest: divergent thinking, mental flexibility, and the detection/perception of novelty.

Divergent Thinking

Divergent thinking has long been viewed as an important component of creative problem solving. The Alternate Uses Test is one of the most popular divergent thinking tasks. Early EEG results from pioneering studies by Colin Martindale distinguished alpha wave activity in relation to engagement in the Alternate Uses Test from activity in relation to engagement in the Remote Associates Test and intelligence tests. These three tasks vary in the extent to which performance is a function of reliance on divergent versus convergent processes: whereas the Alternate Uses Test is generally perceived to be a relatively 'pure' measure of divergent processes, the Remote Associates Test is considered to depend both on divergent and convergent processes, and intelligence tests are perceived to depend primarily on convergent processes. Highly creative people exhibited the greatest variation in EEG alpha wave activity across the three tasks. Specifically, whereas low-creativity subjects exhibited low EEG alpha on all three tasks, high-creative subjects exhibited high EEG alpha only during work on the Alternate Uses Test. Given that alpha wave activity is an inverse measure of cortical activity, this finding confirms that creativity is linked to task-related variation in cortical function.

Recently, Andreas Fink, Aljoscha Neubauer and colleagues have employed the Alternate Uses Test to study brain activity using EEG and fMRI in the same study design. Converging

methodologies is important because EEG and fMRI, due to their greater temporal and spatial resolutions respectively, offer researchers different types of information and thereby a more complete picture about task-related brain function. When EEG data were analyzed along the lower (8–12 Hz) and upper (10–12 Hz) alpha frequencies, the results demonstrated that the generation of unusual uses in the context of the Alternate Uses Test is associated with greater alpha synchronization in lower and upper bands compared to a task in which subjects were instructed to think of typical characteristics of conventional everyday objects. Greater alpha synchronization was especially prevalent in frontal areas of the brain. Interestingly, when subjects were categorized based on the originality of uses generated in the context of the Alternate Uses Test, those with higher originality scores showed greater synchronization in the right than left hemisphere. However, predictably, a different picture emerged from fMRI data. Specifically, the Alternate Uses Task activated a left-lateralized network comprising the inferior frontal gyrus extending to the supplementary motor area and anterior cingulate. This network is frequently activated in linguistic tasks, and its involvement is not surprising given the verbal nature of the stimuli and the task. This indicates that the characteristics of the task are reflected in the activations perceived in imaging technologies. This should sensitize researchers to task features when interpreting imaging results.

Another classic divergent thinking task is Match Problems. Unlike the Alternate Uses Task, Match Problems is a visuospatial problem-solving task. Whereas some match problems can be solved by a sequence of generate-evaluate cycles, others involve start states that create strong mental sets that implicitly obstruct certain transformations. For this reason it has been argued that good performance on Match Problems necessitates 'set shifts.' By relaxing the constraints placed on the problem space, set shifts effectively widen the problem space. Furthermore, set shifts are facilitated by mental representations of the start state that are more abstract and ambiguous than the one provided in the problem statement. This enables subjects to remain noncommittal about solution paths and strategies while flexibly generating potential moves.

Laurie Miller and Lynette Tippett studied the neural architecture underlying the solution of Match Problems in patients with focal brain lesions. Their results have shown that patients with focal right frontal lobe lesions were impaired specifically on those match problems that required set shifts. This selective impairment was especially apparent in patients with lesions to right *ventral* (as opposed to dorsal) prefrontal cortex (PFC). This deficit has been attributed to the role of the right frontal region in permitting flexible strategy shifts. These neuropsychological results have been corroborated with fMRI data. Specifically, Vinod Goel and Oshin Vartanian have shown that whereas engagement in Match Problems was associated with activation in left dorsal lateral PFC and right ventral lateral PFC, the latter structure was activated exclusively when subjects successfully solved problems that required set shifting. The convergence of neuropsychological and imaging results provides strong support for the role of right ventral lateral PFC in flexible strategy shifts in the context of Match Problems.

Some Match Problems allow the generation of multiple solutions to the same problem. Divergent thinking is relevant here because it reflects the ability to generate many solutions to

a problem or prompt (i.e., fluency). In the context of Match Problems, activation in right dorsal lateral PFC has been shown to covary parametrically with the number of generated solutions. There are at least three possibilities for its involvement in divergent thinking ability. First, generating additional hypotheses in divergent trials requires their maintenance in working memory. The involvement of right dorsal lateral PFC in working memory for maintaining and storing information is well established. Second, as subjects generate and evaluate hypotheses, they need to keep track of successful and unsuccessful attempts. On a cognitive level, one would expect a positive correlation between the number of hypotheses generated and the demand on monitoring resources and relations. In fact, right dorsal lateral PFC has been implicated in tasks that require the integration of multiple relations and monitoring subgoal processes, as would be required here. A third possibility involves conflict resolution. As additional solutions are generated, not only is there a need to update previous responses, but also to resolve the conflict between responses. As one generates more responses, the conflict of choosing between multiple responses would increase accordingly. The role of the right dorsal lateral PFC in conflict detection and/or resolution is widely recognized. Of course, these three explanations are not mutually exclusive, and possibly all contribute to divergent production.

Mental Flexibility

One of the hallmarks of creativity is mental flexibility. Mental flexibility is best conceptualized as the ability to relax the constraints within which a problem is embedded, in turn facilitating exploration of multiple possibilities. This idea was alluded to earlier in the form of 'set shifting' in the context of Match Problems, but it will be discussed more focally here. The concept of mental flexibility is intricately linked with the concept of attention. Specifically, recent experimental evidence by Vartanian and colleagues has shown that creative people are more variable in their focus of attention, focusing and defocusing attention as a function of task demands. Specifically, when the problem space is relatively ambiguous, the search for solutions is aided by relaxing the constraints placed on the problem space. This increases the likelihood that seemingly irrelevant information may enter the focus of attention, potentially providing the building blocks for a solution. Under such conditions attention is more defocused in creative people. In contrast, when the problem space is relatively unambiguous, performance will benefit by increasing the constraints placed on the problem space, bringing into focus only those building blocks that have been selected as relevant for a solution through further elaboration. Under such conditions attention is more focused in creative people. This variability indicates that creative people are cognitively more flexible than noncreative people.

Early studies by Martindale relied on EEG to investigate the link between flexibility in attention and cortical activity. Consider story generation. This activity consists of two phases: a phase in which the subject thinks about the story to be written (inspiration phase), and a phase in which the subject writes the story (elaboration phase). Given that creative subjects are more variable in their focus of attention, they should only defocus attention during the inspiration phase of story generation, as reflected by lower cortical activity. This is precisely

the observed pattern of results. Interestingly, creative subjects exhibited lower cortical activity in the inspiration phase only when they were told to be as creative as possible, but not otherwise. This indicates that creativity is associated with defocused attention when appropriate but not otherwise, offering further evidence for cognitive flexibility in creative subjects.

More recent studies have experimentally manipulated task constraints and observed the neural correlates using fMRI. In the context of an anagram task conducted by Goel and Vartanian, the results have shown that right ventral lateral PFC is responsive to variations in the constraints placed on the problem space. In fact, activation in right ventral lateral PFC varies parametrically as a function of the constraints placed on the problem search space. This is consistent with results from Match Problems showing that right ventral lateral PFC is sensitive to the level of constraints placed on the task, and has a role to play in mental flexibility. It is also consistent with results from the reasoning literature indicating this region's responsiveness to indeterminacy in structure of arguments.

Novelty Detection and Perception

Creativity is commonly defined as the generation of novel and useful products. However, novelty is only meaningful in relation to the context within which it is measured. Hence, in experimental settings statistical frequency (i.e., unusualness) is used as a useful proxy measure for novelty. Recently, fMRI studies have investigated the neural correlates of novelty by studying the formation of unusual semantic associations. This process is relevant to creativity because the ability to observe associations between seemingly unrelated concepts can function as an engine for novelty within the creative process. Although the paradigms vary across studies, they frequently involve the presentation of a prompt (e.g., noun) following which a response must be generated (e.g., verb). By explicitly instructing subjects to generate either the first word that comes to mind or a word that has an unusual relationship with the word, experimenters can use the logic of cognitive subtraction to elucidate the neural correlates of unusual word generation. Carol Seger and colleagues have shown that the generation of unusual verbs activates an extensive network in the right frontal lobe, specifically in the superior and middle frontal gyri, with medial frontal activation extending into the anterior cingulate. The involvement of the right frontal lobe is attributed to its propensity to process distant semantic associations, which could in turn function to form novel associations. There is evidence to suggest that the right hemisphere encodes information at a different level of granularity than the left hemisphere. Specifically, the right hemisphere encodes information at a more 'coarse' level than the left hemisphere, which could in turn function as a mechanism for generating novelty by facilitating the formation of novel associations. This is consistent with recent views that both hemispheres can process the same information in different ways, updating the classic hemispheric specialization emphasis from modality (verbal, spatial) to process.

Points of Convergence

Although as a field the neuroscience of creativity is not sufficiently mature for the emergence of a full-fledged biological

model, certain points of convergence have emerged. First, at the level of brain structure, it has been shown that cortical thickness is linked to creativity in both hemispheres, although the direction and strength of the correlations can vary as a function of cortical regions and instruments used to measure creativity. This is analogous to saying that creativity is related to maturation of brain organization. A large amount of literature has linked maturation of brain organization, as measured by cortical thickness, to intelligence. The extent to which cortical thickness shows similar patterns of correlation for creativity and intelligence can offer insights about shared variance between creativity and intelligence at the level of brain structure, and thus offer clues about hypotheses to be tested subsequently at the functional level.

Second, recent evidence suggests that there may be a link between resting-state brain activity and insight solutions, and that this link may be moderated by hemispheric asymmetry and individual differences in the ability to generate insight solutions. Equally important, this finding has emerged within a research program that has generated consistent findings in terms of the involvement of the right anterior temporal lobe in insight solutions. There is a good deal of evidence to point to the role of this region in the formation of distant semantic associations because of the tendency of the right hemisphere to engage in coarse coding of information. Given the link that exists between resting-state brain activity for various personality variables linked to creativity (e.g., extraversion), this program of research could form the basis for substantiating the link between stable individual-difference variables and creativity.

Third, to the extent that creativity benefits from flexible strategy shifting, there is now converging evidence from lesion studies, EEG, and fMRI to suggest that the ventral lateral aspects of right PFC may be mediating the perceptual and conceptual constraints necessary for strategic flexibility in problem solving. Of course, the ventral lateral aspects of PFC bilaterally play a critical role in regulating inhibition. Given that constraint mediation requires inhibition, the responsiveness of the ventral lateral aspects of PFC to task constraints may be embedded in its more general role in regulating inhibition.

Summary

Perhaps one of the most enduring myths in psychology has been to view creativity as a right-hemisphere syndrome. The facts do not support this view. On the contrary, the evidence reviewed here demonstrates that the neural system underlying creativity is distributed, with structures located in the right and left hemispheres serving specific and varying components of the creative process. The current view is the product of the theoretical (and related methodological) approach used to study the neural bases of creativity – conceptualizing it as a

componential and hierarchically organized mental activity. As suggested by Goel, such an approach to studying higher mental function is consistent with evidence from the natural sciences, design, and engineering suggesting that hierarchical organization is “a deep fact about the world.” Given the success this approach has had in shedding light on other higher-order mental activities, there is reason to believe that it will pay dividends for understanding creativity as well. Eventually, however, it will be necessary to study the interdependencies of the component processes. This will require an integrative theoretical framework to motivate studies of how the components within the larger system interact.

See also: Divergent Thinking; Insight; Nature/Nurture and Creativity; Novelty.

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The Brontë Sisters

Charlotte Brontë (Currer Bell) 1816–1855

Anne Brontë (Acton Bell) 1818–1848

Emily Brontë (Ellis Bell) 1820–1849

Poets and novelists

Charlotte Brontë: *Juvenilia, Jane Eyre, Shirley, Villette, and Collected Poems* Emily Brontë: *Collected Poems and Wuthering Heights* Anne Brontë: *Collected Poems, Agnes Grey, and The Tenant of Wildfell Hall*

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*THE BRONTË SISTERS, taken as a collective, constitute the leading English novelists of the 19th century. The three sisters and their brother, Branwell, grew up in the small Yorkshire town of Haworth, children of the local curate. From very young ages, all exhibited a precocity for writing and drawing that was fueled by their mutual interest and need. Although writing in relative obscurity for a major portion of their brief lives, nevertheless, all three sisters had a major impact on the English novel and therefore on world literature. Charlotte's character of Jane Eyre constitutes the earliest example of the independent woman in literature—resourceful, introverted, and clear in her standards and values regardless of external influences. Charlotte's portrayal of women as independent personalities was manifested through a forceful personal narrative style that established her as one of the most brilliant novelists of her time. She is compared favorably with Thackeray and Dickens, and the only female writers from that period who rivaled her were Eliot, Austen, and her own sister Emily. Emily's *Wuthering Heights* provides a brilliant depiction of human passion played off against the wilds of nature and the inevitability of fate. Her juxtaposition of the locale of the moors, so deeply known to her, with the hatred and revenge instincts of her characters provides an intensity rarely found in fiction of any era. Her style of first person narration, outside of a traditional time sequence, also presages more modern techniques. Anne's work, beside Charlotte's and Emily's, appears rather bland, yet her quiet piety seeps through in the use of prose and revealing language in both her novels. Choosing the vocation of governess and the setting of the moors, she combines two of her sister's novelistic devices yet emerges*

*with her own original style in both *Agnes Grey* and *Tenant of Wildfell Hall*. While more muted than her sisters' works, Anne's contributions have been assessed as being major in their own way, and thus fulfilled her strong desire to do some good in the world before she left it, as noted by Chitham's 1991 biography of her.*



Portrait of Emily Brontë. Used with permission from CORBIS/Historical Picture Archive.

The Early Life

The Brontë sisters in childhood shared solitude and seclusion, intelligent companionship, and intense family affection that also manifested itself in a love of animals. Struck early by family tragedy in losing a mother before Charlotte was six, and two older sisters shortly thereafter, the remaining children turned inward and to each other for survival and comfort. Tutors by their scholarly father from early ages and surrounded by stimulating books and magazines, the Brontë children lived in a created world. They reveled in a mysterious supernatural force fueled by the engravings of John Martin, the plays of Shakespeare, the writings of Byron and Sir Walter Scott, and the naturalistic setting of the Yorkshire moors. The Brontë children shared an important perspective on the power



Portrait of Charlotte Brontë. Used with permission from CORBIS/Historical Picture Archive.

of creation. They created the imaginary worlds of Gondal and Angria, using Patrick Brontë's gift to Branwell of toy wooden soldiers as the stimulus for imaginative story development. The children created a language for the soldiers, a cartography of their landscape, and whole plays that gave the soldiers life. These intensely romantic influences in childhood affected the Brontës throughout their lives, always seeking for and finding excitement in the ordinary.

Charlotte, Anne, Emily, and Branwell were all precocious and voracious readers from an early age as well as young practicing artists, pursuing assiduous copying of drawings that interested them, especially Bewick's woodcuts of British birds. The Brontë children also were well versed in history and the politics of the day, appropriating leading British figures for their plays and debating the motivations of such figures. Charlotte at age 14 drew up her list of life's works, an impressive 22 volumes, and exhibited a strong knowledge of literary form. Not only did the early reading, drawing, writing, and family discussions serve to stimulate the Brontës' imagination, it also provided intensive practice in literary and artistic traditions.

The Tapestry of Work and Life

The Brontës have attracted substantial scholarship about their lives and works. They have been the subject of multiple biographical studies, and have left substantial personal writings to be analyzed by scholars. They were also prolific in their published manuscripts, leaving enough work to trace the development of form, style, and content. In the case of Charlotte Brontë, even her juvenilia, the 22 little books she wrote in collaboration with her siblings, constitutes a separate area of study, still being deciphered by scholars.

The Brontës are an excellent example of writers not formally shaped by educational institutions. Modern writers can learn their craft through school and college programs, special seminars and workshops, and formal mentors, but none of these opportunities were available to the Brontës, who led sheltered lives mostly in the context of family. Social context and the historical period in which they lived also may have limited their talent development based on issues of gender and, with the Brontës, class as well.

Like other women of their respective historical periods, the Brontës lived with their birth family or at least nearby. The Brontës never lived anywhere else but Haworth during their entire lives except for one year in Brussels for Charlotte and less time for Emily.

Family provided the basis for friendships, education, and financial and social support. As a result, each writer was geographically grounded as well, accounting for the strong use of "place" in their work. Pollard cites Charlotte from her letters of a bleak Haworth: "No other landscape than a monotonous street—of woodlands, a grey church tower, rising from the center of a churchyard so filled with graves that the raxes weed and coarse grass scarce had room to shoot up between the monuments".

The intellectual quality brought to bear in their work is consonant with the internal influences seen in other studies of creative people. Committed to a vision of an ideal, they worked on a statement of meaning. For the Brontës, the ideal

conveyed a sense of justice for their female characters. Underlying all of their work was the curiosity to explore new forms and meanings and the concomitant persistence to work hard and alone, absorbing themselves in writing for long periods of time.

Overexcitability, an extreme desire to engage the personality in certain types of experiences, in intellectual, emotional, and artistic dimensions of their lives, was very apparent from an early age. The Brontës were described as high-strung, fascinated by ideas, and interested in the artistic domain all their lives. A nervousness, possibly of genetic origin, strongly affected both Branwell and Charlotte. While both were outgoing and exuberant, they were prone to overstimulation.

Branwell is said to have had a nervous breakdown while away at school, therefore accounting for his father keeping him closer to home. His overwrought tendencies tinged with romanticism led to his ultimate humiliation and demise at the hands of his tutee's mother, whom he adored and who would reveal his weakness toward her; Branwell's boyhood was viewed as self-indulgent, in manhood leading him to an addictive lifestyle culminating in an early death in 1848.

For the Brontë children, the act of creating stories and sharing them with each other built a closeknit partnership of the imagination wherein each child became a character and wrote from that perspective over a period of 16 years, according to Spark's 1993 review of essays. It was, however, the quality of emotional sensitivity that fueled their work, and transmitted that feeling into art. And clearly for each of them, real talent and insight were present in their ways of expressing meaning in written form.

According to Alexander's 1991 work on the analysis of the Brontë juvenilia, this juvenilia is the best record we have of the development of writing genius. More importantly, this early work was the basis for all of Brontës' adult work. The particular gift that allowed them to survive as leading writers of the Victorian period lies in their intensity of expression, and their ability to describe with powerful detail the settings, feelings, and the natural world that their characters inhabit. These qualities originated in childhood as a game of Gothic-type motifs for the Brontës to amuse and confound each other.

Great poetry and great art served as major influences on the Brontës' aesthetic sensitivity and creative bent. All of the Brontës painted and used visual art as an adjunct to their writing. Each worked diligently at illustration, exhibiting substantial powers of conceptualization though limited skill in execution. Gaskell notes in her biography of Charlotte, and later Emily, that the sisters were particularly interested in painting and the works of great artists as growing children. For example, Charlotte drew up a list of painters whose works she wished to see by age 13. Moreover, the painstaking reproductions of all three sisters helped to develop important skills of observation and analysis needed to become great novelists. They were especially fond of John Martin's engravings of lost cities of the ancient world, for they awakened in the Brontës a feeling for imagery corresponding to their appreciation of Byron's poetry.

The central motivating theme for all of the Brontës' works is a sense of justice for that which is morally and ethically right. She and her siblings had richer imaginations, greater drive,

and more intellectual energy than other Victorians of the time, setting them apart from peers. The Brontës were also highly conscious of the role that writing played in their lives, stating that work was a wonderful companion. Through the assertiveness of Charlotte, all three women's work was published under the male pseudonyms of Currer, Ellis, and Acton Bell, only later to be revealed as written by women living in a remote area of the country.

For their time, the Brontës could also be considered feminist writers, especially Charlotte. From her early juvenilia to her mature novels, her female characters are vividly portrayed. In fact, all of the Brontë sisters' novels were considered too raw at first publication because of their passionate intensity and portrayal of women rebelling against the social norms of the times.

The Brontës' continual quest for the real behind the conventional in female characters marks them as the most important fictional writers of their time on the plight of women, as noted by the recent biographies of the sisters by Frasier and Barker.

Charlotte Brontë in particular strove to overcome her sheltered experience in the act of writing by contemplating feelings or experiences related by other people until she was able to understand and describe them in writing. In a letter to a publisher, included in Gaskell's 1992 biography, she noted, Is not the real experience of each individual very limited? And, if a writer dwells upon that solely or principally, is he not in danger of repeating himself, and also becoming an egotist? Then too imagination is a strong, restless faculty which claims to be heard and exercised.

The Brontë sisters possessed a mental initiative that allowed them to compensate for and overcome limited experiences in the world.



Portrait of Anne Brontë. Used with permission from CORBIS/ Historical Picture Archive.

Relationship to Creativity

Evidence for the development of their creativity focuses on several variables, cited in VanTassel-Baska's 1998 chapter on creativity, all of which the Brontë sisters exhibited deeply. Informally, the Brontës developed the facilitating processes necessary to create original products in a given domain, such as fluency, a flair for novelty, insight and intuition, use of imagery, and an ability to use metacognitive strategies effectively. Their early childhood preoccupations clearly enhanced these process skills and honed them to high levels for use in adulthood. Their internal factors of creativity include intelligence; such personality variables as openness, intensity, and nonconformity; psychoticism; and mental energy. The Brontës all possessed these qualities and exhibited them in life as well as in their work. Their external factors of creativity include the powerful role of educational variables, strong family values that support the work, and the social-cultural context. While not all of these were favorable to the Brontës, by sheer perseverance their creativity prevailed over limitations in education and social environment. The role of the family was a strong positive influence on the development of the Brontës as artists. Not only was their father a strong intellectual and moral force in their lives, but they were each other's influences as supporters and critics of their evolving writing talents.

Personal catalysts for the Brontës that spurred them to creative heights appeared to include the adversity of coping with early deaths in the family of two sisters and a mother, the isolation of Haworth and the parsonage, their individualistic natures, and the natural setting of the Yorkshire moors.

Using life material as subject matter for character models and lived experience in the natural world, the Brontës evolved a unique form of communication for their period and in the process lived a creative life of the mind.

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Business/Management

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Glossary

Accounting/finance An organizational department that tracks monetary flows and maximizes its utilization for organizational purposes.

Business A process by which the exchange of currency, goods, and services takes place. Business is also used as a synonym for the organizations engaged in these exchanges.

Creative industries A collection of organizations involved in similar businesses whose main output is considered to be creative in nature. Such industries include the film, music, publishing, and video game industries.

Culture The norms, values, and world view held in common by organizational members.

Free/open source software Software made available under conditions where the user can freely access, redistribute, and alter the software's underlying code.

Leadership A management function concerned with developing and setting organizational goals, motivating workers, and controlling work flows.

Management The process by which businesses are led and controlled.

Management information systems (MIS) A business function for facilitating the flow, storage, and use of organizational data.

Marketing The organizational department that scans the environment for new business output opportunities, advertises existing products, and develops channels for product delivery.

Research and development The organizational department that creates new products and processes to produce these products.

Slack Organizational resources not specifically committed to firm operations, and therefore available for application to unanticipated needs.

Total quality management A business process used to reduce output defects and continually increase product desirability.

The Role of Creativity in Business and Management

Some people see a disconnection between business and creativity. This point of view characterizes businesses as rigid hierarchies that stifle individual creative development and hinder societal creativity. The reality is much different for many organizations where creativity and business/management have enjoyed a long-standing symbiotic relationship. This article will discuss the many ways this relationship has manifested.

Business can be defined as a set of activities that facilitate the exchange of desired goods between parties. Usually these activities occur through organizations developed to facilitate this exchange; but business can also be conducted between individuals or between individuals and organizations. Business transactions are usually performed by ongoing organizations with formal designs and structures, or such transactions may also occur through ad hoc collectives with short-term durations (such as farmers' markets). Often the terms business and businesses are used synonymously (as they will be used in this article). Business is also used as a synonym for profit seeking activities, but business also can occur in nonprofit settings.

As with the term business, management has many definitions. The word, however, has a generally agreed upon meaning that will be used in this article. Management is coordinating activities between individuals, resources, and organizational systems to complete business and organizational operations. Management has various interrelated activities designed to control organizations in achieving goals and objectives. Management is responsible for providing vision, setting goals, and developing and implementing strategy. Management is also responsible for coordinating, motivating, and directing the

individual's work; an aspect that is strongly linked to – though separate from – leadership.

An Historical Perspective

To better understand the modern relationship between business and creativity, an historical perspective is needed. There is a long tradition of wealthy and powerful individuals providing patronage to creative artistic works. Examples of such support include wealthy Greek merchants, the Catholic Church (especially during the Renaissance), and Chinese and Japanese emperors. Such patronage usually took the form of these entities commissioning artists to create works glorifying an idea the patron wished promoted or the patrons themselves. While creative works were produced independent of this system, most enduring pieces from the ancient world come from this patronage system. When economies changed to a more capitalist approach, artistic support switched from patronage to market-based structures – artists would present their works to the broader public, and this public would fund future creative endeavors by purchasing existing works. In time, businesses and even whole industries emerged to facilitate the development and distribution of artistic works to a wide audience.

As a counterpoint to businesses' artistic support, business relies on creative ideas to advance and find new markets. Indeed, all business started as a creative idea about conducting transactions. Modern business itself resulted from a series of creative ideas developed and shaped by cultural forces. These ideas have led to such institutions as stock exchanges, advertising, corporations, and restaurants. Businesses also rely on creative ideas for the technologies they employ to remain

competitive and produce goods and services. They use creative ideas to develop new products, delivery channels, marketing methods, financing ideas, and new management methods.

Creative ideas are also important in improving existing management and business processes, for example, routing packages or handling customer complaints. This type of innovation is called garden variety, or everyday creativity and generates incremental progress. Such advancement, however, may eventually lead to larger changes in business processes.

Business/Management's Role in Advancing Creativity

Organizations provide many services for creative endeavors including providing distribution channels for musicians, writers, artists, and other creative workers. Businesses also made inexpensive personal computing a reality, and with this technology new creative vistas opened up for large segments of society. Continually dropping computer hardware prices and free or inexpensive creative software give many people the tools necessary for making music, developing electronic paintings, photographic manipulation, and even creating and editing movies. These new tools provided a creative flowering that could not have been imagined even a decade earlier.

The business environment can also set conflicting possibilities for creative endeavors. For example, with the Internet's emergence distributing creative ideas and products has become much easier. Individuals can send their work worldwide for little or no cost through digital mediums. This technology allows independent artists such as musicians, writers, artists, and film-makers to reach self-sufficiency for the first time. However, businesses continue to act as artistic output gatekeepers. For example, Apple's iTunes store determines which artists have an outlet for selling their work in that venue. While the new distribution channels hold the promise of greater artistic opportunities, it is unclear how far the public is willing to search for new talent instead of relying on existing gatekeeper organizations to vet artistic work.

Social networking, which has become a valuable business in itself, has facilitated new ways of bringing creative work to people's attention. There is also You Tube where videos of all kinds can catch on with the public and go viral. The first movies based on a You Tube video success are currently in production.

One final point needs to be addressed in this introductory section. While this entry attempts to cover creativity in all its business and management aspects, most creative work within organizations is termed innovation. Innovation is purposeful creativity: creativity designed to solve some problem or issue. While the wider term will be mostly used, the narrower term is what actually more commonly occurs in firms.

This article will provide more details on how creativity interacts with the business environment by first giving an overview of management and creativity, then business as a whole, a discussion of creative industries, and a recap with future possibilities for the business/management-creativity link.

Management and Creativity

Scholars and practitioners have devoted great efforts into examining this relationship between management and creativity.

By 2010, over 1100 scholarly articles and books had been published on management creativity. While it is impossible to distill this knowledge corpus into a document of any reasonable length, there is some information about the management-creativity link that most interested parties should know. These areas are as follows: organizational environment, culture, and structure; leadership; teams; and individual worker characteristics.

Organizational Environment, Culture, and Structure

An organization's environment is singularly powerful in shaping an organization's creativity. The environment influences how creative the organization must be to succeed, and thus directs and limits how much management can influence organizational creativity. In general, turbulent and uncertain organizational environments require greater organizational creativity. Organizations increase their creativity – both in output and internal processes – to meet greater competitive demands in a turbulent environment. There is also a Darwinian effect in that less creative organizations tend to fail in turbulent environments, thus leaving more creative organizations to continue competing.

Partially due to environmental forces, certain industries have more creative organizations than others. Newer industries tend to be more creative than established industries. Thus the computer industry is more creative than the flour industry. Also, more competitive industries – those with no dominating set of organizations – tend to have more creative organizations.

An organization's culture is the greatest influence and predictor of creativity. This culture is largely set by the founder, and it is difficult to change once established. Subsequently, it is important to understand how cultural characteristics relate to organizational creativity. A major cultural factor is process (a focus on production methods) or outcome orientation (a focus on end results), with process oriented organizations tending to lower creativity. In addition, firms that promote individual flexibility tend to have higher creativity levels.

Specific organizational structures and characteristics can also foster and support worker creativity. Increased organizational slack and decreased hierarchy increases creativity. Firmer communication channels increases creativity for individual members and teams. Rewarding creativity increases creative behavior but the corollary is that workers must be protected from negative sanctions for unsuccessful creative attempts. A fear of punishment for attempted creativity results in diminished creativity.

Organizational social networks also play an important role in workplace creativity. Ties to more creative workers increase worker creativity, thus potentially creating a virtuous cycle of increased creative output from all involved. However, strong social ties can also inhibit creativity among creative-class workers (workers trained for and with jobs focusing on creative output). For typical workers, it appears that a moderate number of ties may be best for increasing creativity. Too small a number limits the number of ideas a worker is exposed to, but too many may create information overload or introduce a form of peer pressure that limits creative development.

Management must consider these points when designing an organization's structure. Businesses have little control over

their environment, and culture can be too difficult to change – therefore organizational structure becomes one of the best controllable factors for improving organizational creativity. Structures can also be altered to maximize organizational creativity during environmental changes, and may have such useful side-effects as channeling worker dissent into creative modes of organizational support. Some companies during difficult times found creative ways to keep workers on the payroll through having them do jobs done formerly by temporary workers or paying them to do volunteer work. Instead of angry laid – off workers, they developed a community of loyal employees.

Leadership

Top organizational leadership provides the vision for directing creative efforts. This vision channels (and thus limits) creative output, directing what types of creativity are accepted in an organization. This unified vision also allows organizational members to work in the same direction, thus promoting greater collaboration and creative advancement. Organizational leaders should provide an expansive enough vision to promote worker creative input, but clear enough for all members to agree on common goals. Top leaders also must ensure that their creative vision has the potential for profitable outcomes. Additionally, this vision determines how creativity is valued.

Leadership plays an important role in promoting individual creativity. As with strategic leadership, leaders provide direction for how individuals channel creative energies through one-on-one interactions. Information is emerging on specific leader behaviors such as how transformational leadership promotes creativity, though workers must also be intrinsically motivated for this leadership style to be fully effective. Additionally, over controlling leaders will decrease their subordinates creativity. Individually supportive leadership is especially effective when combined with appropriate worker mood states and a positive work context. This context is created when leaders provide an atmosphere of justice, trustworthiness, and developmental feedback. Leaders should also provide workers with more direct support for creative activities such as encouragement, guidance, and resources necessary for increasing workers' creative output.

Teams

Business creativity most often arises in teams. Team based projects help spur creativity through member skill sharing – an individual rarely has all necessary skills for a particular creative endeavor. Rather, different team members make unique contributions to the work. Teams also allow idea exchange between members and promote information flow and new idea generation. However, some team climates and structures promote more creativity – both for individuals and teams. For example, individual creativity is highest in learning oriented teams. Individual creativity is also enhanced when there are other creative individuals in a team. Increased specialization heterogeneity will increase team creativity, though teams need a transformational leader to maximize this effect. Perhaps most counterintuitive is that process standardization can increase creativity. This may be because – as with leader

vision – worker creativity is channeled into specific tasks. When properly structured, organizations can create teams that are very fertile arenas for developing new ideas.

Team climate can play a crucial role in creativity by facilitating an open exchange of ideas between members, and providing a support system for these members. Team members must be rewarded for their creative work.

Individual Workers

While organizational and team characteristics greatly influence a worker's creative output, individual characteristics also play a role. Worker intelligence is highly and positively related to creativity. Research indicates that the type of intelligence also plays a role in creativity. Workers who employ visual thinking are more creative than nonvisual thinkers.

Human resources becomes important for developing a firm's creativity through the selection and training of the most creative individuals available as organizational needs develop and change. In order to maximize organizational creativity, the human resources function must be strategically integrated into all organizational creativity plans.

Areas of Business Creativity

Creativity is a vital part of all organizational functions. This section will provide specifics about creativity's role in Research and Development, Knowledge Management, Advertising and Marketing, Quality Management and Information Systems, and Finance and Entrepreneurship.

Organizational Research Output

Research and development (R&D) is by its nature a very creative process. Firms use R&D to generate new products, processes to make these products, and internal procedures for better performance. In most organizations special teams or departments are responsible for R&D. While R&D is usually a fairly directed process, many prominent firms have policies that promote dispersed R&D across workers. For example, Google and 3M expect all professional workers to spend a certain portion of their time working on their own ideas for new products.

Patent production is a visible firm creativity output. Patents are state sanctioned, time-limited monopolies on new ideas given to encourage transforming creative ideas into tangible commercial output. Therefore, they can be seen as a proxy for organizational innovation. While not all patents are turned into products, most organizations pursuing their development have strong incentives to finalize the ideas into marketable output. Patents also provide a public good beyond the encouragement of new commerce.

By requiring that invention specifics be openly published in patents, the public can capitalize on and freely reproduce inventions after the patent's expiration. The health care sector has especially benefited from this system with the generic drugs. Large pharmaceutical companies and academic institutions spend billions of dollars a year to develop new drugs.

In turn, these creating organizations recoup their cost by manufacturing or licensing high cost drugs. After patent expiration, other manufacturers can use the formula from a patent, manufacture a generic version, and provide low cost alternatives to more expensive brand name pharmaceuticals.

Knowledge Management

Business knowledge management is both a source and outcome of creative work. An understanding of this business functions' importance has increased in the past few years, and it continues to increase in value. Knowledge management's focus is to go beyond simply retaining organizational data such as sales records, to developing an understanding of what the data mean, and how it can be used more effectively. It includes developing organizational memory and cultivating expertise in using existing organizational wisdom to improve operations. Good knowledge management relies on workplace creativity in order to find better ways to foster knowledge creation and development. In turn, firms with better knowledge management systems will have greater intellectual resources to promote and evaluate creative output.

Research indicates that knowledge management provides a coordinating mechanism for organizations that enhances innovation and overall productivity. However, the way knowledge management is implemented also plays a role. Unless the knowledge management system is implemented to exchange information throughout an organization, only local knowledge pools will develop. This limitation will hamper innovation, and thus fail to spark the creativity levels needed by businesses. Studies have also indicated that many different knowledge management methods are equally effective for enhancing innovation – it is not so much the specific type of knowledge management system implemented as how many different practices are put into place.

Advertising and Marketing

Advertising is the organizational creative form that most people imagine when they think of creativity. This makes sense since we are exposed to advertising through radio, magazines, newspapers, television, and the web. Some of these advertisements can display amazing creativity, with audiences often more appreciative of advertising contents than the show itself. The constant creative changes in the use of media such as TIVO and the Internet has forced companies to become more innovative in developing new ways of placing ads. For example, recent years have seen firms renting space encompassing the entire exterior of buses for advertisements.

One interesting finding is that there appears to be a density factor at play for advertising firm innovation. As in many other creative industries, when a geographic area gains more advertising firms, the creativity levels (and new advertising firms) increases in that area. This phenomenon may help explain how certain areas such as New York, London, and Berlin have become advertising centers for the world.

A firm's marketing department usually includes advertising but also helps the organization develop new product ideas and provides input from the wider environment to spur creativity. The marketing function may be seen as a cycle of creative work.

In the first stage marketing executives examine a firm's capability, market demand, and potential new ideas to identify possible products for development. Marketing then examines and develops the potential for these ideas for translation into actual products through marketing research including surveys and focus groups. Then the marketing department may work with research and development and the production department to develop a prototype, budget, and test marketing plan. Once the product is in production, the marketing department must find new ways of increasing public awareness including sales strategy, advertising, and a public relations plan. During this process marketing must also determine prices and distribution methods – tasks that often require creative thinking and a good deal of problem solving. Finally, after a market has been established, possibilities are created for new products and the cycle begins again.

Quality Management and Management Information Systems

Total quality management (TQM) may be seen as disciplined creativity. TQM began as a collection of methods to reduce defects; however, its scope has become much broader. While being defect free is a prerequisite for quality production, quality management's ultimate goal is to delight the customer – a much harder objective than simply eliminating defects. Reaching this objective requires creative thinking on the part of organizational workers.

Employees must be able to place themselves in the customer's position to determine what would please the user. Additionally, new production and delivery methods need to be created to fulfill these desires. Such tasks are made more difficult because these ideas are often restricted by manufacturing specifications that can be difficult to alter without changing an entire production system necessitating a systems perspective to these creative endeavors. Since quality management practices were developed in Japan it is largely a systematic, team-based, bottom-up approach. This approach allows organizations to capture the benefits of using creative problem solving and team based creativity. Procedures made famous in Japan include rotating jobs on a production line so workers are familiar with the entire product, allowing any worker to stop the line at any time and encouraging creative suggestions from everybody in the organization.

In addition to the need for creativity in TQM implementation, quality management can also spur greater organizational creativity. This relationship, however, appears to be somewhat complex, with only certain types of TQM being able to enhance organizational creativity. TQM that is more organic – more flexible and based on adapting quality principles to fit with an existing organization's structure and culture – are better suited for increasing innovation. The more mechanistic approach of simply applying existing quality management techniques does not seem to improve creativity even when overall productivity is enhanced.

Similar to total quality management, successful management information systems (MIS) development and implementation depends on creativity for success. The MIS function is to collect, store, and make available important information to organizational members so that they can better accomplish important tasks. Ideally, such information can be used to

guide an organization in setting future plans and goals. Deciding what information to process, however, requires creative thinking from those involved. When creating or improving an MIS, it can be unclear what information is important. MIS workers must, as with quality management workers, put themselves in the user's position and think holistically. Information needs must be identified, and future needs anticipated. In addition, creativity has to be employed to find methods to capture data and turn it into usable information.

Good MIS operations also provide support and enhancements for organizational creativity. A necessity for creativity is understanding prior creative endeavors, current conditions, and available resources. One challenge firms face is in reshaping their MIS capabilities to fully capture information that promotes creativity. Traditional MIS methods have been best suited to capturing relatively static, quantitatively based information. For the emerging innovation economy, methods are needed to capture more fluid, dynamic, and qualitative creative ideas. Some organizations have been using such MIS technology as wikis for this task.

Finance and Entrepreneurship

Organizational finance and accounting concerns itself with maximizing the flow of capital to support organizational operations. Innovations that are now commonplace include banks, checking, and stock markets. Banks and checking were introduced to the western world by the Knights Templar as a novel means for helping pilgrims travel to Jerusalem without having to personally carry large sums of cash. Similarly, the Dutch created the first continuously operating stock exchange in the seventeenth century as well as many financial transaction forms. More recently such financial instruments as 'penny stocks' and derivatives have been created. Creative derivatives based on mortgages encouraged high risk lending which contributed to the collapse in the housing and stock market in 2008, a reminder that creativity does have a potential dark side.

On the brighter side, recent financial innovations are being put to service for ethical improvements in developing nations. Several organizations have set up micro-loan services which provide low-interest small capitalization (usually less than \$100 and often as low as \$10) for individuals to start up small businesses. While these sums may seem low, they are usually sufficient to create a small business in developing nations – businesses such as weaving or cheese production. These entrepreneurs then repay the loans, and this repayment is used to fund new start ups. These small businesses then provide greater economic development and job growth to the (usually) impoverished areas in which they are located.

Entrepreneurship can be seen as the ultimate in creative business development. It requires an individual or small set of entrepreneurs to transform creative ideas into an entire business: finance, marketing, management, product development – all comprehensive aspects. So it comes as little surprise that so many new business methods and products arise from the entrepreneurial sector. Such firsts as the personal computer, assembly line, and the light bulb were realized through the action of entrepreneurs. Research consistently indicates that economic growth is largely driven by entrepreneurial activities, and some work indicates that it is the high-growth,

high-innovation firms that are primarily responsible for this increase. In addition, new entrepreneurial firms generate innovative spillover to a geographic region as when Hewlett-Packard's opening near San Francisco spurred the creation of the Silicon Valley.

Creativity in the Wider Business Context

Greater competition and uncertainty within a business environment increases the necessity for organizational creativity, and in turn new creative ideas increase environmental turbulence and competition. Firms scan the environment to adopt and adapt other organization's ideas, leading to new creative output in a syncretic process that can become self-reinforcing. In this way, organizations act as information brokers, where they combine existing ideas and products to create new innovations.

In addition to this environmental process, whole industries can be considered creative. Businesses in these industries have creative output as their main focus. Examples include the film, music, publishing, and video game industries. Such industries have brought great works of art to a wide public, and even led to the recognition of new art forms. For example, in France film and comic books have been officially designated as art forms – two modes of artistic expression developed in twentieth century. We may eventually see a new art form emerge with video games. This new industry already has produced revenues that surpass the long established film industry.

As mentioned earlier, the Internet has opened up many avenues for creativity in business, both for idea dissemination and for allowing new creative business start-ups. Major businesses made possible by the Internet include Google, Facebook, Amazon, and eBay. Less obvious is that the Internet has facilitated the appearance of several comic strips (or web comics) that support their creators through advertising and merchandising. Previously, only a limited number of comic strip artists could find financial success through the auspices of comic strip syndicates. Similar business models have been developed for independent musicians, and is emerging for video production.

Websites covering almost every subject imaginable are out there along with millions of blogs. The instant availability of information is changing newspapers and magazines as they make various creative attempts to find a way to reinvent themselves.

The Internet also provides support for creative activities and idea generation. It has allowed freer information flow throughout the world, leading to faster idea development and implementation. An example of these possibilities is the emergence of virtual bands. One person can decide to start a band and put out a call for members. A member can write the music and create a vocal track. This track can be sent electronically to other members who then record their own parts. Once all parts are recorded, the tracks can be merged into a single song and distributed electronically worldwide – without the band members ever meeting.

The Internet has also generated greater competition, requiring faster creative idea production from organizations. The combination of product purchase availability through the

Internet, and inexpensive shipping (even internationally) is eliminating the idea of local competition. Most any product – from a book to music to genetic testing – is as close as a computer: which in most developed nations means at everyone's fingertips. Venues such as eBay, Abe Books, and Amazon.com's cooperative agreements with outside sellers has created the possibility of a global small business with individual vendors marketing to international customers as easily as to neighborhood buyers. Industries that require physical presence for transactions (such as restaurants) have still been impacted by information availability on the Web. These conditions lead to greater competition and creativity as firms must act to retain customers when location is only a minor factor in purchasing decisions.

Another business-creativity area that the Internet has made possible is in open source software and the attendant distributed organizations that have emerged to create such software. While Richard Stallman is rightly regarded as the creator of free software, Linus Torvald was the first to truly take advantage of the developing Internet accessibility to distribute and gain outside support for his Linux operating system. His actions created a distributed organizational model where individual members had great control over the software's development. Indeed, this organizational model blurs the line between producer and consumer where users can provide direct feedback (and even actual product development) to shape the organization's output. So far it is unclear how this new organizational form will affect the wider business environment, but it is one of the more intriguing creative process aspects in the continually changing definition of what we mean by business.

Conclusions

Creativity and the business world must be viewed as partners – with each providing necessary functions to advance the other. Success in global business is increasingly driven by creative ideas, and information sharing's expanding global scope enhances all firms' creative action capabilities.

In addition to businesses' increased global scope, new technologies are lowering entry barriers for creative entrepreneurial action. Computers have been able to replace many dedicated hardware platforms for music, drawing, and film production, and this change is opening new opportunities for creative expression and sales.

Additionally, new communication media allows for creative individuals to set up worldwide performance venues, and develop these venues into profitable outlets. It is far easier for individuals to enter new business areas as technology becomes cheaper and more ubiquitous. One can easily imagine that the next Orson Wells or Eric Rohmer may shoot his or her films with inexpensive cameras, use collaborators from across the globe by transmitting the film electronically, edit the film on a computer, and distribute it through web based channels. Recently a director of an imaginative low budget robot video aired on YouTube was hired to direct a major film.

What is certain is that creativity and business will continue to enable the other to flourish and reach new levels. However, to reach the next level in this relationship, the developed world

must reach out to the developing world and bring it into this cycle. If entrepreneurial actions are a key process in this cycle then developing nations provide vast resources for future growth in both creativity and business operations. While developing nations have often been exploited for their natural resources, they have been neglected as opportunities for cooperative creativity and entrepreneurial development. Fully embracing such cultures can lead to syncretic development such as seen during the renaissance – a flourishing period of growth in creative output and business development largely driven by the intermixing of European, Mediterranean, and Middle-Eastern societies.

This process is already occurring in such nations as India. India has long been the leading film producer, and has exported its movies throughout Asia. Recent years have seen this export expand to top box office movies in Europe and North America. Similarly, partnerships with developed nations have led to increased high tech business expansion in India, and created a vibrant and growing export market for the country – a market that is returning creative business ideas to the world.

Combining a push for increased entrepreneurial activity in developing nations with increasingly ubiquitous communication infrastructures and cheap computing power promises to bring about an even more fruitful collaboration of business and creativity. As with the printing press, radio, telephone, and computer, each technological innovation that expands people's ability to communicate and share their creative ideas across increased distances will push the business/management—creativity cycle to higher levels. The free flow of creative ideas will continue to prove the strong and mutually reinforcing relationship between business and creativity.

See also: Adaptation, Adaptiveness, and Creativity; Advertising with Art: Creative Visuals; Creative Environments, Conditions, and Settings; Creativity Training; Entrepreneurship; Everyday Creativity; Group Creativity; Innovation; Leadership; Organizational Development; Problem Solving; Rewards and Creativity; Teams.

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Lewis Carroll (Charles Lutwidge Dodgson) 1832–1898

Writer

Author of *Alice in Wonderland and Through the Looking Glass*

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CHARLES DODGSON was a mathematician and logician who taught at Oxford University, England, from 1851 to 1892. Under the name of Dodgson he wrote on mathematics and symbolic logic. He met Alice Liddell when she was 4 years old. On July 4, 1863, while on a rowing outing on the Isis river with Alice and her sisters he told the story of a little girl who went down a rabbit hole and had many adventures. Alice was 10 years old and Charles was 30. As a gift to Alice, Charles wrote and illustrated the story for her. In 1865, under the name Lewis Carroll, he published it as Alice's Adventures in Wonderland. Although Charles had been a frequent visitor to the home, three years after the boat outing Mrs. Liddell did not allow him to have social contact with her daughter again. The first book on Alice was a popular success and made Lewis Carroll famous. Six years later he wrote Through the Looking Glass and his fame as a fantasy writer for children was secure. Lewis Carroll's works are classics of nonsense, parody, and satire, and have contributed to popular awareness such characters as Humpty Dumpty and the Mad Hatter. Charles Dodgson is considered a pioneer in early photography. Although he took many pictures, including famous people such as Lord Tennyson, he is best known for his portraits of little girls. In the final part of his life Charles Dodgson turned his attention and talent to books on logic. His final book, Symbolic Logic I and II, completed around 1894–1898, is considered by some authorities as a significant contribution to the study of logic at that time. He was finishing the second part of this book when he died of pneumonia at the age of 66.



Lewis Carroll—Self portrait.

Early Years

Charles Dodgson came from a family with strong ecclesiastical traditions. His father was a clergyman. His great-great-grandfather and great-grandfather were both clergymen and the latter had been a Bishop. The family was pious and took life seriously. However, Charles, the eldest son, showed early

signs of irreverent humor. During his first 11 years the family lived in relative isolation. His playmates were his sisters. There were two sisters before Charles, and five girls and two boys afterward. Perhaps reflecting some family stress, seven of the children, including Charles, stammered. Charles began writing family magazines when he was 13 and published a short humorous story when he was 23. His early writings show the same parody and humor found in his adult works, and some, such as poems in the family magazine *Mismatch*, appear in his later writings such as *Jabberwocky*. Although he appears to have been happy at home at age 14 he entered public school at Rugby. This experience was a very unhappy one for Charles and contributed to his general aversion to young boys that continued throughout his lifetime. In contrast to other people's positive memories of him as a boy, Charles always viewed himself at that age in very negative terms. While at Rugby he maintained close ties to his brothers and sisters and wrote material for them that later appeared in *Alice in Wonderland* and *Through the Looking Glass*.

Oxford

Charles demonstrated considerable skill in mathematics and in 1851 he entered Christ Church, Oxford, as a student. He spent the rest of his life there. In keeping with the family tradition he entered Oxford with the plan to be ordained. However, his diary entries indicate considerable ambivalence regarding the matter. He was ordained a Deacon but finally in 1862 he made the official decision to not take the priestly orders. As faculty at Oxford he had difficulty as a teacher probably due in part to his stammer. His diary entries indicate his interest in theater and he published parodies in various magazines under the name of Lewis Carroll. During his early years at Oxford he also developed an interest in photography that he maintained for 25 years. At the time photography had been in existence for 17 years and Charles was 24 years old. He was a pioneer in this new field and he published articles and stories about the subject. Charles had public exhibitions of his photographs and he was invited to write a review of the 1860 London Photographic Society exhibition.

Photography and Alice

In 1855 Henry George Liddell became the Dean of Christ Church Oxford. He arrived with his wife, a son, Harry the eldest, and three daughters, Lorena, Alice, and Edith. Soon after the Liddells arrived, Charles met the children and was soon photographing them. He became a frequent visitor to the Liddell's home, apparently to see the children for there is little indication that he developed a friendship with either parent.

His contact with the girls was frequent but his relationship with Alice grew over the years. His photographs of her, such as Alice as a young beggar, indicate his complex feelings for her. It was on an outing with the three sisters that he first told the story of Alice's adventures underground. During that same year something happened because he fell out of the good graces of Mrs. Liddell. Three years later he seldom saw Alice again. Although he now had no contact with her he wrote *Through the Looking Glass*, which is the further adventures of Alice. For lack of documentation, the reasons for the disruption of his relationship with Alice are not well established. However, there is some evidence that Charles was interested in eventually marrying her. The two stories inspired by Alice are at one level descriptions of growing up in a dream world inhabited by characters who are animals and humans who are unpredictable. In her encounters Alice reflects common sense in an illogical and often frightening context. The jokes are always based on faulty syllogisms. Whatever the reason for his failure in his relationship with Alice, Charles Dodgson spent a great deal of his time after this entertaining little girls and photographing them. The photographs of the girls were often in various costumes that he provided, but frequently the photographs were of nude little girls. Most of the nude photographs have been destroyed, and there were many of them, but four have survived. That these were images of childhood innocence and purity is difficult to support, especially the reclining nude of Evelyn Maud Hatch.

His affection for little girls was captured in photography and Charles spent a great deal of his time in meeting them during vacations at the seashore, some friend's house, or on the train. He always obtained consent from the parents and took great delight in entertaining these prepubescent friends at his apartment or the theater. He had a bag of gifts and objects for magic tricks to gain an initial contact and he frequently gave a copy of his books on Alice as a gift. His many letters to little girls during this time are full of the nonsense found in his books, but frequently are vaguely concealed love letters full of sexual flirtations. He seldom entertained an adolescent girl or a mature woman. There is little to indicate that he had sexual contact with any female. He found young boys repulsive and never had a relationship with one. Photography allowed Charles to hold the idealized image of his girl friend's permanently and at one time he had a list of 107 little girls who were photographed or to be photographed. Suddenly in July of 1880, what had been a long standing passion in his life was given up. With little explanation in either his diaries or his letters at the time, Charles took no more pictures.



Portrait of Alice Pleasance Liddell.

Parallel Thought

One of the most interesting aspects of Charles Dodgson's personality is how he managed and generally succeeded publicly, if not internally, in keeping the imaginative side of his personality, which appealed to his little girl friends, separated from his more linear, logician side. Although the use of a pseudonym in published writings was not uncommon in the Victorian Period, in Charles's case it would seem that Dodgson and Carroll genuinely reflected aspects of one personality that functioned in two different affective styles: the evocative images in the Alice stories and the dry formulas of symbolic logic.

As a student at Rugby and Oxford, Charles demonstrated outstanding scholarship and talent in mathematics, classical humanities, and divinity. However, as a teacher in his chosen field of mathematics and logic it would appear that he was less than inspiring to his students and he gained little satisfaction from it. There are also indications that he found giving sermons a burden. The liveliness of his thought expressed in his fantasies for children was not expressed in his lectures and sermons. Perhaps his lifelong problem with stuttering accounts for some of this.

His early years at Oxford are noteworthy for his publications of nonsense and parody rather than logic. For example, after becoming secured in 1851 as a life member at Oxford, his major works beside the two Alice stories are *Phantasmagoria and Other Poems*, *The Hunting of the Snark*, and *Sylvie and Bruno*. The first two continue the exploration of fantasy found in the stories of Alice while *Sylvie and Bruno*, published at the time he was ending his career at Oxford, is a mix of fantasy and moral tale. Whereas the other children in *Sylvie and Bruno* are presented in ideal terms and generally not burdened with the more common childlike emotions, one boy, Uggug, is a hideous fat boy whose major function in the book is to be unpleasant. The book itself was a failure and is structurally unsuccessful in the attempt to combine a fairy tale with a moral message regarding the importance of Christian love. The story, combined with Charles's diaries and letters, is consistent in establishing the negative image that he had of young boys. Passages from the book indicate that when Uggug looks at Sylvie in a sexual way he becomes even more animal-like than usual.

At the time he was writing *Sylvie and Bruno*, Charles published several mathematical works under his own name. He had been teaching mathematics for 22 years. Three years later, in 1879, he published under his own name *Euclid and His Modern Rivals*. The years 1880–1881 appear to be important for Charles because he gave up his photography and lecturing. His letters and diaries from this time reflect a return to his long-lasting interest in word games and logic. For approximately the last 12 years of his life there is little original work on fantasy and Charles turned his attention to the problems of logic. He would not answer mail addressed to Lewis Carroll. There is considerable evidence that Charles found logic as a source of joy and order with the significant feature that it will "give cleanness to your thoughts and see your way through a puzzle," to quote from the preface to one of his works on logic. The result of his efforts at this time was *A Game of Logic*, which was written for the general reader, and his more ambitious project, *Symbolic Logic, Part I*. Charles thought that *A Game of Logic* was

written in such a style to appeal to children whereas *Symbolic Logic* addressed advanced logical concerns regarding paradoxes. *Symbolic Logic* went through four printings in his lifetime. He was writing *Symbolic Logic, Part II* when he died, and a manuscript of that book has been recently found. Although none of his contemporaries thought that his contributions to logic were exceptional, recent evaluations by such authorities as Bertrand Russell indicate that he was an original thinker who advanced logic beyond its Aristotelian limits to the methods of modern thought.

Conclusion

As a boy Charles Dodgson demonstrated a talent in mathematics and a joy in word games, puzzles, and nonsense. Up until age five his only playmates were four younger sisters. He saw himself as an undesirable boy and although he demonstrated more than a usual amount of affection for prepubescent girls, he disliked boys that age and avoided their company. Charles Dodgson–Lewis Carroll was characterized by a unique synthesis between fantasy and logical thought in a personality where concepts of self were rigidly separated and unavailable to conscious exploration. As Lewis Carroll, Charles attempted to establish affectionate relationships with very young girls in an effort to express the more affect-laden images of his thought. In his creation of images growing up in the Alice stories he combined fantasy and logic as they had

never been combined before. Interrelated with his affection for the real Alice Liddell and romantic images of that ideal was his lifelong passion for photography. Combining his interest in science and technology, as well as allowing him a socially acceptable avenue for his erotic wish to possess prepubescent girls, photography gave Charles Dodgson a great deal of aesthetic and erotic pleasure.

His creative efforts in his stories for children, really little girls, and his photographs of little girls are instructive examples of the contribution of conflict to creativity. These two passions, love of little girls and photography, dominated his early life. As he grew older he returned to the study of mathematics and symbolic logic. He pursued these with passion and took pleasure and comfort in the order and rules of that mode of thought. However, the unique creativity of his thought found expression in the irrational and illogical stories he wrote for an imagined little girl who was to never return his love.

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Mary Cassatt 1844–1926

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Mary Cassatt (1844–1926), renowned for her depiction of women and children, was the only American member in the group of French artists known as the Impressionists. After exhibiting her work at the Paris Salon, Cassatt was invited to join the Impressionists by Edgar Degas. In addition to being a painter and a printmaker, Cassatt was also an advisor on art who influenced American collectors and subsequently impacted the holdings of major museums (Figure 1). She was also an early feminist and a strong supporter of women's rights, especially the right to vote. While Cassatt's fame in America increased after her death, she had greater success in France during her lifetime and at age 70 received their highest award, the Chevalier of the Legion of Honor.

Background and Family

Born Mary Stevenson Cassatt on 22 May 1844 in Allegheny City, which is now part of Pittsburgh, Pennsylvania, she came from a family of privilege and creativity. Ancestors on both sides of her family were landed gentry and Revolutionary war heroes. For generations they had been bankers, lawyers, and civil servants yet when her father Robert Cassatt started his own investment company, it was regarded as daring and risky. Business was Robert Cassatt's domain of creativity and he eventually became successful enough to retire in his forties and take his family to Europe for an extended stay. Her mother, Katherine Cassatt, was musical and their family home always included a piano. Lydia, her older sister, did needlework and weaving while her oldest brother Alexander Cassatt, like her father, turned his creativity to business. Alexander eventually became one of the richest men in America and as head of the Pennsylvania Railroad, was the person who linked their trains by tunnel to New York City. Her younger brother Gardner also became an investment banker and the head of his own firm. By manifesting a variety of creative modalities, the Cassatt family showed great evidence of everyday creativity, which encompasses the many ways it is possible to be creative in daily life.

Robert and Katherine Cassatt lost a son and a daughter in infancy but of their remaining five children, Lydia born in 1837, Alexander born in 1839, Robert, born in 1840, Mary born in 1844, and Gardner born in 1849, Mary Cassatt was closest to her brother Robert, known as Robbie. When Robbie was seven, he began showing symptoms of tuberculosis of the knee. His worsening pain and the prospect of good medical

care in Europe was one of the reasons the family traveled there. Another reason was the availability of excellent education for their children, specifically engineering schools for Alexander, the oldest son. When the Cassatt family sailed for Europe in June of 1851, their first stop was England where they saw the Great Exhibition in London's Crystal Palace. In August the family sailed for Paris where they stayed two years before moving to Germany for another two years.

Having taken classes in French and German, Mary Cassatt was fluent in both languages by age 11. Years later this fluency in French would be an immeasurable aide to her career in France. Another benefit was that having spent years in Europe as a child, she did not experience it as a foreign place when she returned to live there as an adult. The Cassatt family was going to stay a third year in Germany, but when Robbie succumbed to illness at age 13 they returned to America. After being sick for years, he died just days after Mary Cassatt's eleventh birthday. It was a tragedy for the entire family but it may have affected Mary the most because Robbie was her steadfast companion throughout childhood.

Turning to Creativity

In response to Robbie's death, Cassatt may have turned to creative activity to soothe and distract herself from this great loss. The psychologist Ernst Kris (cited in Niederland, 1967) notes that children tend to be creative during times of stress and when Robbie died at age 13 the resulting trauma may have turned Mary Cassatt to a life of art. Eminent artists usually show signs of creativity in childhood and while Robbie's death was not the only reason for her choice of career, it was an important stimulus in her early life. Each one of our actions is generated by multiple causes which are often events in our lives, themselves the result of an almost infinite number of stimuli. Yet certain of these events have more profound an impact on us than others becoming the occurrences that shape our destiny. One of these occurrences for Mary Cassatt happened shortly after Robbie's death and may have intensified her desire for creativity. It was seeing great art at the *Exposition Universelle*, the Paris World's Fair.

On their way back from Germany to America, the Cassatt family stopped in Paris to see the *Exposition Universelle* with its display of art by Ingres and Delacroix as well as the work of Courbet in a separate pavilion. Exposure to these works of art



Figure 1 Mary Cassatt, Self Portrait. ca. 1880. Watercolor on paper.

may have made a great impression on the young Cassatt, especially seeing the paintings by Courbet, who became one of her favorite artists. Bullard says that this experience could have inspired her desire to become an artist. Art lessons had been part of Cassatt's education and learning to draw provides a greater appreciation when viewing the art of others.

Seeing great works of art can be life changing for a child recently immersed in tragedy. Their beauty may well have been a distraction from Cassatt's pain and experienced as healing for the 11-year-old girl. Later on Cassatt would repeatedly turn to art as healing in response to the difficulties in life. It is possible that Robbie, like other children with debilitating illnesses, made art while he was sick because he was unable to be physically active. Creativity could have been his method of occupying himself during years of confinement. If this is so, then Mary Cassatt and Robbie may have shared an interest in creativity and pursuing art may have been experienced as a way to keep him close to her after he died. When children cannot comprehend the irreparable nature of death, they may want to restore the lost object with a greater intensity than that found in adults. Losing a sibling in childhood may inspire strivings and fantasies of restitution making creativity in response to the object loss a restorative experience. Creative activity can also provide a sense of companionship for a child suffering from loss and feeling alone. As such it becomes a way to search for wholeness after trauma. Of course losing a sibling is hardly a sufficient condition for becoming a creative artist. Innate talent is also crucial, as well as having encouragement from a parent or other caretaker.

When the Cassatt family returned to America they lived in West Chester, Pennsylvania for three years before moving to Philadelphia. By age 15, Mary had grown into a tall athletic girl with strong interests in literature and politics but said her real passion was for drawing and painting. Her interest in art was so intense that she was the first person to sign up for a class at the Pennsylvania Academy of Fine Arts. At that time the Pennsylvania Academy of Fine Arts was the leading art school

in the country and dedicated to producing professional artists. During the years of Cassatt's attendance there were a number of students who went on to established careers. Among the women were Anne Whitney, Emily Sartain, and Fidelia Bridges and male students who achieved eminence were Thomas Eakins, Robert Wylie, Earl Shinn, Harry Moore, and Howard Roberts.

When Cassatt finished her classes at the Academy, the family moved into their new estate in Westtown, Pennsylvania. Cassatt still traveled to Philadelphia for art exhibitions and to learn on her own by studying examples of great art in the museums, which she preferred to organized classes. At home in Westtown Cassatt used the local inhabitants as models for her art, a practice she would continue throughout her career no matter where she lived. Although Cassatt enjoyed horseback riding through the countryside, she eventually realized that Paris was the place she wanted to be. When she told her father about her plans to become an artist and study in Paris, he retorted, "I would almost rather see you dead" (cited in Hale, 1987: 31). Robert Cassatt, who wanted to keep his daughters close to home, succeeded with his older daughter Lydia, who was unmarried at 28 and still living with her parents. Mary Cassatt, who later said, "Oh I am independent! I can live alone and I love to work" (cited in Munson, 1999: 55). Sailed for France at age 21.

An Artist in Europe

Cassatt's mother accompanied her to Paris in late 1865 and stayed there for about half a year seeing that her daughter was settled in as a boarder with a trusted family. Within that time friends from the Pennsylvania Academy, such as Thomas Eakins, Howard Roberts, and Eliza Haldeman also arrived in Paris. In France Cassatt studied with the painters Charles Chaplin, Jean-Léon Gérôme, and Thomas Couture. She also spent a large part of her time copying works in the Louvre and took sketching trips to the country. By 1868 she had her first painting accepted into the Paris Salon, which showed a young woman playing the mandolin. When the Franco-Prussian War was declared in 1870, Cassatt went back to Philadelphia but soon realized that her true focus was in Europe and returned there in 1871, this time to Parma, Italy.

There she studied the paintings of Correggio and Parmagianino and learned print-making techniques from Carlos Raimondi. After Italy she traveled to Spain, first coming to Madrid and then staying in Seville. In Spain she completed her first major body of work, again using local inhabitants as her models for the young women and toreadors in the paintings. Two of the canvases, *Spanish Dancer with a Lace Mantilla*, 1873 and *Torero and Young Girl*, 1873 were later shown at the Paris Salon. Previously Cassatt exhibited her work under the name of Mary Stevenson and then Mary Stevenson-Cassatt but after 1873, she used Mary Cassatt and continued with that name for the rest of her life.

An Advisor on Art and a Feminist

Returning to France in 1873 Cassatt met Louise Waldron Elder, an American woman studying at a boarding school in Paris. Elder, who was very interested in art, admired Cassatt's

knowledge and abilities and the two became close friends. When Cassatt convinced Waldron to buy a Degas, it became the first Impressionist work that was brought into America. Later when Elder married E. O. Havemeyer, Cassatt was very influential in guiding their art acquisitions which became the Havemeyer Collection and eventually part of New York's Metropolitan Museum of Art. Trusted by all the important Impressionist and Realist painters and collectors, Cassatt was a connoisseur of French art, who also advised them on purchasing works by old masters such as Goya and El Greco. Cassatt and the Havemeyers formed an art collecting alliance that became one of the greatest in the history of American culture.

In addition to art, both Mary Cassatt and Louisine Havemeyer shared a passion for women's rights, especially the right to vote. In 1912 they made plans for an art benefit in New York featuring the works of Degas and Cassatt to aid the suffrage movement. Although Cassatt and Havemeyer admired Degas' work, it he was an unusual choice to aid a feminist benefit. Degas was extremely conservative and known for his misogynistic remarks, such as the time he saw Cassatt's painting, *Two Women Picking Fruit* and exclaimed, "No woman has a right to draw like that."

Joining the Impressionists

Despite his prejudices toward women Edgar Degas admired the work of Mary Cassatt. In 1877, when he invited her to show with the Independents, better known as the Impressionists, Cassatt said, "I accepted with joy." Degas also bought her paintings and eventually owned 90 of her prints. Cassatt's palette had been getting lighter since 1873. The deep shadows of her earlier images were gone and she had begun posing some of her models outdoors, as seen in the 1875 paintings *Picking Flowers in a Field* and *Head of a Young Girl with Blue Eyes Outdoors*. Although her work fits in with the Impressionist style, it was a leap of courage for Cassatt to forgo the traditional route of showing at the Paris Salon and joining what many derided as a group of outcasts. Impressionist artists such as Edouard Manet, Auguste Renoir, Claude Monet, Camille Pissarro, and Berthe Morisot are now well known but then they were considered to be rejects of the Paris Salon.

Looking back at Cassatt's bravery in joining the Impressionists, the art critic Gustav Geffroy said in 1893 that "Miss Mary Cassatt, though, has not gone the way of fashion, of the popular styles, of success, for she has gone to the disparaged Impressionists." He continued in his admiration, stating, "A similarity of vision determined this choice, and this vision has expanded, has become increasingly searching, this strong-willed woman has truly learned to paint." Other American women painting in Paris at the time such as Elizabeth Gardner and Mary MacMonnies remained within the academic establishment and continued showing at the Paris Salon. While both of them had success during their lifetimes, their posthumous reputations have greatly diminished. In contrast, Cassatt rejected academic art and the Salon saying, "I had already recognized who were my true masters. I admired Manet, Courbet, and Degas. I hated conventional art. I began to live."

Joining the Impressionist movement was a life changing event for Cassatt. It brought her into a group of painters that

were altering the course of European art. In addition she was now able to enter into French culture and society at a level that had previously been unavailable to her. Cassatt not only exhibited with the Impressionists but became an active member of the association, using her considerable business and organizational skills to promote their work and help arrange the exhibitions. She was first invited to participate in the fourth Impressionist exhibition and continued to show her work in the fifth and sixth Impressionist exhibitions. Following Degas' lead, she refused to participate in the Seventh Impressionist exhibition when conflicts broke out among its members, but showed her work again in 1886 as part of the eighth and final Impressionist exhibition.

Family Responsibilities

In 1877, the same year Cassatt joined the Impressionists, her mother, father, and sister Lydia came to live with her in Paris. Her father who had gone back to work after his earlier initial retirement now retired again and he, along with her mother and older sister Lydia were moving to France as their permanent home. Fully accepting the responsibilities for her family, Cassatt gave up her previous apartment-with-studio in the artist's quarter and found a larger apartment on the Rue Beaujon in an elegant neighborhood near the Champs-Élysées that could accommodate the entire family. She also rented a studio for painting in her former neighborhood.

Neither of her brothers moved to Paris, but remained in Pennsylvania where they had successful careers and raised their families. In 1868 her older brother Alexander married Lois Buchanan, a niece of President Buchanan and had four children, while her younger brother Gardner married Eugenia Carter in 1883 and took his bride to Paris to meet the family. They had three children. Cassatt enjoyed painting her nieces, nephews, and other family members, but the portraits of her sister Lydia from 1877 to 1882 are among her best works of art. They include *Lydia Reading the Morning Paper*, 1878, *Five O'clock Tea*, 1880, *Lydia Crocheting in the Garden at Marly*, 1880 (Figure 2), and *Lydia Working at a Tapestry Frame*, 1881.



Figure 2 Mary Cassatt, *Lydia Crocheting in the Garden at Marly*. 1880. Oil on canvas.

After suffering from poor health her entire life, Lydia died in November 1882 at age 45 from Bright's disease, a failure of the kidneys. Cassatt nursed Lydia when she was sick and her sister's death was an emotional blow. As an unmarried woman, she had assumed she would live with her unmarried sister Lydia and they would grow old together but now that could not happen.

In 1884 Cassatt and her parents moved into an apartment at 14 Rue Pierre Charron that had room for Cassatt's studio. Three years later, they moved again, this time to an apartment and studio on rue Marignan near the Champs-Élysées that had an elevator and central heating, amenities that were a great help to her aging parents. Cassatt maintained this residence for the rest of her life. In 1891, her father died at age 85 and Cassatt nursed him in his failing health, as she had done with her sister Lydia and would do in her mother's final illness and death in 1895. Cassatt's admiration for her mother was evident in the portraits she painted of her, such as *Reading Le Figaro*, 1877–1878, which shows an intelligent strong looking woman reading the newspaper. The health problems in her elderly parents brought out a very nurturing aspect in Cassatt. This capacity for caring affected the imagery of Cassatt's work, resulting in a greater closeness between mother and child as in the pastel *Hélène de Septeuil* 1889–1890, where a woman holds a child so closely that their faces touch and seem to meld into one.

Beyond Impressionism

Although Cassatt continued to keep the sunny palette of Impressionism throughout her life, her paintings began to take on more structure and definition in the mid-1880s with works such as *The Family*, 1886 and *Girl arranging Her Hair*, 1886. With an increasing emphasis on line that highlights her excellent skills in drawing, the paintings become stronger, culminating in *The Bath*, 1892, and *The Boating Party*, 1893–1894. A strength in Cassatt's work is strong drawing and excellent composition with a lack of sentimentality. In April 1890 Cassatt repeatedly went to an exhibition of Japanese prints at the École des Beaux Arts with Degas and friends. Japanese woodcut prints, known as ukiyo-e, were available in Paris before but this exhibition with its hundreds of works made an enormous impact on Cassatt. That summer and fall Cassatt worked on an etching press with a professional printer. She used 250 color plates, each one of which she inked by hand, to create a series of 10 color prints, showing Japanese inspired images of Western daily life. These are her greatest graphic works and among the most esteemed prints created in the nineteenth century.

In 1891 Cassatt had her first one person show at the Durand-Ruel Gallery in Paris; it would be followed by others including a show in their New York gallery in 1895. Beginning in 1907 she also exhibited at the Vollard Gallery in Paris. In 1892, Cassatt bought what was to be her permanent country home, the Chateau de Beaufresne in Mesnil-Theribus, 50 miles northwest of Paris. In that year she also began work on a painting called *Modern Woman*, a large 12 by 58 foot canvas that was commissioned to be a mural for the Women's Building at the 1893 Chicago World Fair. Cassatt's three part

painting showed women picking the fruits of knowledge and education, pursuing fame, and remaining attentive to domestic responsibilities. The mural elicited great praise in close viewing before it was hung but unfortunately, the artist had not judged how it would appear at a distance. In place near the ceiling, it looked garish and unclear, eliciting a very negative public response. Cassatt treated negative reaction to the mural just as she had treated negative responses to her art in the past – she ignored it and kept on working.

Degas, a Mentor in Art

Of all the artists Cassatt knew in her lifetime, Edgar Degas was the one who was most important to her and the artist with whom she had the deepest and most complex relationship. He was also the person who exerted the greatest influence on her creative process. Even before they met in 1877, they admired each other's work. The first time Cassatt saw one of Degas' pastels in an art gallery window she said, "I used to go and flatten my nose against that window and absorb all I could of his art. It changed my life." When a friend showed Degas a work by Cassatt, he said, "There is someone who feels as I do." Degas was ten years older than Cassatt and although she was American and he was French they had a great deal in common. Both came from backgrounds of wealth and privilege. Degas' father was a banker and because his mother was an American from Louisiana, he may have felt a special rapport with Cassatt. This rapport may have been intensified by the longing Degas felt for his mother, who died when he was 13. Degas had visited his American relatives and one of his early oil paintings, *The Cotton Exchange in New Orleans*, 1873, shows a scene from his trip to Louisiana.

From 1879 to 1880, Cassatt and Degas worked together making prints for *Le Jour et La Nuit*, a journal that Degas had planned. Although the journal was never published, it strengthened their friendship and encouraged Cassatt to focus on printmaking as well as painting. While Degas was helpful, he had a very difficult personality that could be abrupt and irritating. Cassatt's father, whom she adored, also had a stubborn and difficult personality, which was possibly one of the reasons that she could tolerate Degas. Yet, unlike her father, who had discouraged her from pursuing a career, Degas strongly supported her work and became her mentor. He would stop by her studio to see her progress and in one painting, *Little Girl in a Blue Armchair*, 1878, he even found the model and painted on the background. Degas encouraged Cassatt to focus on drawing which became one of the greatest strengths in her work. Cassatt was also helpful to Degas. She tirelessly promoted his work by using her influence to ensure that it was consistently bought by American collectors visiting Paris.

Degas and the Creative Imagination

The psychoanalyst Kathryn Zerbe, noting the artist's strong feelings for her father, says that in Degas, Cassatt found an idealized paternal transference, which enhanced her creativity. Zerbe believes that Degas' influence transformed Cassatt's work and suggests that sometimes a woman's creativity can

be inspired through attaining a special position with an important male figure in her life. This man, who is usually her father, admires her 'masculine' aspects such as creativity, ambition, and motivation for success. He also encourages the woman to identify with his interests and achievements. This happened twice with Cassatt; first in assimilating her father's fervor for business and success, and then with Degas, who became a role model and inspiration for her art. It was he who suggested that Cassatt paint mothers and children, a subject matter that remained central throughout her career.

Both Cassatt and Degas remained unmarried for their entire lives and despite her love and admiration for him it is unlikely that their relationship was sexual. We cannot know this for certain because Cassatt destroyed all her letters from Degas before she died and most of her letters to him were lost. Instead, their connection was most likely one of inspiration and desire channeled into art. Taking a Freudian point of view, Zerbe believes that Cassatt's paintings represent an unconscious desire to have Degas' child as well as being her own symbolic offspring. Even if they have biological children, it is very common for artists to consider the products of their creativity as children. Throughout the ages, artists such as Michelangelo have regarded their creative works as their children and Freud noted this phenomenon. This parental view of creativity is not exclusive to visual artists. The writer Charles Dickens said his favorite child was David Copperfield, the hero of his novel by the same name.

In spite of their mutual passion for art, Cassatt and Degas did not always agree. During the Dreyfuss Affair, Degas was certain that Captain Alfred Dreyfuss was guilty of treason, while Cassatt believed in his innocence. History has proven her correct. Dreyfuss, who was wrongly accused and imprisoned because of anti-Semitism, was later exonerated and honored by France. Cassatt could also be difficult. A very outspoken and critical person, she had a long history of broken friendships throughout her life. It was inevitable that two such strong-willed people would have rifts but when these occurred, mutual friends would bring them together again. At the very end of his life when Degas was blind, going deaf, and losing his cognitive faculties, Cassatt persuaded his niece to take care of him during his final two years. Expressing her sorrow when Degas died in 1917, Cassatt said, "He was my oldest friend here and the last great artist of the nineteenth century. I see no one to replace him."

Public Response and Growing Fame

In the autumn of 1898 Cassatt made her first trip back to America since 1871. She was so little known at that time, that even in her home town of Philadelphia, the *Philadelphia Ledger* wrote, "Mary Cassatt, sister of Mr. Cassatt, President of the Philadelphia Railroad returned from Europe yesterday. She has been studying painting in France and has the smallest Pekinese dog in the world." Posterity has reversed the order of fame in this nineteenth-century newspaper citation. Alexander Cassatt, an extremely prominent business man of his day, is now better known as Mary Cassatt's brother. Also, Cassatt had finished her studies decades before this trip and her little dog was a Brussels Griffon. True to her strong work habits, Cassatt



Figure 3 Mary Cassatt, *Mother and Child (The Oval Mirror)*. ca. 1899. Oil on canvas.

did a series of portraits in America, which include her pastels *Frances L. Hammond as a Child*, 1898, *Portrait of a Grand Lady (Mrs John Howard Whittemore)*, 1898, and *Boy with Golden Curls* 1898 (see [Figure 3](#)).

Ocean voyages were extremely difficult for Cassatt who suffered from severe sea sickness yet she visited America twice more in her life, in 1904 and then again in 1908–1909. On these later trips, her fame in America had grown. In 1904 she was the guest of honor at the Art Institute of Chicago's opening for its annual exhibition and she was also awarded the Lippincott prize and the Harris prize, both of which she rejected. Cassatt did not approve of prizes given to older established artists. Instead she believed they should go to struggling young art students and instructed that the 500 dollar Harris prize be given to Alan Philbrick, a young American artist working in Paris. While Cassatt's outspoken opinions against the art establishment and her concern for struggling art students made her a heroic figure to young American artists working in France, those that met her in person were intimidated by her arrogant and austere demeanor. There was a prize she did accept. In 1904 France gave her its highest award, the Chevalier of the Legion of Honor.

A Painter of Women and Children

Mary Cassatt's work is almost exclusively about women and children. Grown men are rarely depicted in her painted world. Degas encouraged Cassatt in this subject matter because he believed that "only a woman can paint infancy. There is a special feeling that a man cannot achieve." The first book written about Cassatt was called *Mary Cassatt: A Painter of Mothers and Children* by the writer and art critic Achille Segard. Cassatt had previously been included in anthologies of Impressionist painters but this was the first book dedicated solely to her work and other books would follow. Yet the subject matter

of women and children for which she is best known and admired, eventually became a limitation later in her career.

Although Cassatt was a highly intelligent woman, who read widely, none of her literary knowledge is conveyed in her art. After her mother died, Cassatt turned to spiritualism in an effort to contact her but without results, yet none of this metaphysical interest is apparent in her work either. Instead, the imagery remains largely of interior scenes depicting tender moments between women and children. While Cassatt created extremely strong works like *The Bath*, 1891, showing a mother bathing her child, in her late works the mother and child theme is repeated with too much similarity. In addition the figures are sometimes less well drawn as in *Woman and Child Admiring a Baby*, 1906 and *Children Playing with a Cat*, 1908. One of the reasons that Cassatt stayed with the same subject matter to the extent of producing less creative paintings was the pressure to keep making art that sold well.

Acknowledging the decline in her later pieces Cassatt blamed her art dealers saying, "I sold my soul to the dealers, that's all. It was the dealers who stole my life!" Dealers can exert great pressure on artists to keep creating commercially viable works. Cassatt's art with its subject matter of mothers and children had widespread appeal that sold easily. Too often, galleries see art as a commodity and view sameness of product as a factor that can encourage continued sales. Yet the pressure to sell also came from Cassatt. She was an excellent business woman, who described herself as "ravenous for money." Raised in an atmosphere of currency and investments, Cassatt used that business intelligence to guide her successful career. Selling art was of paramount importance to her.

Her Later Years

Another reason for the sameness in Cassatt's work may have been her personal resistance to change. As she aged, Cassatt, who was always opinionated, became rigidly self-righteous and was unable to transform her work even when faced with an opportunity to guide it in a new direction. The opportunity was her encounter with Egyptian art in 1911 when she journeyed to Egypt with her brother Gardner and his family. Cassatt admitted she found Egyptian art overpowering, saying, "I am crushed by the strength of this art. I wonder though, if I can ever paint again."

After the trip, Cassatt had a breakdown that manifested in emotional and physical exhaustion. Other creative people such as Charles Darwin, Elizabeth Barrett Browning, and Florence Nightingale turned their illness into a time of productivity and there is a long history of visual artists who also used illness to transform their lives and their work but Cassatt did not in spite of suffering from both incapacitating physical exhaustion and severe emotional stress. Although she mused in Egypt "fancy going back to babies and women to paint," when she regained her health that is what she did until her eyesight began to fail. Diagnosed with cataracts in 1912, Cassatt underwent a series of operations beginning in 1917 but none of the operations were successful and they ultimately hastened her loss of sight. Cassatt had also developed diabetes, which she attempted to control through a restricted diet.

In the later part of her life Cassatt had the extended companionship of her very loyal and long term housekeeper,

Mathilde Vallet. It was Vallet who took care of the artist in her older years and final illness. In gratitude Cassatt left Vallet a number of artworks to provide her with financial security. One of the pieces that Cassatt bequeathed was a portrait of Vallet tenderly holding the artist's nephew called *Woman and Child (Mathilde and Robert)*, 1885. In her sixties, Cassatt became friendly with James Stillman, an American banker living in France. He bought 24 of her works, and like the Havemeyers, valued her advice on collecting. It is generally thought that Stillman asked her to marry him and that she declined. Yet Cassatt and Stillman continued to be close friends and he eventually returned to New York in 1916.

Although blind for the last years of her life and unable to paint, Cassatt remained dedicated to art and conveyed her enthusiasm to the young artists who continued to visit her. Diabetic for many years, Cassatt died in 1926. As a Chevalier of the Legion of Honor, she was given a ceremonial funeral and was then buried in the family plot in Mesnil-Théribus near her summer home the Chateau de Beaufresne. During her lifetime Cassatt, who was called both "one of the glories of France" and "The Most Eminent of Living American Women Painters," still wondered whether posterity would recognize her. After death her fame has continued to increase, granting Mary Cassatt a strong, secure, and admired place in the history of art.

See also: Art and Aesthetics; Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Expressive Arts Therapy.

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- <http://www.metmuseum.org/> – The Metropolitan Museum of Art.

Paul Cézanne 1839–1906

Painter

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CÉZANNE is a painter of timeless accomplishment, radical innovation, and inestimable importance for the art of the 20th century. Paradoxically, the work by which he influenced those who followed was very different from the painting he had intended to do as a young man. His initial aims were to represent events, mostly imaginary and highly emotional; his achievements, however, were paintings that were based on close observation of visual reality, complex yet resolved, and revealing a simultaneous interest in the structure of things and the richness of perception. This change seemed more a matter of internal development than of external constraints, and was due to a change in the importance of perception, rather than imagination, as the starting point of his work.



Paul Cézanne: Self-portrait before a pink background, c. 1875. Used with permission from Erich Lessing/Art Resource, NY.

Childhood and Adolescence

To understand how Cézanne created, ideally we should emphasize in equal measure the era in which his early ideas were formed, the teachers and contemporaries who influenced him, and the early experiences which determined his character. We should also look at the makeup of his adult personality, the material support available to him, the conditions under which he worked, and the specific talents that gave his work its form and quality. Alas, no account of a painter is that complete, and no interpretation of creativity that firm; in Cézanne's case, although there is much information on his adult life and the context in which he developed and worked, the record of his childhood is incomplete. And talent, of course, is always difficult to analyze.

Nevertheless, we do know something about his childhood and considerably more about his adolescence. Born in 1839 in Aix-en-Provence, France, as the first of three children of

Louis-Auguste Cézanne—a self-made man who rose from hatter to banker by dint of honest, hard work—and Anne-Elizabeth Aubert, who later became Louis-Auguste's wife, he held his father's character and practical attainments in awe but resembled his mother in temperament: lively, and possibly nervous and depressive. He received an excellent education in the public schools of Aix, and at the age of 13 formed a close friendship with an equally sensitive and intelligent young man who later became the novelist Emile Zola. We must note right away that his temperament was not suited for what was expected of him, that is, to follow in his father's footsteps—even with the refinement of law training—and we would be right to suspect that his attitude toward his father was a mixture of admiration and rebellion. Both aspects of the attitude ultimately bear on his work. During his adolescence, however, the friendship with Zola (and a third companion, Baille) was formative, and crucial emotionally and aesthetically. Rewald, on whom all the biographical information here is based, writes,

The three friends found themselves closely drawn together by a number of unusual interests and ambitions, and at school they came to be known as the "inseparables." They took long walks together over the countryside around Aix, and passed the time fishing, swimming, and reading verses by Homer and Virgil... Artistic questions particularly absorbed them and they discussed everything that was on their minds, persuading each other that they had a great and extraordinary destiny. Zola wrote poetry which he read to his friends, and they in turn wrote verses. Zola found Cézanne's more poetical than his and encouraged him to continue his efforts.

The friends in fact also wrote three-act comedies in rhyme, and pretended to hunt; but according to Zola's later notes, "The hunt always ended in the shade of a tree, the three of us lying on our backs with our noses in the air, talking freely of our loves. And our loves, at that time, were above all, the poets." Even such a brief reconstruction of the adolescent years says much about the conditions of Cézanne's future work. There is the love of the beautiful countryside, the capacity for intense friendship, the apartness from the crowd—and the intellectualized handling of adolescent concerns—the capacity for intense artistic work, and of course the dawning decision to dedicate oneself to art. What Zola and Cézanne understood by art, and by its purpose, was not yet divided into the visual and verbal. Art served to express the emotional concerns already evident to them: love, romance, disappointment, remorse, guilt, and even death.

They resolved that if they succeeded in becoming artists, these would be their subjects. Real love would be postponed for now; it would be achieved only through becoming an artist. One is reminded of Freud's comment on the role of wishes

in creating art: the artist creates because his unfulfilled wishes drive him, and later, when he has succeeded in expressing them in an artistic way, reality may grant them. As a description of Cézanne's and Zola's initial motives—of their direct sublimation of personal concerns into artistic ones—this is quite apt; but we shall see that motives change as artists grow, and that Cézanne grew into a different artist than he had foreseen.

Attempting to Make a Decision

When Cézanne was 19, Zola left for Paris to become an artist, and the two friends expected to join him after taking their exams. Cézanne in fact took three years to get away (Baillie never did), and the hesitations of those three years, and the correspondence he kept up with Zola, help us reconstruct his psychodynamics. Zola tried to bolster Cézanne's self-confidence and kept encouraging him to come to Paris. Cézanne instead studied for his baccalaureate exams, and to satisfy his father entered law school. This failed to interest him; increasingly he dreamed of painting, and enrolled in the free drawing academy of Aix, where he at least studied from plaster casts and the living model. He also became acquainted with the work—some of it landscape work—of Provence's painters. Eventually his father came to understand that painting was what Cézanne most wanted to do, gave him a monthly stipend, and went with him to Paris to help set him up.

It should be noted that Cézanne, fearing his father's reaction, never confronted him openly, and that without the latter's unstated understanding and ultimately lifelong material support, would never have become a painter. In the intervening correspondence Cézanne often gave vent to his robust poetic talent and inadvertently preserved for us a record of his inner conflicts. Writing spontaneously, in addition to the chatty news, he might begin or end with a poem. In one poem, Hannibal feels guilty before his father for having stayed up and caroused instead of defending his country; in another, a young man lost in the woods is about to be rescued by a beautiful woman who bares her breast to him, only to turn into a skeleton as he attempts to kiss her. Pleasure seemed always alloyed with pain, guilt, or even death. Cézanne began his artistic career, then, with more than the usual anxiety about love and a more than usual fear of his father; he also went to Paris with some training in art and acquaintance with Provençal painters, and the conception of art as predominantly narrative.

He was also easily discouraged; he returned home after five months and resigned himself to working in his father's bank. This, too, made him utterly unhappy, and a year later he was back in Paris. He returned to the studio where, without instruction, he could work from the model. There he met some of the young painters who, 12 years later, would exhibit together and receive the nickname "Impressionists." Monet and Renoir, nearly the same age, would eventually become his friends, and Pissarro, 10 years older, would become friend, supporter, and admirer—not a trivial feat in the early years—and later embody and communicate a devotion to landscape painting when they came to paint side by side.

Early Development as a Painter

For the first 10 years or so of his painterly career Cézanne's subject were mostly narrative but his style varied considerably. The narrative pictures were quite unlike his mature work: religious scenes alternating with sexual ones, to be replaced with an orgiastic banquet, a lugubrious picnic scene, an autopsy, or a murder. The mood might be straightforwardly narrative or ironic; within the composition there might be a bald man looking on, resembling the Cézanne of the time (see *Pastorale*, Figure 1). Many paintings, though not all, are dark in tonality, and equally many depend on an interplay of slashing diagonals for their organization.

In some respects his subjects appeared to continue the concerns he had shared with Zola when they were 16, but they also served to illustrate stories, fables, and myths; the two purposes were closely joined. What is remarkable about the early paintings are two qualities. One is their uncommon verve—their utter frankness and originality. No painter of his time painted anything so risky and occasionally so blatant, or so free of the constraints of previous painting authority. The other is the evidence they give—when one sees the originals, rather than reproductions—of a search for a self-consistent style. Over 10 years the style changed radically, sometimes abruptly, but within each painting it remained consistent. Even in the face of the apparently turbulent subjects, which seemed closely connected with the tenor of the fantasies Cézanne had written out in his poetry, he seems to have been able to exert some degree of painterly control.

Nevertheless—and we reach the crux of the psychodynamic question regarding the evolution of his style and his ultimate discovery of a mode of working that was as satisfactory as it was successful—his most successful paintings were done from observation. Portraits (*Louis-Auguste Cézanne, père de l'artiste, lisant L'événement* of 1866, *Achille Empereire* of 1867–1868) and still lives (*La pendule noire* of 1867–1869) can be counted as the masterpieces of this first decade, and several landscapes are calm and well realized. What they have in common is a



Figure 1 Cézanne, *Pastorale*, ca. 1870. Musée d'Orsay, Paris. Used with permission from Erich Lessing/Art Resource, N.Y.

mode of working—they are no longer based in imagination—and a fully realized form: a well-balanced composition free from excessive tensions.

Pissarro and the Observation of Nature

Clearly Cézanne's best painting would depend on harnessing his powerful temperament by observation. We do not know to what degree he was aware of this; we can say at least that in his old age he was quoted by a young friend (Gasquet) as saying that his only method afterward was "hatred of the imaginary." We can assume that he would have been confirmed in this development by painting in Pissarro's vicinity, between 1872 and 1874, sometimes side by side in the open air. Pissarro taught and exemplified a patient observation of nature, and Cézanne even began to record the effects of light—in the manner of the colleagues who would hold their first exhibit in 1874 and receive their nickname from Monet's painting, *Impression, Sunrise*. We may conclude that not only would Cézanne be supported by Pissarro in valuing observation over fantasy, but that he would see the expressive possibilities of landscape.

In the years to follow he would give up the effects of light but continue to observe attentively. A certain conservatism (which could be observed much later in his political views), shown in his admiration for the art of the museums, made him turn away from his colleagues' flocculent innovations and return to portraying the solidity of things. Paradoxically, this conservative bent created his most radical innovations. It must also be added that Cézanne never gave up painting from imagination altogether; although by the mid-1870s he no longer painted scenes of sexuality and violence, he did replace them with bather compositions, male or female. He remained deeply attached to this subject, and in fact by the end of his life painted almost as many bathers as landscapes; they were followed by still lifes and portraits. With some exceptions, the bathers, too, are held in somewhat less esteem than the later work done from observation, and thoughtful critics have asked themselves why. Fry presumed that Cézanne, unlike, for example, Titian, simply did not have the capacity to summon up a serviceable image of the human body. But we may suppose as well that his imagination was constrained by the anxiety which it evoked, and in this connection we may remind ourselves of the evidence of his early poetry, in which impulse so easily arouses guilt or evokes punishment.

For Cézanne, then, creating came to rely on a broader kind of sublimation: in part the sexual and aggressive impulses were turned toward the more gentle sight of nudes bathing—in part the sheer vigor of his energies was directed toward passionate observation. (That he became deeply attached to observing is shown in part by comparisons of his landscape paintings with the views that served as their motifs. The correspondence is surprisingly close—Machotka's book shows a large number of them in color—and indicates attentive observation as well as an ability to capture his perceptions in a unified and self-consistent manner; see [Figures 2 and 3](#)). One may also say that Cézanne's successful creating meant finding a "conflict-free" sphere in which to work, that is, to work in the pleasurable sphere of observation rather than the ambivalent one of expressing fantasy.



Figure 2 Photograph of site in [Figure 3](#) (Machotka, 1996).



Figure 3 Cézanne, *L'Eglise de Montigny-sur-Loing*, 1904–1905; BF #970 Gallery XVII. ©The Barnes Foundation. Merion, Pennsylvania. Reproduced with permission. All rights reserved.

Mature Styles

The concepts of need (as in the need to express fantasy or the need for fame) and defense (whatever one does to avoid anxiety brought on by needs) are necessary for understanding a painter's psychodynamics, but they are not sufficient. One must also note certain aesthetic purposes, which are fully conscious and less reducible to personal organization. In Cézanne's case there is certainly a search for a consistent style—a style that would be adequate to his subject matter, to the needs of his compositions, and to his perceptions. One must mention all three purposes, because it is perhaps for meeting them all so well, for the sense, as Fry puts it, that “the smallest product of his hand arouses the impression of being a revelation of the highest importance,” that he is known, admired, and indeed revered.

During the first 15 years of his career as a painter, Cézanne's search for style was serious and often successful, but neither linear nor smoothly progressive. Toward the end of the decade of the 1870s, however, it culminated in a new method of laying down touches of paint in parallel to create a surface at once lively and controlled, one in which every part of the canvas responded in some manner to every other part. At its inception, the method seemed useful for controlling the vividness of his imaginative subject matter, but by 1879–1880 he came to use it in still lifes and landscapes, above all to order his perceptions of the motif's complexities. He was justly proud of his achievement and somewhat unreasonably protective of it, and he resented Gauguin for adopting it for his own painting in 1881. Because short touches laid in parallel also formed a group with an upper and lower boundary at right angles to each touch, the method would help him align vague surfaces with other, much clearer ones. As Machotka shows, in landscapes it might serve both to order a chaotic expanse of foliage and to align it with one or another major structural line such as a tree trunk or bridge support. His paintings took on a character of unusual unity—a unity achieved not through repetition but through thoughtful opposition and internal resonance. We must remind ourselves that neither the conscious purposes nor the particular talents by which they are realized can be accounted for by psychological means—or indeed by any other means. The one is a mysterious consequence of thinking and feeling, and the other an apparent given, sharpened through experience. Cézanne's achievements cannot be understood through his personality alone, no matter how much his personality, and its development, help us understand his early interests and later renunciations.

The parallel touch—this cornerstone of his mature work—was further transformed in the mid-1890s into a system of smaller patches of color. They were sharply bounded on top, and depending on how they were needed in the composition, they would either overlap those above them, producing a receding surface, or move both in front of some and behind others, indicating a more disorderly surface such as foliage. In them, the parallel touch was suppressed, though detectable; it was the patches themselves that became the structural unit. These remarks should not be read as suggesting that Cézanne worked by formula, and even less that the formula might be learned. On the contrary, the parallel touches no less than the later patches were used flexibly for a variety of purposes

and variously for different subjects—indeed, they were needed neither in the still lifes nor in the portraits—and what they have in common is the sense they give us of revealing a rich and attentive perception of the objects they help portray.

The patches were the invention of a man of about 55 who was yet to paint his greatest work. It is one of the unanalyzable mysteries of the course of life that some artists—Titian and Cézanne among painters, and Verdi and Janáček among composers—should find not only a new style but a new inventiveness and productivity at a time when their physical energies might be thought to diminish. One can think of no common thread binding these artists, save for the obvious emancipation from their former work and willingness to search for new forms.

Cézanne's Achievements

Cézanne's turn from imagination to perception was a precondition of his best work, not the achievement itself. Seen externally, his work encouraged young painters who followed—in 1907, within a year of his death—to create their own systems of parallel touches and patches to analyze the surfaces of objects and recombine them in new ways to produce new objects.

From this way of seeing Cézanne's work, Cubism, the first revolutionary movement in painting of the 20th century, was born. If the Cubists misinterpreted Cézanne—by forgetting the function of color in creating form, for example—they nevertheless produced extraordinary achievements of their own. Seen internally, and apart from their effect on later painting, his achievements may be illustrated, though hardly encompassed, by looking again at [Figures 2 and 3](#). *L'Église de Montigny-sur-Loing* was painted in 1904–1905, about two years before his death, and shows a perfectly satisfying view of a northern French town's Romanesque church. Yet how much grander the painting is, even in its unfinished state, than the photograph. Cézanne has both accepted the view as he saw it and transformed it nearly imperceptibly: he has noted all the hard, flat surfaces—in relation to each other—and given us an indication of their local color, but he has also brought the receding diagonals—the edges of the various roofs—close to the horizontal.

This has the effect of making the scene appear as just flatter enough than it is to keep it close to the physical plane of the canvas, thereby reminding us that the painting is as much a physical object as it is a representation, and ultimately making the church and buildings appear more stable, even monumental.

Parenthetically, the patches he used here are not the ones previously described; here they are mere notations, strung out horizontally, and serve as a kind of shorthand to indicate what might later be elaborated more formally. But the unfinished state of the painting is neither unusual nor troubling. As with other unfinished canvases, because Cézanne has firmly placed the objects in relation to each other, and given us at least a hint of their color harmony, he has said in some ways all that needs saying: the painting has its full structure already, and if we should wish to fill in the blanks, we could, but there seems no need to. While such comparisons may help us see his achievements, they are not necessary. Fry's sense of

“revelation of the highest importance” in Cézanne’s paintings, although not put as felicitously by others, is widely shared. We may see it in a sense of the “rightness” and permanence of the objects he portrayed, and in the richness, tension, and ultimate resolution of his way of seeing them. His compositions are complex, but they are also richly resonant internally, their parts calling attention to each other, their oppositions resolved, and their details placed into a more encompassing order. In them one sees both the interconnections between things and, in Cézanne’s phrase (quoted by Gowing), the “logic of organized sensations” by which the painting process is governed.

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Chaos Theory and Creativity

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Glossary

Attractor A region in the space describing the behaviors of a system toward which the system will tend to go and where it will tend to stay. *Strange attractors* characterize chaotic behavior and consist of confined trajectories that describe a system that is never in the same state and moving in the same direction twice.

Bifurcation A system's transformation from one type of system into another, for example, from a system with periodic motion to one in chaos. *Catastrophe* is a similar term, which generally refers to a seemingly discontinuous change in one system.

Chaos A class of dynamic behavior of deterministic systems characterized by sensitive dependence on initial conditions, diverging but constrained trajectories that imply unpredictability, and complex organization or structure.

Complexity is sometimes used as a synonym for chaos.

Dissipative systems Systems, such as living systems, that are using up energy.

Fractal A pattern characterized by similar structure at different magnifications, more roughly described as self-similarity at different scales; strange and other complex attractors generally have fractal structures.

Nonlinearity A term describing a relationship between two variables or a causal relationship between components of a system that is *not* strictly proportional and thus cannot be represented as a straight-line graph on ordinary graph paper.

State space A space containing representations of the possible conditions or locations of a system.

'Phase space' is sometimes used as a synonym for state space, but a location in phase space describes not only the current state of the system but also where it is moving next.

Systems theory Theory describing the behavior of composite entities composed of changing, interacting, and connected parts whose functioning emerges from the mutual influences of the parts.

Introduction

Chaos theory, more technically nonlinear dynamical systems (NLDS) theory, is an exciting, rapidly developing area of mathematics with increasing application in the physical, biological, and social sciences. Along with great metaphorical appeal, nonlinear dynamical systems can also add rigor and realism to human sciences; this article describes how they may help illuminate creativity, an elusive, sometimes near magical phenomenon that has defied simple explanations. Chaotic or near-chaotic systems can demonstrate surprising flexibility and adaptability. Despite connotations of 'chaos,' they also demonstrate order, complexity, and self organization. Some relatively simple, mechanistic, completely deterministic systems are capable of surprising, discontinuous, and seemingly unpredictable change. While this article is somewhat speculative, the connections it describes can hopefully be made more rigorous and tied to data about creative processes and products.

Potential Contributions of Chaos Theory to the Study of Creativity

Nonlinear dynamical systems theory is finding specific application to various human processes, including cognition, perception, motor movement, affect, learning, development, attitude formation, social behavior, self-evaluation, personality, and psychopathology. The field is changing rapidly as new

phenomena are explored with dynamic models and new data analytic techniques; these approaches are useful at both low-level (e.g., neuronal) and higher (e.g., societal) conceptual levels. Applications of dynamical systems ideas to psychology are still piecemeal, without systematic meta-understanding of how new models connect to more familiar theories, notations, and constructs. This article describes and suggests connections with well-known problems in creativity theory and research.

Definition of Nonlinear Dynamical Systems

NLDS theory describes the behavior of systems that, first of all, change with time; this is the meaning of 'dynamic,' referring to actions of forces producing motion. In addition, the theory describes systems where at least some of the relationships among components are nonlinear. In contrast much work in mathematics and the sciences historically focuses on linear systems, where change in one part results in proportional change in another and where the relationship between the magnitude of variable A and its effect on variable B can be represented graphically by a straight line. Linear systems have many desirable properties, including that effects can be computed as weighted sums of parts; they are often amenable to mathematical solutions that describe or predict their behavior over time. Research in psychology has emphasized such models, and, despite the importance of longitudinal work, cross-sectional or short-term relationships among variables, downplaying the passage of time. The correlation coefficient

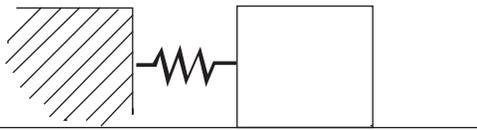


Figure 1 A simple linear dynamical system.

tests fit to a straight-line relationship between variables, often measured at a single time.

Figure 1 depicts a simple linear dynamical system considered as containing only one functional linear relationship. It is composed of a block resting on a frictionless surface, attached to a solid wall by a 'linear' spring whose restoring force is proportional to how far it is pulled or pushed. If the block is pulled and released, it oscillates back and forth in a smooth, identically repeating pattern, easily modeled and predictable as a simple function of time. In contrast, NLDS theory studies situations where the relationship between variable A and its influence on variable B is represented by some curve other than a straight line. Such relationships are surely the rule in nature, with linearity a useful simplification or special case. For example, discontinuous or all or none responses, such as reaching the threshold for a neuron's firing, are nonlinear ones.

Systems can be discussed in terms of mechanisms, processes, and paths. The previous paragraph and **Figure 1** describe the construction of a simple mechanism. Once a system is set in motion, we can describe the processes of its movement as well as the paths or trajectories its behavior follows. For systems that contain nonlinearities, behavior over time is often complex and fascinating; it can become more and more difficult to predict over time, even in the absence of technically defined chaos. Nonlinear systems are difficult to solve mathematically; this lack of 'analytic' solutions is one reason they have been avoided in many areas of science. However, this behavioral complexity lends them much current appeal; they promise ecologically valid explanations of real-world processes and appear particularly relevant to historically elusive abstract and practical problems. One reason for the onrush of interest in these systems is that computer technology has made possible iterative modeling and visualization of systems' behavior without solving them. Indeed, algorithmic, heuristic solutions to intractable problems, perhaps including 'being creative,' may make them more tractable.

Characteristics of Nonlinear Dynamical Systems' Mechanisms and Behavior

NLDS models are applicable to psychological phenomena for several reasons. They provide not-very-complicated and deterministic causal models compatible with observations of complex, patterned, often unpredictable behavior. Discontinuous, suddenly changing, or startling deterministic systems can seem disorderly, noisy, and random. Yet, despite resisting prediction, they also have surprising order and organization. The seemingly random development of snowflakes follows very strict symmetry and results in uniquely beautiful objects that, while nonidentical, have similar properties. Some features described here, such as the absence of analytic mathematical solutions, are associated with nonlinear but not necessarily chaotic systems; others, such as strange attractors, specifically apply to chaos.

Change with time

By definition, dynamical systems involve temporal processes. All human activity, of course, changes with time, and psychological and social systems exist in this context; important physical and cultural passages mark flux over the life cycle. Yet, most psychological research relies on short-term observations of these inherently long-term phenomena.

Closed and open systems

Systems are units composed of multiple linked parts; interconnection can be defined by rules and regulative processes. Cybernetic models of communication, control, and automation of the 1940s and 1950s contain many of the features of more recent theory. However, they tended to emphasize linear effects, limit themselves to simple causal loops (unidirectional not reciprocal), suppose that systems distribute accurate information throughout, and focus on stability, regulation, and homeostasis, rather than apparently less orderly behavior. Opponent-process (such as excitation and inhibition of neural circuits) and dialectical models (describing the synthesis of conflicting ideas) have been popular in psychology and biology. They are amenable to explanation via multiple interacting, possibly hierarchical processes and enriched by the complexifying consequences of nonlinear coupling.

Many current models assume closed systems, considered self-contained and isolated from other systems and the environment. In contrast, open systems are embedded and exchange inputs and outputs with the surroundings. Bodies transfer energy and information to the physical and social environment; they are also dissipative systems, constantly using energy. This has important implications for the complexity of human function.

Simplicity in structure with complexity in behavior

Relatively simple biological and psychosocial mechanisms, if including nonlinear causal relationships, are capable of complex and chaotic dynamics. The unpredictability, mysteriousness, sudden change, and robust adaptiveness of psychological processes can become comprehensible, rational, and potentially amenable to deterministic modeling.

Importantly, this nonlinearity does not generally refer to relationships between inputs and outputs of whole systems, or to discontinuities in outputs, but rather more narrowly to nonlinear linkages among internal components. Systems that include time delay are more complicated than ones with immediate response. As mentioned, nonlinearities are widely observed in the social sciences (e.g., the Yerkes–Dodson curve), but also commonly ignored.

The Behavior of Nonlinear Dynamical Systems

NLDS are capable of many different sorts of behavior, regular as well as chaotic. Some of the following characteristics apply specifically to chaos and complexity.

Unpredictability and sensitive dependence on initial conditions

Some systems are easily predicted, for example, the behavior of the linear device shown in **Figure 1**. However, others exhibit behavior where simple mathematical solutions are difficult.

There are two issues here. One concerns problems reducing motion of a system to a simple predictive equation, solving it analytically. This is true for many nonlinear systems, chaotic or not. The second is that at times nonlinear systems enter regimes of complexity or chaos. A defining characteristic of chaotic systems is sensitive dependence on initial conditions, where small differences in starting state result in large differences later. This is also true for small outside perturbations. Visualizing a system as following a trajectory over time, this means that paths through points that are very close together diverge radically later on, something with major implications for notions of cause and effect. Small influences can have drastic consequences, the usual meaning of the celebrated 'Butterfly effect.'

This reduces ability to predict the future. Unless the position and motion of such a system are observed exactly, one cannot know accurately where it will be later. Less-than-perfect observation of a chaotic system results in increasingly inaccurate prediction. While this unpredictability is superficially similar to the uncertainty principle, the Heisenberg principal operates only at extremely small subatomic scales. Uncertainty about future states of a macroscopic chaotic system does not come from minute quantum effects. Rather, this unpredictability is fully compatible with completely Newtonian physics, a consequence of the difficulty, given observational error and imprecision, of saying exactly where a system is and is going at a particular moment. If we knew these facts exactly, we could predict even chaotic systems. This distinguishes deterministic chaos from quantum uncertainty and from true randomness of stochastic, nondeterministic processes. What we call 'random' may be completely determined, yet still unpredictable. Galton's famous peg-board generates an approximate normal curve from marbles falling through pegs. For all intents and purposes their paths are governed entirely by the completely mechanistic and deterministic causal laws of Newtonian physics as they spin and bounce off pegs and wobble through air currents. Yet, the trajectory of a given ball is difficult to predict, sensitive to initial conditions and uncontrolled influences.

Social scientists generally employ deterministic models and remain puzzled by their failures at prediction and control for individual behavior, social policy, and intervention. Contemplating their own lives, many believe in free will, and also that they defy prediction by others, act spontaneously, and sometimes elude even *self* control (e.g., trying to change habits). NLDS models, while deterministic, also encompass unpredictability. This helps solve some methodological and philosophical problems; difficulties in prediction and control are just properties of real life. Yet, cross-sectional and locally linear psychological models are partially correct and still useful; overemphasizing linear relationships is a flaw easily corrected in principle. Many small and simple systems are probably involved in interesting psychological phenomena, and these subprocesses are coupled in under-studied and probably nonlinear ways.

Intractability

Much ongoing human behavior is intractable, not just in the sense of stubbornly eluding self-control and defying intervention. Certain classes of problems are notoriously difficult, apparently insoluble. Accounting for creativity is one. Dynamical systems may well help tackling these theoretical and

practical problems. It is even useful to seek out where older methods have failed, noting dynamics researcher and cardiologist Ary Goldberger's reference to problems "whose only apparent unifying theme was their 'resistance' to traditional models."

Catastrophic change and bifurcation

Another characteristic of dynamical systems is the possibility of sudden qualitative changes. These radical shifts are called catastrophes, and now popularly 'tipping points.' Seemingly discontinuous psychological changes include an alcoholic's 'falling off the wagon,' inspiration and brief encounters with the Muse, insight, and psychotherapeutic 'aha' experiences. Such processes are modeled by catastrophe theory, which has substantial overlap with NLDS theory. In addition to catastrophic state changes a system can also transform into a qualitatively different one, termed bifurcation; a system may shift from periodic to chaotic as values of its parameters are changed. This appearance of new systems is called 'emergence.'

Apparent regularity without identical repetition

Periodic regularity, repetition, and contained cycles characterize the stable oscillations or dynamic equilibria of classical dynamics, much beloved by physiologists and psychologists. Irregularity in oscillating systems has been attributed to random noise, measurement error, and extraneous variables. These are important concepts, but it is worthwhile asking when fluctuation represents data rather than noise, indicating a process is a candidate for nonlinear dynamic explanation. NLDS extend interest to bounded but irregular changes and unstable equilibria. Much human activity appears oscillating and generally bounded, yet only approximately regular, as well as capable of surprising. New research on normal and disordered biological rhythms suggests that both overregulation and underregulation can be maladaptive. And, the relatively bounded behavior of well-functioning organisms is sometimes adaptively chaotic, allowing reorganization, resistance to environmental influence or internal perturbation, and development.

Chaotic behavior and complexity

Not all NLDS are in chaos, but the possibility of chaos is one interesting feature. Because chaotic systems are ever-changing, never going through the same state with the same velocity (speed and direction) precisely twice, they can produce originality and constant innovation. They are characterized by the delightfully named strange attractors, regions containing bounded but always different (never-crossing) trajectories in phase space. (Phase refers both to the location of a system's elements at a given time and where it is heading next.)

Types of attractors

An attractor defines a region in phase space where a system tends to go and to stay. A fixed-point attractor represents a unique place that a system will approach. If friction is added to the system in [Figure 1](#), the block will eventually stop moving, a situation represented by a single position and no movement. One example of a periodic or limit cycle attractor is the motion of a clock pendulum. As long as the mechanism is wound, even if bumped the pendulum returns to the same regular swing. Such attractors characterize much of classical dynamics.

In contrast, chaotic systems have strange attractors. While a system orbiting a strange attractor may be in the same location at different times, it never does so with the same velocity; its trajectories in phase space do not cross. This describes the unpredictability of chaos, as very close but not identical paths diverge with vastly different outcomes later. Strange attractors, bounded but never repeating, include elements of both order and disorder, divergence and convergence. Antithetical to both stasis and repetition, behavior around a strange attractor is constantly new.

Dissipative systems and the edge of chaos

The edge of chaos refers to systems not yet settled around a strange attractor or the order characteristic of chaos. This represents the edge of order, like the point between freezing and melting prior to the formation of a snowflake. A related concept involves 'dissipative' systems that use up energy, also termed far-from-equilibrium systems. A dissipative system is illustrated by someone falling and running forward, constantly off-balance. Walking is similar to this; stopping suddenly demonstrates that halting really is catching a fall and does not result in stillness. Even standing in one place contains novel possibilities.

Scaling, symmetry, and self-similarity: fractal phenomena

Strange attractors also demonstrate interesting structures, including fractal patterns with properties of self-similarity across different scales. Similar behavioral patterning over different instances, temporal scales, and locations in space is related to Wittgenstein's 'family resemblance concepts' and to the notion of artistic 'style' across different works and over a career. Observations of similarity across scale are common in clinical psychology in miniature occurrences in the therapy hour and recapitulations of old interpersonal patterns, forms of personal self-similarity. Some theories describe art as 'working through' a psychological or technical problem. Freud noted that this mastery-oriented 'working through' and self-defeating 'repetition' are similar – healthy versus unhealthy – cycles; they may represent periodic versus strange attractors.

Self-similarity but not self-identicalness also provides an account of consistency in personality. Individuality may represent personal complexity, detail visible when one is known deeply and across longitudinal ebbs and flows. Consistency exists in the face of the stark self-contradiction important in the human soul and the material of much literature; it occurs at different scales and does not mean people always do the same thing, even in similar situations. Viewing personality styles as strange attractors with fractal structure reconciles personal identity with cross-situational and within-subject fluctuation and originality.

Fractal patterns also occur in temporal phenomena like a faucet dripping. They suggest leaving a purely unidirectional view of time for a combination of linear and cyclic pictures,

encouraging diversity in the Kantian basics of time and space. From this perspective, regular and seemingly periodic eras are regions around attractors that we enter, orbit, and leave. While cycling, life appears repetitive, with nearly symmetrical beginnings and endings and narrative-like episodes of rising and falling action. Then the story changes or reverses, and our lives depart for new regions.

Self-organization

Some, notably Stuart Kauffman, have emphasized chaotic systems' self-organization, including properties of symmetry and self-similarity. They argue for a special sort of systemic order, 'order for free,' occurring even as systems dissipate energy. These visions of order and organization indicate how 'progress' may be reclaimed in the face of entropy.

Nonlinearity Can Make Even Simple Systems Complex

Figure 2 illustrates a small nonlinear mechanism – what I call a Somewhat Complicated System (SCS) – composed of two simple systems from Figure 1 coupled by a nonlinear 'hard' spring in the middle, whose restoring force is represented by a function of the form $F = k_1x + k_2x^3$. With certain parameters this system exhibits chaotic behavior; it serves as an analogue of two, nonlinearly coupled self-regulating systems, a dual homeostat with possibly unpredictable behavior.

Applications of Nonlinear Dynamical Systems Theory to Creative Process and Product

The remainder of this article explores how concepts from NLDS are applicable to core problems in creativity theory and research.

Nonlinear Dynamical Systems in Creativity and the Arts

Temporal changes

Creative products, however spontaneous, necessarily emerge in dynamic process. While a flash of insight seems instantaneous, inventing unfolds over time. Creative activities have been described as comprising stages of generativity and consolidation, incubation, and elaboration. Psychological 'regression' and the association of ideas also unfold temporally. Creative productivity develops over a life span as work's meaning and realization are modified with cultural and historical context, the creator's experience and life stage, and shifts in approach and technique. Genres and movements emerge historically and are pushed along by generations of participants. Researchers including Colin Martindale, Dean Keith Simonton, and Sidney and Ethel Blatt have studied changes over historical time periods. Yet, while speaking of the process of creating, hence

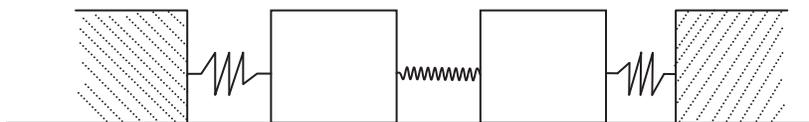


Figure 2 A nonlinear dynamical system consisting of two systems from Figure 1 coupled in the middle with a nonlinear spring.

invoking time, empirical creativity researchers often take static trait (not transactional) approaches, treating divergent thinking as an individual difference instead of a process of divergently solving problems. While speaking of the path of a career, we may still focus on 'completed' works that – once produced and 'tweaked' – change relatively little, although their influence on audience and culture resonates.

Systems and open systems in creativity

The creative process

Even working in isolation the creative individual, not completely self-contained, is embedded in a social milieu and responds to wider cultural problems. This defines an open systems phenomenon. The creator, the artistic medium, and the problem to be found or labored on; economic factors, society, technology; other people, including caretakers, critics, competitors, cronies, colleagues, grant managers, groupies, muses, patrons, and roadies: all have roles. Creative endeavors involve context-sensitive adaptation to fluctuating environments. This denotes reciprocal feedback loops connecting creator and public, product and audience response. Dialogue is a feature of successful work, where a piece of art 'speaks' to the audience; the viewer or listener is taken by the hand and led to see, understand, and even change. Communicability may distinguish 'true art' from 'psychotic art,' related to Frank Barron's 'Ego strength,' which may differentiate creativity from psychopathology.

There is also interchange between perceiver and perceived; the creative individual is modified while attempting to use the social or natural world as theme, inspiration, or medium – accommodating as well as assimilating. Several definitions of creative activity include the term 'adaptive,' including Guilford's 'adaptive flexibility' factor and adaptive regression in the service of the ego. 'Adaptive' can mean 'useful' but also implies that creative activity is connected to reality and responsive. It also includes self-stimulation and internal feedback; Tobi Zausner notes 'autocatalysis' as the artist responds to the work itself as well as environmental feedback. This is related to Maturana, Varela, and others' 'autopoiesis,' the self-creation of living systems.

Systems properties of creative products

New productions emerge from multiple interacting processes directed at interlocking problems. Two or more factors influencing one activity, such as competing expressive modes or coupled strategies, produce entanglement in a system. Given nonlinear linkages, a combination of simple processes – a Somewhat Complicated System – can show complex behavior, deep and textured forms of life. 'Intelligent' behavior results in new approaches to robot navigation employing simple rules or heuristics, not complete internal maps of the robot's world. This is a shift from intensive computation and complicated mental representation to simpler perception-action schemes – from 'top-down' executive function to 'bottom-up,' distributed and partially autonomous coupled processes. A robot that 'avoids obstacles,' 'follows walls,' and 'finds doors' can navigate without internal maps. This is similar to the Santa Fe Institute 'Swarm' project's modeling of collective behavior.

Similarly, a creative product can emerge from small and unrelated problems or performances, not necessarily a grand totalizing design imposed from the top. Evolutionary biologist

W. D. Hamilton suggested that modular systems with different agendas can evolve separately, accounting for organisms' robust but sometimes contradictory strategies and goals, and for the existential foundations of human life. Frederick Abraham cites Howard Gardner's creativity model with three coupled processes involving individual, discipline, and the judgmental society. Coupled push-pull creativity models are rich places for researchers to consider NLDS approaches, and loose versus tight coupling among subsystems represents a crucial parameter. Nonlinearity has a place in input-outcome relationships, starting with "more of a good thing is not always better." Art, science, and philosophy must sometimes resolve opposition and contradiction; this can be understood with competing and coupled subsystems with nonlinear 'dose-response' functions.

Simplicity and complexity in art and its making

The creative product itself displays simple origins and complex realization. A poem's simplicity manifests on the surface of the page, yet its depth can make both inner life and external 'fate' intelligible. The creative act may arise from simple actions that, put in motion, crystallize an artistic product.

Characteristics of the Creative Process and Product in Relation to the Behavior of NLDS

Unpredictability and sensitivity to initial conditions

The unpredictability of creative work means its trajectories cannot reduce to simple equations; insight emerges from heuristics rather than algorithms guaranteeing solution. (Heuristics represent inexact procedures without guaranteed results that can be highly efficient and useful.) We can provide guidelines and procedures to assist creative brainstorming but not write a book for cooking up the ideas themselves. Indeed, if we found this cookbook we might not call the results creative. This is not to say that creativity resists modeling or implementation with deterministic processes; however, techniques are iterative, their results generally not predictable in advance. Behavior can come from mechanistic processes and still be surprising as even nearby states diverge radically.

The creativity question as intractable

This article has discussed two forms of intractability, both relevant. First, facilitating creativity is difficult; it may even be paradoxical to push for a creative solution, not allowing it to appear. Second, the study of creativity tantalizes theorists and researchers. One hint that its puzzles might be amenable to NLDS comes from this very difficulty of its description and essence.

Catastrophic change, bifurcating systems, and emergence

Creative phenomena exhibit both near-regularity and wild fluctuations. Near-periodic creativity occurs in innovation during periods of normal science. In contrast are qualitative leaps in ideas and artefacts during insight and illumination, when genres break, and in scientific revolutions. This is also true of inventive and apparently self-initiated action. Psychologist Phyllis Perna speaks of cycles of disorganization and reorganization.

Bifurcation refers to the transformation of one type of system into another, for example, from periodic to chaotic; Zausner writes of creativity comprising subsystems bifurcating

into a new order. The transition zone at the edge of chaos near a new chaotic system may be especially important. Chaotic systems can also settle back into stable attractor regions. Transitions from inspiration through consolidation and then to implementing a creative program may represent bifurcations.

Repetition and near-periodicity in creativity

Repeated jousts at the same problem may be necessary. Psychoanalytic ego psychologists described play as repetition aimed at mastery and working through, and many, including Sandra Russ, have commented on the inventiveness of children's play and the play-like, restitutive aspects of creating for adults. Playfulness is part of the 'regressed' or developmentally prior quality of some adult creative work. Whether play or art solve particular psychological problems or represent neurotic repetition can be understood with different attractors.

Chaos, complexity, and creativity

Several characteristics of chaos are seen in creative process and product. Zausner again notes how artistic work is very sensitive to stimuli and speaks of the role of the 'inconsequential' in art, the unpredictable but not random influences. Relevant to top-down versus distributed processing, she also asks, "Doesn't the artist have a plan for the painting?" A work of art may be more emergent phenomenon than planned progress toward a prearranged point. This again speaks to heuristics and what economist Herbert Simon calls 'satisficing,' opposed to either 'optimizing' or 'maximizing,' which both may be inherently or computationally impossible. Frederick Abraham speaks of 'self-organizational bifurcations,' observing that chaos and instability can facilitate creativity. The late poet laureate Howard Nemerov spoke metaphorically of chaos as the primordial order before creation. Ben Goertzel, Ronald A. Finke, and others are describing chaotic logic and cognition. Theorist and clinician Michael Butz also refers to psychic swings not strictly speaking periodic, with structure emerging from chaotic behavior.

The creative process must avoid stasis, stagnation, and premature closure, capture by fixed-point or limit-cycle attractors, and the strictures of an imperious environment. Chaotic systems may demonstrate healthy flexibility, adaptability, readiness for change, resistance to environmental entrapment, autonomy, and openness to new information. Neurologist Walter Freeman said, "Chaos provides the system with a deterministic 'I don't know' state within which new activity patterns can be generated . . ." (Skarda and Freeman, 1987: 171).

Attractors in art

Attractors may be useful for describing creative products and styles. The vicissitudes of creative process can be viewed as trajectories in phase space – the positions and directions of multiple problem-finding, problem-solving, expressive, and generative processes. When a trajectory is near some particular attractor, work remains within a genre, style, school, theoretical orientation, paradigm, convention, or norm; style is an attractor in a region of phase space. Patterned themes and motifs within a single work can also be understood as attractors. This includes rhythm, oscillation, progression (cycles of fashion, rediscovery of old ideas, recapitulation of themes within a single work), the entrainment and synchronizing of different systems (adoption of a theory or

artistic approach, contained progress in normal science, or multiple near-simultaneous discoveries), and the emergence of new paradigms when revolution is truly in the air. Individual creative episodes may also be viewed in phase portrait terms.

Creativity and dissipative systems: the edge of chaos

Ruth Richards, Frederick Abraham, and others are exploring the importance of operating at the edge of chaos to creativity and evolutionary adaptation. Conditions that foster brainstorming may represent cognitive sets or work settings somewhere between stasis (or periodic behavior) and chaos. Csikszentmihalyi's 'flow' lies between boredom and anxiety. The edge of chaos, observed in dissipative systems, also sheds light on transitional or 'liminal' phenomena, psychological or cultural frontiers important to play, phantasy, and psychotherapeutic change. Zausner views artistic products as manifesting order, while the creative process is dissipative, with the uniqueness of a work coalescing from dissipative structures. She also comments on potential disorder, with a fine line between 'breakthrough and breakdown'; creativity and psychopathology may sometimes be very close together. Similarly, Aldous Huxley once wrote how the mescaline experience was poised between 'heaven' and 'hell' (two attractors?), and David Schuldberg speaks of both 'giddiness and horror' in the creative process.

Symmetry and fractal properties in creativity

Fractals can depict the self-similar patterning of trajectories around chaotic strange attractors. Zausner notes how a person's creative periods also appear self-similar, with successive inventiveness and reflectivity; this may account for associations between alternating mood states (including bipolar affective disorder) and creativity. In addition, works of art – as opposed to reproductions and cover versions – are unique; fruits of creative process have unpredictable but not disorderly shapes. An artist's style is self-similar. Works bear family resemblances to each other, and this kinship reflects their birth process.

Fractals also have aesthetic qualities. They are similar (although not identical) at different magnifications. To a beach connoisseur Washington beaches are recognizable (and distinguishable from Cape Cod beaches) at many scales: in aerial photographs, viewed from a headland, walking by the water, and even in tiny fringes around a tidepool. Miniatures have an important relation to creativity; a symbol, song, a statistical model, and a mathematical notation can all be miniatures. Levi-Strauss stated that "all miniatures seem to have an intrinsic aesthetic quality," precisely because they are small and complete. Similarly Ruth Richards notes how people find fractal patterns beautiful, are drawn to things, like waterfalls and beaches, that instantiate them. Mathematical analyses of Jackson Pollock's 'spatter' paintings suggest a fractal organization not found in 'pseudo-Pollocks.'

Another issue concerns ambivalence between symmetry's sometimes inherent beauty and the contrasting role of imbalance and complexity. Creative individuals may choose complicated and asymmetrical forms and tend to prefer Barron-Welsh Art scale figures that are asymmetrical and complex. Creativity involves both order and symmetry breaking; nonidentical fractal similarity helps reconcile these ideas.

The creative process as self-organization

Creativity involves self-organization, related to continually 'self-producing' and 'autopoietic' structures. Creativity may also be dissipative, leading to the self-organization of artistic products. Musical works, new theories, and novel solutions to engineering problems can be viewed as emergent structures. Emergence provides a view of how new information is produced by culture.

Nonlinearity and Creativity

Creative products, no matter how complex, can perhaps be understood as artefacts emerging from relatively simple psychological and sociological processes. This will require systems involving coupled, dialectical, or opponent processes, along with nonlinearity. In this Somewhat Complicated Systems account of creativity simple mechanisms and processes produce complex and extraordinary results. Some nonlinear psychological relationships have already been mentioned; Richards and others have also demonstrated 'inverted-U' relationships between creativity and psychopathological characteristics, and this may also hold true for positive and negative affect. More basically, adaptiveness, health, and well-being do not generally follow in simple linear fashion from positive behaviors or virtues; a medium is not always happy. Thresholds, floor and ceiling effects, responses that level off or drop, time delay, double-edged personality characteristics, and interactions between two or more causal variables all introduce nonlinearity.

Simonton, David Harrington, and others have commented on nonlinear relationships within creativity. The nonlinear model in [Figure 2](#) provides an example if we define its horizontal axis as ranging from 'intrapsychic-focus' on the left to 'environmental focus' toward the right. The blocks then trace oscillating paths of incubation, 'woodshedding,' and potential access to 'primary process' at the left, with dissemination, performance, and getting (perhaps suffering) critical feedback to the right. Strange attractors in phase portraits of the blocks' motion would indicate constrained novelty; the system can also settle into stable, repetitive, less creative states.

Specific Phenomena in the Creative Process

Intuition

In *Being There* neuroscientist Andy Clark touts environmentally engaged cognitive heuristics (discussed above) and modular low-level problem solving over top-down, executive-dominated thought. Induction and insight may be similar. Mandell and Salk describe how "structure arises autonomously from the superficially random motions of complex cooperative systems [which] suggests that 'intuitive' ... properties may be the source of more linear 'reason.'" Our apparent rationality may arise from intuition, not vice versa.

Brainstorming, Improvisation, and Juxtaposition

Recombination and going beyond information given are used in brainstorming techniques and facilitating induction. Similarly, improvisation refers both to inventiveness and to a type of performance. How does it occur? Juxtaposition,

superimposition, accretion, and Albert Rothenberg's 'home-spatial' thinking all provide routes to new ideas. These represent different combinatory forms and the 'blind variation' of D. T. Campbell's account of creative cognition. Juxtaposing and combining distinct or diverse elements, sliding unrelated concepts past each other, examining match, mismatch, and interesting features, noting when contrasts create conceptual connections, and discarding unproductive or unpleasing correspondences (part of Campbell's 'selective retention'), all produce new wine in old skins. Richards discusses the importance of experiencing and reconciling contradictory moods. Superimpositions are temporary and casual; they may initially display playful, even hostile and destructive attitudes toward more 'sensible' or accepted combinations. 'Contamination' of concepts on the Rorschach inkblot procedure is similar; noun-noun combinations are important in the speech of young children. Juxtaposition occurs in nonhierarchical combinations in techniques of collage and assemblage; these do not strive for superordinate categories or top-down hierarchy, and combinations can initially be force-fit.

Bricollage, a handyman's improvisational problem-solving usually directed at a repair, is both top-down and bottom-up. There is an end in mind – to repair a broken object or solve a problem; it utilizes planning but relies on heuristics and not the textbook solutions of service manuals, which require factory-compatible parts. Materials and tools may be used in ways not originally intended. Bricollage is also related to nonnarrative expositional forms, where elements and moods are laid on each other in sequences or admixtures, where story does not follow standard progressive forms.

Temporal Change in Cultural Milieu

Cultural diffusion, spreading innovation, individual acquisition of expert performance all unfold in time. So does grasping a new idea or paradigm, trying it, and making it one's own. These processes include dialectical acceptance and rejection, accommodation and assimilation; we can view creativity as resulting from struggle between adaptive and conservative processes. Martindale and Simonton discuss how new ideas, tastes, aesthetic values, and movements change over time. Martindale noted how fashion tends to make incremental changes; when a style has gone (what later observers declare) 'too far,' a trend reverses. Men's ties become wider, then progressively narrower, and again. Such oscillation can be modeled with both classical and nonlinear dynamics. But, fashion may involve chaotic rather than strictly periodic attractors just because history does not precisely repeat. Styles never return exactly, even in nostalgia; irony and distance, sentimentality and reclamation of youth, are all wrapped up in 'retro' fashion. The leg warmers of 2009 were not quite the same as the leg warmers of 1989; if a 'revival' is a strange attractor, 'old school' is also recognizably not quite the past.

Evolutionary Epistemology and Emergent Order: Creative Cognition

Evolutionary epistemology studies how new knowledge emerges analogously to the evolution of biological structures

through Darwinian natural selection. Chaos theory has found applications in evolutionary theory, and it is fruitful to pursue how mutation, selection, and adaptation can be applied to – using Dawkins' term – 'memes' of creativity. As creative cognition 'channelizes' (in evolutionary biologist C. H. Waddington's image) in particular paths, this implies emergent order. These paths can be viewed as basins of attraction in 'fitness landscapes' of ideas. Models of these processes have been constructed with neural networks and other techniques, for example, simulating schizophrenic thought. Particularly relevant is the experimental work of social psychologist Robin Vallacher on the temporal formation of attitudes as attractors, also applicable to problems in insight.

Conclusion

Further Steps in a Dynamical Systems Program for Creativity

Creativity theorists will do well to consider how dynamical models illuminate originality. Psychological systems containing a term for time, that include internal nonlinearity or use dialectical processes are all places where new theories and techniques can be applied. Systems whose behavior shows bounded but imperfect repetition, temporal development, or qualitative jumps all deserve further study. The referents of many psychosocial terms relevant to creativity are dynamic ones. How does regression in the service of the ego unfold over time? How does a 'remote associate' on Mednick's test emerge? What is the trajectory of a career in creativity or leadership? What is the phenomenology of transitions from incubating to elaborating, from boredom or anxiety to 'Flow'? How is a 'creative crisis' resolved? Descriptive qualitative dynamics will point to new and testable models.

A Preoperational View of the Dynamics of Improvisation

This article concludes by arguing for a relationship between creativity and relatively simpler forms of thinking, akin to Piaget's preoperational thought. The juxtapositions and recombinations mentioned above are similar to classification strategies used by preoperational children, who use one dimension at a time to sort objects that can only be compared exhaustively with more complicated schemes. The child cannot hold distinct classificatory dimensions simultaneously; schemes fluctuate and compete. A creative adult's incomplete approaches are also heuristic strategies, practical wisdom but not theory. Real objects do vary on too many dimensions for complete categorization, even by competent adults; we may need to construct more manageable, less exhaustive accounts of our experience. We may look down on the child's dimension-reducing, but when we make sense of our own lives, planning, steering, and rational control are constrained, with significant blind spots. These are limits to how useful abstractions can be.

Living as we do through everyday language, we use incomplete but handy views of the world. We are successful because we deploy many of these simple, humble heuristics in parallel, and we use them all the time. Our tools for knowing are not limited, in the sense that their limitations could be avoided or they could be substantially improved upon. Inexact everyday cognition is limited only in not living up to grand phantasies

of comprehension, prediction, and control. Real life requires bottom-up improvisation in real time, filled with what Richards calls Everyday Creativity. Because we use multiple heuristics with nonlinear effects, our attainments are not easily decomposable into components, nor reversible like the schemas of Piaget's formal operations. Tobi Zausner speaks of the irreversibility of painting, situating it outside formal operations and within the realm of dissipative systems.

When chaos is involved, even simple systems can make complex products. This is connected to Wittgenstein's accounts of the limits of language. In everyday use language does not have much trouble living with big ideas, as long as we refrain from philosophizing or psychologizing. We *inhabit* big ideas and grapple with existential concerns; life's practical techniques do not guarantee solution, putting limits on social science and denying a truly encompassing, exhaustive view of the good life. Yet, this does not limit what is *possible* in everyday life and in creativity. The everyday is determined yet unpredictable, complex but also organized, self-similar day to day, sometimes very beautiful. Without a guaranteed solution we extemporise, lacking the unattainably huge computing power for a stable big picture or for navigating a steady course toward a comprehensive goal. Using benchmarks and approximations, our apparent mental steadfastness is really a falling forward, far-from-equilibrium, dissipative, always unstable. We *must* improvise.

Creativity across fields is related to the aesthetic qualities of everyday life. Although not reducible to fool-proof procedures, everyday life has striking beauty and some order, all amidst constant flux. Everyday living requires backing away from enlightenment ideas of progress and perfection to embrace – and create – the rough-cut beauty of our real worlds.

See also: Cognitive Style and Creativity; Divergent Thinking; Emotion/Affect; Everyday Creativity; Heuristics: Strategies in Creative Problem Solving; Improvisation; Intuition; Janusian, Homospatial and Sepconic Articulation Processes; Mad Genius Controversy; Mental Health: Affective Disorders; Play.

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- <http://www.santafe.edu/> – Santa Fe Institute.
- <http://www.societyforchaostheory.org/> – Society for Chaos Theory in Psychology and the Life Sciences.

Charlie Chaplin 1889–1977

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Chaplin's Life and Work

Charlie Chaplin was born Charles Spencer Chaplin on 16 April 1889, in London, England. His parents were both entertainers in the music-hall tradition: his mother was Hannah Chaplin, a singer and actress. His father was Charles Spencer Chaplin Sr., a vocalist and actor. As a small child Chaplin lived with his mother (his parents separated when he was still very young) and his half-brother Sydney, in Lambeth, London. Chaplin's father was an alcoholic, and died of alcohol related causes when Charlie was 12. Charlie and his father had little contact except for a few brief meetings and a short period during one of his mother's illnesses when the brothers lived with their father and his mistress. Although Charlie hardly knew his father, he made a big impression on the boy, as did his mother, whom he adored.

The Chaplin family's fortunes waxed and waned during Chaplin's childhood, and he spent much of his childhood in abject poverty, starving, and even living on the streets for a brief period. His mother was mentally fragile, as was his grandmother who also suffered mental illness. Chaplin's mother was admitted several times to asylums during Chaplin's boyhood leaving Charlie and his brother in workhouses at Lambeth, in South London and The Central London District School for paupers in Hanwell. The young Chaplin brothers had a close relationship and gravitated to the music-hall while still very young, in order to survive. They learned to be both entrepreneurial and opportunistic in the tough and cruel circumstances of their upbringing. Chaplin's early years of poverty, homelessness and hunger were a great influence on his later characters, films, and political beliefs.

Chaplin demonstrated stage presence, a natural aptitude for impersonation, and dancing prowess when he was a young child. He joined the Fred Karno troupe in 1910, and when the troupe toured America in late 1913 Chaplin's act was seen by Mack Sennett who hired him for his studio, the Keystone Film Company. Sennett mentored the young Chaplin and Chaplin sought out role models, mentors, and people he could learn from throughout his life. Chaplin's pictures were popular successes, and he was one of Keystone's biggest stars. Keystone was Chaplin's creative 'infancy.' Chaplin learned about film making and developed his tramp character while he worked at a phenomenal rate completing 34 short films in one year. Chaplin's 'tramp' gained enormous popularity among cinema audiences all over the world. He was known as Charlot in French speaking countries, Italy, Spain, Andorra, Portugal, Greece, Romania and Turkey, Carlitos in Brazil and Argentina, and Vagabond in Germany.

While at Keystone Chaplin was entrusted with directing and editing his own films. Chaplin's brother Sydney joined him in 1915 and helped Charlie sign a more favorable contract with Essanay Studios. Chaplin's time at Essanay was his 'adolescent' creative period; he further developed his cinematic skills, and

added new levels of depth and pathos to Keystone-style slapstick. His films became much more ambitious, being twice as long as a typical Keystone picture. Many of the films he made with Essanay are classics including *The Tramp*. They show Chaplin's nascent talent and many of the ideas that were to come to fruition in his later mature period of film making.

Chaplin sought complete artistic control over his products from very early in his career. At Essanay he became a full-blown celebrity, as he was very popular and he made himself and those around him wealthy. Chaplin developed a loyal stock company, including ingénue Edna Purviance and comic villains Leo White and Bud Jamison.

The silent tramp pantomime character Chaplin invented was central to his success. During Chaplin's period immigrant groups arrived in America in waves, from diverse countries and creeds. Silent movies were able to cross all the barriers of language, and so Chaplin had unprecedented popularity. Everyone could understand and relate to him. Chaplin's Tramp enacted the difficulties and humiliations of the immigrant underdog, the constant struggle at the bottom of the American heap. The Tramp would triumph over adversity in his films, but his life remained essentially the same so he stayed in touch with his audience and retained their sympathy. In addition Chaplin himself personified the rags to riches story of the American mythology of opportunism and success.

From Essanay Chaplin moved to the Mutual Film Corporation in 1916. Mutual paid Chaplin \$670,000 to produce a dozen two-reel comedies. He was given near complete artistic control, and produced twelve films over an 18-month period that rank among the most influential comedy films in cinema. Practically every Mutual comedy is a classic: *Easy Street*, *A Dog's Life*, *The Paunshop*, and *The Adventurer* are perhaps the best known. This period in Chaplin's career was his happiest, although he found the stringent production schedule demanding and restrictive, especially because his method of film-making involved improvisation and repetition, which were both expensive and time-consuming.

At the conclusion of his contract with Mutual in 1917, Chaplin signed a deal with First National to produce eight two-reel films, which First National financed and distributed from 1918 to 1923. Chaplin enjoyed much more creative control over all aspects of the filming process including production and he built his own Hollywood studio. He was also able to perform at a more relaxed pace that allowed him to focus on quality. Although First National expected Chaplin to deliver short comedies, he expanded most of his personal projects into longer, feature-length films, including *Shoulder Arms* (1918), *The Pilgrim* (1923), and the feature-length classic *The Kid* (1921), which introduced a strong element of pathos and sentimentality to silent movies which was innovative at this time. In 1919, Chaplin along with other celebrities (Mary Pickford and Douglas Fairbanks Sr.) cofounded the United Artists film distribution company in order to escape

the growing power of film distributors and financiers in the fast developing Hollywood studio system. With this move to United Artists Chaplin assumed complete control of film production. His independence was crucial in allowing him to achieve artistic maturity.

Chaplin made his mature masterpieces at United Artists. They were all of feature film length, beginning with an atypical drama in which Chaplin had only a brief cameo role, *A Woman of Paris* (1923). This was followed by the classic comedy *The Gold Rush* (1925). In an iconic scene that tells a great deal about Chaplin's techniques, he turns starvation into a joke, by eating his shoe: he picks at the nails of his boot as though they are 'the bones of a delicious capon' and eats the laces as though they were spaghetti. His companion imagines he is a chicken and chases him around the room, wishing to eat him. This idea, Chaplin said, came from stories he heard about American pioneers starving and dying of hunger and cold, and resorting to cannibalism, and roasting their moccasins to relieve their hunger. Chaplin claimed that comedy was paradoxical because it arose from tragedy, which stimulates ridicule. Laughter through ridicule was defiance against the unassailable forces of nature which might otherwise make people go insane.

After the arrival of sound films, and while still with United Artists, Chaplin made *The Circus* (1928), *City Lights* (1931), as well as *Modern Times* (1936) before he committed to sound. He was nominated for an Academy Award for 1927–1928 for best actor and best comedy picture for *The Circus*. However the Academy withdrew his name from competition and gave him a special award "for versatility and genius in writing, acting, directing, and producing *The Circus*." *Modern Times* and *City Lights* are considered to be prime examples of Chaplin's art. Both are sophisticated pieces of symbolic film-making that were essentially silent films scored with Chaplin's music and sound effects. Voice is heard in *Modern Times*, but it is mediated through technology, and Chaplin's own voice is heard in the 'nonsense song' at the end of the movie. *Modern Times* is a sublime critique of Chaplin's difficult situation *vis-à-vis* the invention of the 'talkies,' as well as being a humanitarian commentary on the dehumanizing effects of rampant industrialism. *City Lights* is billed as a comedic pantomime, but is a complex symbolic rumination on film celebrity, wealth, and the philosophy of communication (especially sound and vision).

Chaplin's first dialogue picture, *The Great Dictator* (1940), was an act of defiance against German dictator Adolf Hitler, Nazism, Anti-Semitism and Fascism. It was filmed and released in the United States one year before the United States abandoned its policy of neutrality to enter the second World War. Chaplin exploited the similarities between Hitler and The Tramp (especially the little moustache). He played the role of Adenoid Hynkel, Dictator of Tomania, clearly modeled on Hitler. The film was seen as an act of courage in the political environment of the time, both for its ridicule of Nazism and for the depiction of Jewish persecution. Chaplin was nominated for best writing and best acting Academy Awards for *The Great Dictator*, but he did not win.

Chaplin's personal life and fortunes were followed voraciously by the media. He was married three times, first to Mildred Harris, with whom he had a son who died shortly after being born, and the second time to Lita Grey, with whom

he had two sons. Both women were only 16 when he met them and both brief marriages were spectacular failures, ending in bitter and acrimonious divorces. He had several other close relationships with women before marrying Oona O'Neill when he was 54 and she was 18. They had eight children in a long and successful 35 year marriage that lasted until his death. He also enjoyed successful relationships with Edna Purviance and Paulette Goddard, with whom he remained life-long friends.

Chaplin remains possibly the most universally famous mass celebrity figure in history, and although he was feted as a genius he was also eviscerated by the media for perceived personal and political transgressions. Chaplin was often associated with left-wing politics in America, and knew many communists, but he also had friends amongst the wealthy and powerful such as William Randolph Hearst, Winston Churchill, and H. G. Wells. In the 1940s United States, his political views (in conjunction with his influence, fame, and status in the United States as a resident foreigner) were seen by many as radical, and this was exacerbated because although he was a resident from 1914 to 1953, he never became an American citizen. During the era of McCarthyism, Chaplin was accused of 'un-American activities' as a suspected communist and when, in 1952 he left the United States for what was intended as a brief trip to the United Kingdom his reentry permit was revoked. His final film in the United States, made when he was feeling persecuted in America, was *Monsieur Verdoux* (1947), also considered to be one of his finest works. Although ostensibly about a serial murderer it is also widely understood to be a critique of capitalism and American foreign policy.

Chaplin made his home in Vevey, Switzerland. He briefly and triumphantly returned to the United States in April 1972, with Oona O'Neill to receive an Honorary Oscar. Chaplin's final films were *Limelight* (1953), *The King in New York* (1957), and *A Countess from Hong Kong* (1967).

Chaplin was a musician, composer, and choreographer as well as film-director and actor. He composed scores, wrote songs, and choreographed most of his films. Two of his most popular songs are 'Smile' and 'This is my song.' Chaplin's score for *Limelight* won an Academy Award in 1972. There was a delay in the film premiering in Los Angeles due to Chaplin's unpopularity in America in the early 1950s and so the movie became eligible decades after it was filmed.

In his later career Chaplin wrote extensively on his life. He also wrote original music compositions and scores for his silent pictures and rereleased them. Chaplin's last completed work was the score for *Woman of Paris*. He was knighted at age 85. Sir Charles Chaplin died in his sleep in Vevey on Christmas Day 1977.

Chaplin's Creativity

Much can be learned about creativity by examining the life and art of Charlie Chaplin as he exemplified the art of 'creative living.' Scholars have often used psychoanalytical theory to explain Chaplin's creative imagery in his movies. Chaplin has been put 'on the couch' not least because Chaplin himself has said that *pain* was the source of his comedy, and that comedy was a 'strategy for living.' Comedy was, quite literally,

Chaplin's 'therapy' to help him overcome personal and professional challenges. Both *Modern Times* and *City Lights* for example exemplify Chaplin turning his personal difficulties into art of almost mythological proportions. The famous scene of Charlie being ingested into and then expelled from the great machine in the first stunning sequences of *Modern Times* is widely understood as being Chaplin's commentary on his own situation *vis-à-vis* being chewed up and spat out by the film industry.

So, one source of Chaplin's creativity was his autobiographical processes, but a number of other factors, both external and internal contributed to Chaplin's creative life. Two major external influences were music-hall from England and Keystone in America. The theatre world into which Chaplin was born was the outcome of several centuries of entertainment tradition and evolution. Music-hall gave Chaplin a background in the comedic arts but he recognized the limitations of its conventions and found it restrictive. Keystone also placed very rigid prescriptions and conventions around what was considered to be funny – the chase. Chaplin was never satisfied with restrictions and was always looking to extend form and technique in his craft.

Another important external influence was American culture and history: Chaplin's Little Tramp was a peculiarly American figure. Chaplin had an ambiguous and contradictory place in American popular culture because he lampooned the American dream at the same time as he yearned for it in his movies and personified it in his own life. The Tramp character, and indeed Chaplin himself, championed an anarchic individuality and he became emblematic of the potential in America, which is the very system he criticizes so relentlessly in his work. This paradox makes Chaplin's work all the more fascinating.

Although Chaplin's film art was American, it was still strongly influenced, as were American slapstick comedies more generally, by European film-makers and comedy conventions in other countries. Chaplin himself was directly influenced by the films of French film-maker Max Linder and by English comedy conventions. In general, the silent films of America took what was vital and attractive in French, Italian, Jewish, and English comic traditions and yoked them to the enormous energy of a youthful nation and a new technology. Chaplin personified this American eclecticism and the youthful nation's search for an identity and culture. The most important work exploring in-depth America's influence on Chaplin and vice versa is Charles Maland's book *Chaplin and American Culture*.

Chaplin had a number of individual characteristics that are shared by other creative people. He was courageous, persistent, highly sensitive, and resourceful. For instance, he was courageous enough to discard movie conventions in the great humanitarian speech at the end of *The Great Dictator*. In this speech he abandons his two characters of Hynkel and the Jewish Barber to directly address his audience in his own voice to appeal for peace and empathy in international relations. Yet, he was still ironic enough to add a sting in the tail of the speech by slyly recognizing his own proselytism in this still incandescent speech on the dangers of propaganda. This does not weaken the speech, but makes it even more touching, and in the light of history, more powerful and prescient.

Creative control is a very strong theme in Chaplin's creative development. With each successive renegotiation of his studio contracts Chaplin increased his control over his creative

product. With United Artists, where he had almost complete control, Chaplin was able to take more time and reflect deeply on his work, and so the films he made with United Artists are his most complex and timeless works. However, earlier in his career Chaplin tried out new ideas which eventually came to fruition in his later mature works – for instance short films for Essanay such as *The Tramp* (1915) and *Work* (1915) show some of the basic plot-lines and gags he was to reuse later on. His need to control every aspect of film-making also extended to the performances of others. Chaplin often showed his actors exactly how he wanted them to perform.

Chaplin was always coming up with ideas for routines and feature pictures. His autobiographies provide much insight into instances of how he got specific ideas. For instance, in his autobiography he describes how as a child he once witnessed the witless panic of a sheep being chased towards a slaughterhouse at the end of the street in which he lived. Everyone found the chase amusing, as did Chaplin, but then the 'reality of the tragedy' overwhelmed him and he broke down weeping "They're going to kill it!". He credits this memory with providing the template for his future feature films: the combination of the tragic and the comic. In general he believed ideas came through his intense desire for them, which involved periods of anguish, and perseverance, so his mind became a 'watch-tower' always looking out for incidents that could excite the imagination. After generating many ideas he would then eliminate them until he had what he wanted.

Chaplin's story about the creation of the Tramp character is retold by Richard Attenborough in his film of *Chaplin* with Charlie played by Robert Downey Jr. In this story Mack Sennett tells Chaplin to put on stage makeup. Chaplin has no idea what makeup to put on, but decides everything should be a contradiction with the pants baggy, the coat tight, the hat small, and the shoes large. Costumed, the character of the Tramp magically takes shape as Chaplin senses his character and merges it with his own. This story about costume and character in the creation of the Tramp is archetypal: the merging of costume, mask, character, and actor is centrally important to the ways that actors create the theatre experience, which does indeed appear to be other-worldly, although it is underpinned by constant practice and skill mastery.

Comedy involves constant creativity. It is not loose and indiscriminate horseplay but a highly structured activity, involving, in particular, the manipulation of language (or symbols), and timing. Visual gags follow a logic of mathematical precision and actors become masters of timing, pacing, and spacing in order to create suspense and surprise and fulfill the potential of a joke. Slapstick, according to Chaplin, had a very exacting psychology that he initially found difficult to blend with The Tramp's (and his) preference for pathos and sentimentality, and his evolving complex comedies. Chaplin studied laughter seriously and he worked hard to make slapstick work in tension with pathos. Because he did not use dialogue Chaplin became a very good actor – he used his body and face to their full effect to convey his messages.

Chaplin's methods were exacting and time-consuming. He would improvise, but he paradoxically left nothing to chance. Chaplin would often start from a vague premise, for example 'Charlie enters a health spa' and he would then have sets constructed and work with his stock company to improvise

gags around them. He almost always worked his ideas out on film, a method that seems incredible now that film production is so tightly managed and controlled. This improvisational process carried on as ideas were accepted and discarded, until eventually a narrative structure would emerge. This process frequently required Chaplin to reshoot an already-completed scene that might have otherwise contradicted the story. These unique film-making techniques became known after Chaplin's death when rare surviving out-takes were discovered and then examined in a 1983 documentary, *Unknown Chaplin: My Happiest Years*.

However, there were downsides to his methods. Until he began making spoken dialogue films with *The Great Dictator* (1940), Chaplin never shot from a completed script. He once had a café set built with no idea how he was going to use it; he simply argued that 'something always happens in a café.' Consequently Chaplin took longer to complete his films than his rivals, as he would go over and over his scenes until he was satisfied. He would shoot every single rehearsal and view them on a screen several times, so that he could find the flaws which spoiled the effect he was striving for. He would start again if he was not satisfied, and he was his own harshest critic. This combination of improvisation and perfectionism often resulted in enormous expenses and it was also emotionally and physically exhausting for Chaplin.

Like other artistic people Chaplin experimented with forms and mixed genres. He used satire, parody, pathos, tragedy, and melodrama. Chaplin was the first to introduce a sad ending in his comedic films. He introduced fantasy sequences, and irony, and was innovative especially in the genre of romance. At Essanay Chaplin helped pioneer film as something more than a short reel car chase, and from that point on developed longer, more complex, and more developed stories. As well as experimenting with different artistic dramatic forms, Chaplin used fast-developing film technology to its utmost to bring his visions to screen.

Chaplin was innovative in his use of a variety of scenarios involving a vast array of props, film editing, and film-making effects, to make unique and entertaining films. Speeding up the camera and running the camera in reverse were two simple techniques often put to use. But Chaplin pioneered many other editing and special effects techniques, including set building, motion tracking, and close-ups. Animals and children were used by Chaplin to great effect in *The Kid*, and *The Circus*, two of his most admired movies. Chaplin even used titles artfully, as can be seen at the end of *City Lights*.

Chaplin could play several musical instruments, and was a composer and a dancer. He credits music with giving him many ideas for his comedies. It seems ironic that Chaplin is famous for his refusal to give in to sound until he absolutely had to while he was such a master of sound himself. Charlie's physical grace was legendary; he was balletic, athletic, and gymnastic. One of the best examples of Chaplin's skill at expressing ideas physically through dance and music can be seen in *Modern Times*. This film, a social and political satire, showed "mass production to be a form of social choreography." Chaplin both describes and criticizes the dehumanizing factory environment through comedic balletic play.

Chaplin, like many other creative people, was a risk-taker. He had a highly entrepreneurial spirit and as a young person

was continually preoccupied with business schemes. He learned resourcefulness in his childhood, and these lessons stood him in good stead as he grew up. His move to America was crucial in realizing his entrepreneurial spirit; he saw opportunity there and he wanted to make money, and lots of it. Even so, he himself credits some luck in his casting and in various key moves he made during his career.

Risk-taking is one of the outstanding features of Chaplin's personality. Chaplin made art during the apocalyptic and devastating First and Second World Wars and during this period he was an outspoken political critic of world events. Although Chaplin never consistently identified with any specific religious or political ideology he was often outspoken on some issues. He is most accurately described as a nonconformist and independent thinker.

Because Chaplin was outspoken and was the premier film star of his age, an influential figure, he became the target of persecution. It did not help Chaplin that the film industry was at the vanguard of reformulating moral codes in post-Victorian America, and his personal life was colorful and controversial. Yet, despite the high stakes of failure as a high profile public person he took risks constantly with his reputation and his fortune.

Modern Times was a bold risk for an artist of Chaplin's stature, and it did not make money until it went into foreign distribution. Chaplin chose as his first talkie movie a biting satiric critique of Hitler's rise in Europe, *The Great Dictator*, which was an enormous financial, personal and artistic gamble. Chaplin put much of his personal fortune into its production. Chaplin's comic genius and courage is shown in one particular scene of sublime ridiculousness which aims at destroying Hitler's credibility. Hynkel savagely splutters through one of his diatribes against Jews in Germanic sounding nonsense words. As he walks back to his seat after his last expletives are delivered, Chaplin delivers his final comment on Hitler's intelligence as Hynkel picks up a glass of water, and puts it in his . . . ear. In 1997, *The Great Dictator* was selected for preservation in the United States National Film Registry by the Library of Congress as being "culturally, historically or aesthetically significant."

Summary and Contribution

It is easy to underestimate the power and force of a comedic character who has become so familiar. Just as we get used to electricity or fresh water from a tap, the creation of a comedic character like Charlie's Tramp is truly revolutionary. However, with a comedy symbol such as the Tramp the power of the invention is always to some extent conditional on an audience's desire to sustain the invention. A character such as the Tramp needs to speak directly to an audience that is receptive and listening to him.

Chaplin created his character, but his audience adopted him, and then eventually largely rejected him. In the present era there has been a renewed appreciation of his work by fans, researchers and writers and others rescuing his significance from the largely undeserved damage done to his reputation in his later career. Chaplin has spawned a critical industry appraising his work, remains a relevant point of learning for actors and film-makers, and is now reborn via the Internet to a

vast new audience, who are viewing and reinventing his work again. The popular conversation about Chaplin's films on the Internet, which occurs in all languages, attests to his continued relevance as an international comedian.

Chaplin was able to straddle both the popular audience and yet, at the same time, gain artistic credibility. Because film was a relatively new medium, especially as a form of mass entertainment, he can be argued to be critical to the development of film as an art form because he showed the potential of the medium to communicate complex themes. In his mature period Chaplin made intricate films, his vision was unprecedented, and he provided an abrasive exploitation of paradox and ambiguity. He mastered the discourse of comedic language even though he initially eschewed the talkies. Chaplin was the premier comedian and film maker of his time, and remains influential in the present day. His contribution as a creative person himself and as an inspiration to countless other people has been unique, widespread and timeless.

See also: Acting; Risk-Taking.

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- <http://www.charliechaplin.com/> – Official Chaplin website.
- Some of Chaplin's earlier movies (from 1914–1919) are available for download from the Internet Archive at <http://www.archive.org/> and many of his later movies have been restored and are available for purchase.
- Wikipedia provides a very good entry about Chaplin, his life and films, key people in his life, and information about his films.
- YouTube contains a vast number of Chaplin tributes and excerpts from his movies posted by his fans.

Julia Child 1912–2004

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Au début – In the Beginning

The oldest of three children, Julia Carolyn McWilliams was born in Pasadena, CA. During the early years of her life, Pasadena – a conservative city best known for the annual Tournament of Roses Parade – was experiencing tremendous growth in terms of population and cultural activity. Benefiting from the city's prosperity, Julia's father, John McWilliams, was a successful, conservative businessman who worked as a farm consultant and real estate investor. Mrs McWilliams, whose family fortune was made in the paper industry, managed the home front with the help of a maid and cook. Living in Pasadena, Julia grew up with a great appreciation for the bounty of fresh fruits and vegetables available, as well as the quality of meat the cooks prepared for the family's meals. Nevertheless, Julia was not inspired to try her own hand at cooking, and the family's dining experiences consistently centered on basic American dishes, such as chicken and potatoes, and an array of tasty albeit nondescript brown sauces that were common in that era.

La jeunesse Julia – The Young Julia

Julia and her siblings grew up with many comforts, enjoying a range of activities, particularly outdoor sports such as tennis and skiing. Career goals were not a part of Julia's early education experience, yet her natural leadership qualities emerged as she developed into a young woman – a rather tall woman at 6 ft, 2 in. Mr and Mrs McWilliams chose to send Julia to an elite boarding school for her high school years, deciding that it was time for her to receive a more serious education. As the tallest person in her class at San Francisco's Katherine Branson School for Girls, Julia was a standout in terms of her overall presence, including her physical stature as well as her knack for verbal candor and adventurous spirit. Although her mother's ancestry included famous intellectuals William Cullen Bryant and Oliver Wendell Holmes, Julia's intellectual abilities were not what distinguished her from her peers. It was her flair for dramatics and physical activity that made her a social success and 'head girl.' She was taller and stronger than her peers, and was a self-proclaimed ham.

In 1930 Julia's academic standing, paired with the fact that she was the daughter of an alum, was strong enough to gain her admission to Smith College, in Northampton, Massachusetts. With the same panache she had displayed in high school, Julia completed four successful years at college, and was once again the tallest woman in her class. While in college she majored in history, and blithely entertained the notion of becoming a writer or basketball player. She graduated from Smith in 1934 with her degree but not a wedding engagement, which was the ultimate goal of many young women at the time. Women's careers were somewhat limited at the time of

her graduation, and her family's financial background did not require that she take up a profession. Since Julia did not savor a career as teacher or nurse, she instead moved to New York.

In New York Julia shared an apartment with friends from Smith, and was primarily supported by her parents. She took up a brief occupation as a copywriter, working in the advertising department of the well-regarded home furnishings company W&J Sloane. She stayed in this position for a few years, refining her natural talents for writing and communication. She learned to write press releases and to work with staff photographers, as well as handle public relations under the tutelage of the advertising manager. Julia's success in this position was accompanied by personal successes submitting her own written work to magazines, such as the *Saturday Review of Literature*. She enjoyed a rather active social life in New York, and kept up a solid network of friends. Julia was known to be quite modest and to focus on the strengths in others and downplay herself in social situations. Her friends shared Julia's enthusiasm and appetite for stimulating activity, and yet Julia was not quite satisfied. She was unhappy over the end of a romantic relationship and was concerned about her mother's ailing health, so after her time in New York postgraduation, she ultimately returned home to Pasadena.

Julia's mother passed away a mere two months after her return to California. She decided to stay on the West Coast and take care of her father, and landed a job writing for a newly created fashion magazine. She later transitioned to a job overseeing the advertising office of the West Coast branch of W&J Sloane. In the early 1940s, however, she was feeling less eager to continue with her job. She was purportedly fired for insubordination – an outcome she felt was justified and that she did not regret.

Il était censé être – It Was Meant to Be

Julia believed and often said that the Second World War changed her life. As America became more entrenched in the war, Julia desired to support the war effort. Julia did not share her father's Republican political views, and was a loyal and enthusiastic democrat. She moved from California to Washington, DC and applied for positions with the WAVES (Women Accepted for Volunteer Military Service) and the WACs (Women's Army Corps). She was disqualified from a position in either service organization because of her height, but would not be deterred, and accepted a job as a typist in the Office of War Information.

After only a few months she applied for a job with the newly formed Office of Strategic Services (OSS), hoping to engage in work as a spy. Her skills at organizing material as well as leading staff worked to her advantage, and she eventually headed up an office of 40 employees, working six days a week. In 2008, thousands of pages of personnel files were

de-classified by the National Archives and it was revealed that Julia did indeed work as a spy for the OSS during the Second World War. She worked as part of a large spy network created by President Roosevelt, which was precursor to the organization known today as the Central Intelligence Agency (CIA). It was in this capacity that she was sent on an overseas assignment in 1944. She and her colleagues were stationed in Ceylon (now Sri Lanka), an island off the coast of India. Julia worked in the OSS headquarters for South East Asia, where she aided in the communication of top-secret documents between American government bureaucrats and corresponding intelligence officers. She was thrilled to be in a foreign country, working in a position that involved such urgency and energy, and introduced her to so many interesting people.

One of the most important people that she ever would meet was a man ten years her senior – Paul Cushing Child. Paul, a fellow OSS employee who worked in the map-making department, came from a well-respected Boston family. They met in 1943 through chance circumstances but their friendship quickly solidified as Julia was fascinated by Paul's worldliness – especially his artistic talents and passion for food. Paul was transferred to China, and Julia followed soon after. Paul introduced Julia to cooking while in China, where they compared their Ceylonese dining experiences with Chinese cuisine. Julia's experiences with foreign cuisine opened her palate to new possibilities, and what could have been a mere work friendship blossomed into something much more serious and transformative for her.

Julia had experienced serious romantic relationships in her life, but had never met the man whom she could call her true love – what she referred to as 'simpatico' – until Paul. It was with Paul that Julia felt an awakening of her senses as well as her intellect. When the war ended, she and Paul went their separate ways, and she returned to California and began to study fundamental cooking in Beverly Hills. She and Paul maintained their relationship, and eventually they decided to take a trip across the country together, from California to Washington, DC. They had decided to marry by this time, and their cross-country trip turned into a journey into the next chapter of their lives. Married in September 1946, they set up their home in Washington and Paul worked for the Foreign Service while Julia practiced her cooking on her new husband. They lived in Washington, DC for two years, when Paul was assigned to a post in Paris – a turn of events that would forever influence Julia's personal experience with food and transform the art of French cooking in America.

La belle France – The Beautiful France

Julia was thrilled with Paul's assignment at the American Embassy in Paris, for the city possessed the glamour and allure of a bohemian lifestyle. They settled in Paris in 1948, and their first meal upon arrival was the catalyst that launched Julia's passion for French cuisine. Paul drove them to a restaurant listed in the *Guide Michelin*, named Restaurant La Couronne, and Julia's meal of sole meunière was at the heart of the most exciting dining experience of her life. She was quite inspired by her perfect dining experience, from the manner of the servers to the kindness and knowledge of the maître d', but the food

triggered something inside of her. While Paul worked running the exhibits office for the United States Information Service (USIS), Julia began exploring the marketplaces. She spent much time attempting to converse with vendors in the markets, getting to know them and practice her French. She was so moved by the quality of available ingredients and the attention given to the simplest preparations that she endeavored to learn French, signing up for private lessons with Berlitz so that she could better converse with the neighborhood shop owners and merchants and try her own hand at French cooking.

As her passion for French cooking and culture grew, Julia decided to invest some of the inheritance she had received upon her mother's death and use benefits of the GI Bill to enroll in cooking school at Le Cordon Bleu. Once again, Julia was a standout among her peers – the only woman in a class of 12. Her classmates were eleven former GIs who seemed to approach cooking from a very trade-oriented perspective, instead of the artistic, creative angle that Julia enjoyed. She watched her professor, Chef Bugnard, with rapt attention and admiration, learning much from the enthusiasm that he brought to cooking, and the careful manner in which he approached preparing the most simple of dishes or accompaniments. Her competitive spirit buoyed her confidence as she worked hard to keep up with her fellow students, taking copious notes and practicing at home. She particularly admired qualities of a few instructors, such as Pierre Mangelatte's recipes, which were written with clarity and were easily understandable, and the amazing attention to detail of Claude Thilmont.

Her formal cooking education sparked new ideas for Julia, and she was quickly able to build upon the rough cooking foundation she had built while taking cooking classes in California. She learned to be more creative using fewer ingredients and spices, letting the natural flavors of the food take center stage. Paul became her willing partner at their home, readily eating her homework and marveling at the way she was able to move in the kitchen. In a letter to his twin brother, Charlie, he compared Julia to a symphony conductor as he admired her nimble movements.

It was around this time that Julia first learned of a new machine that was gaining popularity in the United States – the television. Through correspondence with friends and family, she learned of the concerns people had about how the effects of this new invention would forever change the American family. Though she and Paul tried to find a television in Paris, there was none to be found. Julia had no way of knowing what an impact she would have on American television and her self-confidence was not very strong after her first attempt to graduate from Le Cordon Bleu.

Julia failed her first graduation exam in 1951, but became more determined than ever to master the art of French cooking and gain her diploma. She had recently joined an exclusive dining society, Le Cercle des Gourmettes. They were interested in attracting more American members, and met in a model kitchen every other week for cooking presentations and instruction, and then ate the gourmet fare that they had helped prepare during their presentation/instruction. Julia relished these meetings, as she was able to learn much about French cooking and meet a diverse group of French women.

It was through this group of women that she met Simone Beck Fischbacher, a fellow Gourmette. Julia and Simone

connected immediately through their mutual love of food – from food selection to careful preparation to fine food establishments. Simone introduced Julia to another Gourmette, Louise Bertholle. Simone and Louise had been working for some time on a cookbook that they aspired to publish in the United States. Julia thought that a book filled with well-researched French recipes was perfect for the US market, where French food was relatively unknown.

These three culinary compatriots – Julia referred to them as her ‘French sisters’ – found such a common desire to create recipes others could learn and recreate in the comfort of their own homes that they formed a new enterprise. They formed a cooking school of their own, called *L’Ecole des Gourmettes*, and convened their first class in January of 1952. They later renamed the school *L’Ecole des Trois Gourmandes*, which Julia fondly translated as *The School of Three Hearty Eaters*. Each woman brought her own strength to the effort, and Julia had a knack for illuminating the practical matters involved in cooking the recipes that her French colleagues overlooked from their lifetimes experiencing French methods or else knew instinctively. For example, Julia painstakingly experimented with typical American ingredients as they worked to create French recipes that would work with typical American ingredients. When they planned to teach a lesson involving piecrusts, Julia discovered that there was a fundamental difference in American and French flours. A piecrust made with French flour required less fat to create a rich, delicious crust, but the flour spoiled more quickly than American flour. This scientific approach to knowing her ingredients led to innovative approaches to cooking classic French dishes with an American flair.

Julia’s comfort with experimentation was also reflected in her attitude toward mistakes. Julia believed that making mistakes was a critical part of the learning process, and that cooks should never apologize for their food or make excuses, for then they would fall into the self-deprecating behavior that would hinder, rather than benefit their learning. It was through continual trial-and-error, accompanied by evaluation of her teaching technique, that Julia discovered the specific steps needed to perfect individual items that would eventually find their way onto an eager diner’s plate.

When the freelance editor that had been helping Simone and Louise quit, leaving the two women without an accurate lens onto Americans’ cooking needs and habits, they asked Julia if she would step in and help them complete their project. Julia was thrilled with the offer. She accepted immediately, and thus began a collaboration that would combine Julia’s sense of humor, communication, research, and organization skills, and her ever-evolving passion for food into an enduring masterpiece.

La cuisine française – The French Cuisine

Julia received her diploma from *Le Cordon Bleu* in 1952, and delved intensely into her work on the cookbook, tentatively titled *French Home Cooking*. She investigated every step that her coauthors took for granted, as she recognized that American cooks would appreciate understanding the ‘why’ behind the suggested techniques. She wrote narratives to accompany the recipes, as she reasoned that American cooks would benefit

from concrete examples or anecdotes that would provide context to their dishes. Julia also intuited that some French techniques were revered, yet were never questioned and therefore were often misunderstood. She dared to investigate some of the old wives’ tales and urban legends related to certain classic recipes in an effort to provide a detailed explanation inside the technique that would result in imaginative, foolproof recipes.

An example of the forthright, investigative manner in which Julia attempted to understand elements of French dishes was when she was pondering the use of butter in French sauces. She and Paul went to a small bistro and met the chef of the bistro, who kindly invited them into her kitchen and demonstrated her method of making *beurre blanc*, a butter sauce that was a regional specialty but that no cookbook explained in comprehensive detail. Julia paid close attention to the method that the chef used to create a delicious sauce, and then went home to try her own hand at the sauce on her own stove. She used her own language to interpret the steps involved in creating the butter sauce, and ultimately served a dish to a group of friends. The outcome, she felt, was tremendous, and underscored her desire to revise all of Simone and Louise’s recipes. She wished to eliminate readers’ misunderstandings or the need for readers to make assumptions because of a lack of information or lack of clarity provided in the recipes.

The work of producing the cookbook turned into a laborious effort that included a pinch of luck and a dash of coincidence. Mr Sumner Putnam – head of the original publishing house, Ives Washburn – sent a letter to the authors, requesting their finished manuscript in a few months. Julia sent him a letter back explaining the innovative nature of their cookbook, and their logical approach to cooking complex French dishes. Julia received no response from anyone at Ives Washburn, but she had begun correspondence with Avis De Voto, a resident of Cambridge, Massachusetts. Julia had read a column in *Harper’s Magazine*, written by Avis’s husband Bernard, about the unsatisfactory quality of American-made cutlery. Julia and Avis subsequently struck up a trans-Atlantic friendship discussing cutlery, cuisine, and Julia’s cookbook. Avis had connections to Houghton Mifflin publishing company, her husband’s publishing house, and the cookbook trio finally left Ives Washburn and entered into a contract with Houghton Mifflin to deliver a cookbook that would introduce American cooks to the art of French cooking. Unfortunately, when the cookbook was finally finished in 1959, totaling over 700 pages, the editors at Houghton Mifflin balked at the length and the projected cost of production. While they respected the effort and research that had been put into the work, they felt that consumers would prefer a shorter book, and suggested they consider turning their masterpiece into a series of smaller books. Houghton Mifflin suggested that the women contact Doubleday – a large publishing house with their own book clubs. Avis De Voto, however, who had become their biggest fan and advocate, sent their manuscript to another contact at Knopf publishing house without asking Julia or her colleagues’ permission. Avis had a strong feeling that the publishers at Knopf possessed the vision that would make Julia’s cookbook a published success.

Avis’s faith and gumption proved to be the perfect ingredients for the cookbook’s rise to published work. A new editor at Knopf, Judith Jones, was hired to work with translators of French books, and immediately resonated with the vision

that Julia, Simone, and Louise had poured into their recipes. In May, 1960, Julia finally received a letter from Judith at Knopf, in which Judith expressed her excitement at the potential for the cookbook, and the publishing company's desire to produce the work and bring it to an American market.

Nouveau à la maison – Home Again

Julia's journey as cookbook coauthor had coincided with changes in Paul's career. The couple had left Paris, and subsequently traveled to Marseilles, Bonn, and Oslo as Paul was reassigned to various positions with the USIS, now called the United States Information Agency (USIA). When Paul retired in 1961, they settled into a house in Cambridge, Massachusetts, featuring a kitchen designed by the couple and equipped with an array of utensils and gadgets that are considered by millions of fans to be Julia's magical tools of her trade [Figure 1](#). Julia's cookbook, *Mastering the Art of French Cooking*, was published the same year.

In its first year, the cookbook sold over 100 000 copies, and by the end of the decade, had sold over 600 000 copies, which was remarkable for a culinary work at that time. The book set a new standard for high quality, crisp, innovative recipes. More significantly, the cookbook altered an eating culture that had revolved around prepackaged items, such as canned goods and frozen foods. Selecting and preparing fresh, simple ingredients became viewed as a healthy, joyful experience for women who had previously seen cooking as a routine chore. Julia was quickly regarded as a culinary expert, and was asked to write articles for several publications. Four months after the cookbook was introduced to the public, Julia was invited to appear on a television program called *I've Been Reading*, featured on a local Cambridge television station, WGBH. The station was the highest-funded educational television station at the time, and Julia's television interview turned out to be the

launching pad that propelled her from successful cookbook author to household name.

Professor Albert Duhamel, host of *I've Been Reading*, did not often invite culinary guests on his program. Instead of the usual brief interview slot, Julia was given a 30-minute interview, and she arrived to the set with a variety of equipment, such as a hot plate, assisted by husband Paul, now retired and unofficially managing Julia's work. During the interview, Julia enthusiastically demonstrated the proper way to make an omelet, from chopping the items that would fill the omelet to whisking the eggs with a flourish inside a big copper bowl. She was so absorbed in her cooking that she never mentioned the cookbook, but her appearance prompted many letters from viewers who raved about her and wanted to see her make more television appearances.

Combinaison parfaite – Perfect Combination

The hungry viewers' wishes were granted, as Julia was asked to film three half-hour shows that would be aired as pilots so that producers could gain a sense of viewers' responses to Julia's cooking ability and personality. Called *The French Chef*, the three programs were titled, *The French Omelet*, *Coq au Vin*, and *Soufflés*. The shows were received quite favorably, and viewers enjoyed Julia's good humor and ease in front of the camera. WGBH offered Julia the opportunity to film a series of 26 subsequent cooking episodes of *The French Chef*, which aired weekly. The program became the longest-running program in the history of public television, and Julia's knowledge and finesse was recognized with a Peabody Award in 1965 and an Emmy Award in 1966. It was Julia's boldness and flair for teaching that made her a legend.

As her teaching continued to build a broader fan base, she expanded her writing and television enterprise. Her dedication to the craft and rigor involved in cooking inspired Americans



Figure 1 Julia Child's kitchen at the Smithsonian.

to take risks and become show people in their own kitchens. Whether flipping a pancake or frosting a cake, in front of an audience or on the pages of a text, Julia's message was that food was something to be savored and trusted, not feared.

Julia's desire to find someone with whom she could be simpatico was echoed in the devotion of millions of fans, but her number one fan and supporter remained her husband Paul. In 1989 Paul suffered a stroke and was forced to relocate to a nursing home to receive the care he needed. Julia reduced her feelings of loneliness by immersing herself in new projects. She had founded COPIA: The American Center for Wine, Food, and the Arts in northern California in 1981, and she continued work that would promote an understanding of the quality and overall importance of wine and food. She began collaborating with fellow chef Jacques Pepin, who had envied and praised her work on *Mastering the Art of French Cooking*. Their relationship proved to be very satisfying, as their rapport contributed to the comfortable manner in which they chatted comfortably preparing and eating French food.

Un nouveau debut – A New Beginning

When Paul – husband, friend, and artist – passed away in 1994, Julia continued to write and work on television programming for two years. She had been inducted into the Culinary Institute of America's Hall of Fame in 1993, which elevated her to a new level as the first female inductee. She was awarded France's highest honor, the Legion d'Honneur, in 2000. In 2001 she moved to a retirement community in Montecito, California and donated her house and office to Smith College. Her kitchen, however, including utensils and a collection of 800 knives, was generously donated to the Smithsonian National Museum of American History in Washington, DC. She donated her cookbook collection to the Shlesinger Library at Harvard University. Her legendary pots and pans were brought to Washington, DC from COPIA – reunited and appreciated by a new generation of fans and followers.

Julia Child passed away a few days shy of her 92nd birthday, due to complications of kidney failure. In the year before her death she endured knee surgeries, kidney failure, and suffered a stroke. She opted not to receive treatment when her doctor informed her of an infection that would require hospitalization, remaining the conductor of her own symphony to the last.

Toujours bon appetit! – Always Bon Appetit!

Julia Child's contributions to the culinary field reflect a level of creativity that was unsurpassed by her peers. She was not born a talented chef, nor was she exposed to innovative cooking techniques and meals as a child that inspired her to pursue a career as a French chef. Rather, she possessed a predisposition toward cooking that was manifest when her temperament met with circumstances that resulted in opportunities for her talents to flourish. Throughout her career she was able to adapt cooking to the trends of the times and the needs of consumers. Several qualities stand out as particularly relevant to her creative success:

1. *Learning environment*: Julia's life path brought her to foreign countries, where she felt invigorated and met Paul, whom she credited with awakening her senses. In Paris, the environment sustained her initial appreciation for French cooking, but strengthened her developing knowledge of aesthetics and gastronomy, encouraging her to try her own hand at creating delicious, innovative food. Her travel experiences afforded her the opportunity to combine knowledge from diverse cultures, broadening her palate as well as her vision.
2. *Gift of association*: through her own methods of scientific research, Julia gained a working knowledge of the chemical properties of ingredients and the physical properties of cooking equipment, as well as their respective limitations. As this knowledge base developed, she was able to make associations between otherwise unrelated ingredients and recognize unique combinations that resulted in truly savory dishes and accompaniments.
3. *Comfort with the unknown*: the learning process, which Julia believed to be a lifelong endeavor – entailed not only testing of hypotheses but also exploring uncharted territory in the culinary world. Recognizing the ambiguity in a combination of ingredients or a process of combining the ingredients did not serve as a deterrent to her professional pursuits, but rather awakened her imagination to new possibilities, combinations, and ideas that she could work into a recipe.
4. *Acceptance of mistakes*: a natural extension of experimentation and exploration is sometimes making mistakes. Julia's ebullient approach to cooking was linked to her self-forgiveness and sense of humor. Mistakes were not viewed as failures, but necessary steps in the learning process that revealed new information that translated into opportunities for deeper understanding.
5. *Flexibility of mind and spirit*: Julia's ability to move between countries and cultures, to speak and understand different languages in different contexts, and to coordinate materials and people served her well in her cooking, writing, and television activities, and was evident in her earlier years as well. Her mental and manual dexterity proved invaluable as she worked on numerous projects throughout her career.
6. *Persistence in the face of obstacles*: The burning passion that Julia possessed for food and eating may have fueled the fire for her tireless energy creating dishes for others to enjoy. Her efforts creating *Mastering the Art of French Cooking* are but one example of the tremendous effort involved in seeing a project through from inception to completion. The delay of gratification required as she toiled in the kitchen perfecting recipes and narrative, while publishers suggested that she shorten the cookbook to something briefer and catchier is an example of an inner drive that dominated any urge to quit or settle for a less-than-ideal product.
7. *Support of family and friends*: Paul's unwavering support was a critical ingredient in Julia's success. His own creative endeavors centered on art and photography, which he used to help Julia plan illustrations for her cookbook, design her incredible kitchens, and document their life together – capturing the sights and people that served as constant visual reminders to Julia. Julia also surrounded herself with encouraging, stimulating friends and teachers. Many of these friends served as inspiration for her to follow her dreams, and others served as vital contacts that moved

her career forward at critical points throughout her lifetime. Recognizing the strengths in others, she strengthened the likelihood that she would succeed in her efforts.

Julia Child's career spanned more than 40 years as a television personality, and her writing continues to influence people today. Her respect for *la cuisine française* never faltered as she opened the door to new and wonderful opportunities for American home cooks. Inasmuch as she inspired people to enjoy cooking, she ultimately set in motion a new approach to education and communication, forever laced with her signature *joie de vivre*.

See also: Aesthetics and Creativity; Ludwig van Beethoven 1770–1827; Climate for Creativity; Creative Environments, Conditions, and Settings; Everyday Creativity; Food, Creativity of Recipes, Pairings, Menus; Humor and Creativity; Improvisation; Personality: Autonomy and Independence; Serendipity.

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- <http://americanhistory.si.edu/exhibitions/exhibition.cfm?key=38&exkey=59> – Julia Child's Kitchen at the Smithsonian.
- <http://www.youtube.com/watch?v=2ohiUbQyDhk> – The French Chef Julia Child's Chicken.
- <http://dosfan.lib.uic.edu/usia> – United States Information Agency homepage.
- <http://www.wgbh.org> – WGBH Boston.

Camille Claudel 1864–1943

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Background

Camille Claudel was a sculptor during the very artistically active Fin de Siecle, or end of the nineteenth century, in Paris. Although her work was lauded by critics and fellow artists, she had little commercial success during her life-time. The popularity of her work and interest in her life have grown in recent years. Much of the interest is due to the details of her life, which include beauty, extraordinary talent, romance, betrayal, defiance of convention, and tragedy.

This renewed interest is not just because of her talent, though she was certainly a talented artist, nor due to her beauty, though that does add appeal to her tale. The interest is not even due to her very tempestuous relationship with Rodin, though that ensured her place in history. In fact, it has been argued that her story and talent were often obscured by her relationships with the two creative men she loved: her brother, Paul, poet and statesman, and her lover, Rodin, an established sculptor at the time they met. Her story is of continued interest because it is such a tragedy and such a lesson about what can happen to someone who steps out of society's limits, in her case, the limits imposed upon young women creators.

This resurgent interest spawned an eponymous movie about her, released in 1998 starring Gerard Depardieu and Isabelle Adjani; a musical, which premiered in 2003; several recent art exhibits featuring her work, one alongside the sculptures of Rodin; the publication of several biographies about her; a novel and poem; and the establishment of at least one school named after her, the Lyceé Camille Claudel. Yet, her immortality is best ensured by her distinctive features evident in some key sculptures by Rodin and what remains of her own art.

Early Life and Family

The oldest of three children in a middle class family, little is known of Camille's early childhood, except that the family was described as bourgeois, arrogant, and quarrelsome. By all accounts, Camille's father, Louis-Prosper, was a civil servant who provided the family with a comfortable lifestyle and moved them often due to position reassignments. He had a volatile temper, but favored Camille and supported her interests in sculpture, both emotionally and financially.

Her mother, Louise, on the other hand, neither understood Camille's disinterest in feminine pursuits nor had patience with Camille's volatile temperament. Louise paid little attention to art and much preferred her younger daughter, also named Louise, whose interests and temperament were more like her mother's. The two Louises disapproved of Camille's choices and lifestyle, and it is clear that the youngest child, Paul, was often jealous of his accomplished older sister, Camille. He wrote a preface for Camille's posthumous exhibit in 1951 in which he said, "I see her once again as she was, a superb young woman, triumphant in her beauty and genius,

wielding an often cruel ascendancy over my early years." In spite of their rivalry, Camille and Paul were very close growing up, and it has been speculated that their artistic competition, though in very different fields, inspired both to greater heights.

Other early influences on Camille's work include the countryside in which she grew up, the effects of her family's frequent moves, and her father's interest in the classics. It was said that Camille was almost preternaturally drawn to nature, and she and Paul often took long walks where she undoubtedly was impressed with large rock formations they saw. In addition, the family's frequent moves prevented Camille from making close friends outside of her family, so she had long periods of solitude. An avid reader, Camille had access to her father's library, which included a good collection of classics. She also had time to model figures out of clay, something she reportedly started at an early age.

One of the most important developments in her artistry occurred in 1876 when the family moved to Nogent-Sur-Seine. The family hired a tutor for the children, and Camille, 12 years old, continued with her nascent art, getting family members to model for her. It happened that the sculptor, Alfred Boucher, had a home near the Claudel family at this time, and he was struck by the young girl's talent. Although it is not clear how much instruction he gave her, he undoubtedly introduced Camille to some techniques, art exhibits, and eventually to other sculptors, most notably Auguste Rodin. During this time, Camille sculpted works that showed such promise that an art critic, Morhardt, later commented upon them in an article.

In 1881, Louis-Prosper established his family in a home in Paris while he continued to live in the country. There is some dispute as to why Camille's family split at this time. One theory is that Louis-Prosper wanted his growing children to receive the kind of education that they could not get in the more provincial schools. But, Paul wrote that it was Camille who forced the family to move to Paris so that she could pursue her career in sculpting. It is likely that both are true; Camille was ambitious, and Louis-Prosper wished to afford his talented children the opportunities to follow their ambitions: Camille in art, Louise in music, and Paul in writing.

Paris and Rodin

Even in Paris, Camille was not allowed to enroll in the all male and prestigious Ecole des Beaux-Arts, so she enrolled in a private art school that did admit females and rented a studio with three other female students. For the first time, Camille had the companionship of females with similar interests. One of the girls, Jessie Lipscomb, remained a friend for life.

Boucher stopped by the studio regularly to advise the young women, until he won the Grand Prix du Salon and left for Italy the next year. He asked his friend, Rodin, to visit the girls in his absence and help them. There is no record of Rodin and Claudel's meeting, and various accounts place it sometime

between 1881 and 1883. At the time, Rodin was in his 40s and Camille was between 17–19; he was 24 years her senior. He was a ground-breaking sculptor who was beginning his ascent to fame, and she was a beautiful, talented, and bright young woman. Her brother, Paul, described her as having magnificent blue eyes and hair as “red as gold.” Her beauty surely caught Rodin’s attention, as did her passion to sculpt. His talent and passion for his art must have been very attractive to her, too. That they were soon lovers has been verified by the discovery of an ardent love letter from Rodin to Camille written in the fall of 1883.

By the next year, both Camille and her friend, Jessie, were employed in Rodin’s studio where he was feverishly working on the Gates of Hell and The Burghers of Calais. As with most such studios of the time, students were required to work on the parts of the sculpture assigned to them while the entire project was overseen by and credited to the head artist. During this period, Camille became very involved in the creations, both posing for figures and doing more and more of the sculpting. Rodin much preferred modeling with clay to working with stone, and Camille showed great proficiency in the latter. So, she quickly moved from the role of student to one of an assistant. During this time, Rodin even finished and signed his own name to some of Camille’s sculptures. Although the Claudel family, and later Camille, accused Rodin of exploiting Camille in this way, it was typical of the apprenticeship practice in the nineteenth century for the master to teach the assistants in exchange for their work, and all work completed in the atelier belonged to the master. On the other hand, the master provided many opportunities for the young artists besides lessons – they had access to expensive equipment and materials, opportunities to meet other famous artists, introductions to possible buyers, and an entrée to the Salons. It was a symbiotic relationship that worked for a while for both Rodin and Camille.

By the time that Camille went to work with Rodin, they were involved in a fervent love affair, though she still lived at home with her mother and siblings for several years. Rodin lived with his long-time companion and former model, Rose Beuret, with whom he had a son just two years younger than Camille. Rodin’s continued relationship with Rose was one of the sources of conflict in the relationship between Camille and Rodin. Their art was another. The relationship between these two very passionate and strong personalities was never peaceful, and it was marked with drama, splits and reconciliations, long trips together, at least one pregnancy, and possible additional infidelities. By the time Claudel split with Rodin for good, they had been together for about ten years. Although Rodin finally married Rose Beuret very shortly before they both died, many of Camille’s and Rodin’s mutual friends believed that they only ever truly loved each other.

Camille’s Art

How much Rodin influenced Claudel’s work and vice versa is a matter of debate in the art world. However, it seems reasonable to believe that the two gifted sculptors who worked and lived so closely together for some time influenced each other’s work to some degree. However, in the end, they each had their own

unique style that represented their own backgrounds and influences. It is said that Camille never lost the classical influence that marked her work from the time of her study of the classics in childhood to the early influences of Boucher on her work. Her later pieces were very small and delicate. Rodin, on the other hand, specialized in large pieces, ones that were more forceful than lyrical.

It is clear that Camille was already a very talented and accomplished artist at the young age at which she met Rodin, and she continued to produce important pieces long after they had split. It has been said that her inability to support herself by selling her art was due to the difficulty of women to work and live independently at that time. Also, it was considered improper for a woman to model the human body, especially from a live model. The most prominent art critics of the time praised her work, but few bought it and even fewer commissioned it. She began to think that Rodin and his friends were conspiring to destroy her.

When Rodin established his museum in Paris at the Hotel Biron, he agreed to include a number of Camille’s works there. However, by that time, she was confined to a mental institution and was never to see it. The Musée Rodin has 15 pieces by Camille Claudel on permanent display.

Descent and Confinement

Split from Rodin and his world of friends, effectively estranged from her disapproving family, Camille isolated herself more and more to her home studio where she barricaded herself from the outside world. Her behavior, always volatile, became more erratic. At one point, she destroyed over 90 of her works. The nature and degree of her mental illness is not clear, but it seems that she did exhibit signs of paranoia in her view of Rodin’s conspiracy against her, and her personal care and hygiene suffered. However, there was no indication that she was ever a threat of violence to herself or anyone else. Whether crazy or eccentric, her condition was an embarrassment to her family.

The family balance, in Camille’s favor when it was the two Louises against Paul, Camille, and Louis-Prosper, was upset when a rift occurred between Paul and Camille. When Louis-Prosper died, the balance tipped against Camille. Camille was not present at her father’s funeral; it is assumed that she was not told. Just a few days later, her brother Paul arranged to have her taken from her home and confined in a mental asylum. At the time, one could have a family member committed with a medical certificate. Paul contacted a family doctor to write the certificate, and he and his mother acted quickly to sign the order of commitment. Paul watched with some distress as the terrified Camille was taken away in an ambulance, and he later confessed his conflicted feelings when he saw the poor mad creatures at the asylum who would be his sister’s house mates.

For Camille, confinement to the institution meant the loss of the two things she valued most: her freedom and her art. The loss of freedom for one who was once such an independent person had to be hard, but the crowning blow had to be the loss of her first love, sculpture. There are differing reports as to whether the doctors disallowed the sculpting as part of her therapy or she refused to sculpt as an assertion of her will

and manifestation of paranoia that they would steal her product. It is known that for the 30 years she was confined to mental hospitals, she did not sculpt. During those 30 years, there is a record of only one visit from her sister, after being prodded by Jessie Lipscomb, but her mother never did visit her.

Camille spent most of her time in the mental hospital, especially in the beginning, writing letters in her attempts to be released. The letters show that she still had her keen intellect and was capable of rational thought and sympathy. She wrote kindly and caring of her mother, though her mother repeatedly thwarted her efforts to be freed. Though her letters sometimes exhibited signs of the paranoia that caused her to fear 'Rodin's Gang,' poisoning, and other conspiracies against her, she also wrote movingly of her reflections on her life. She wrote to a friend, "I have fallen into an abyss. I live in a world so curious, so strange. Of the dream that was my life, this is the nightmare."

Camille and Paul

Camille and Paul were very close as children and their closeness continued into their teens and young adulthood. In fact, some have insinuated that their closeness was incestuous, or at least had erotic undertones. There is no evidence for this other than their observed closeness and intimacy, as well as Camille's strong expressions of love for Paul. It is reported that her dying words were of affection for Paul. Very likely, their closeness was fueled by their isolation, similar temperaments, passion for art, and distance from their mother and sister, Louise.

The family was Catholic as were most families from the region, but they were not religious. Camille decided early on that she was agnostic. It was only once the family had moved to Paris, and Paul attended a Christmas service in Notre Dame, that he became very devout with a strong belief that marked his work throughout the rest of his life. Undoubtedly, Paul's conversion created a distance between Camille and him. He blamed her for the family's religious lapse as he had blamed her for the move to Paris. It is probable that her growing talent inflamed his jealousy, and her illicit relationship with Rodin further upset him. Although there are differing reports, there is evidence that Camille became pregnant by Rodin and may have had an abortion. Some contend that she had multiple pregnancies and abortions, and that she may have given one or more infants up for adoption. It is sure that Paul with his newly inflamed Catholicism would have despised this sinful behavior.

Perhaps this rift explains Paul's eagerness to confine Camille to an asylum only a few days after their father's death, and his seeming indifference to her pleas to be allowed to come home. He believed that she was possessed and that she had to be confined to pay for the sins she had committed. In those days, many people believed that mental institutions were the appropriate places to confine individuals who were guilty of moral crimes, and women were the ones most likely to be so confined. As the male family member, Paul had total control over Camille's fate, and the laws of the time gave mental patients very few rights. Therefore, he was able to keep her confined, even though Rodin and others argued for her release, and her doctors agreed that she could go home. Even if Paul truly believed her to be mentally ill, he only wrote to her and visited her sporadically, once allowing seven years to lapse between his visits.

The conditions of Camille's confinement give further credence to the belief that the Claudel family was punishing Camille. First, there was a difference between regular commitment and sequestration. The former one might use with individuals with milder disorders, especially those that are not dangerous. Sequestration, cutting one off completely from the outside world, was usually reserved for the most dangerous and severely mad. The Claudels chose to sequester Camille, closely controlling her mail and visitors, perhaps in an attempt to squelch scandal. Second, there were levels of service for those confined, from first class to fourth. The first class patients got significantly better meals and accommodations than those in the fourth class, and their families paid considerably more for those privileges. Although there are indications that Camille may have started at one point in the first class, in later years she was in third class, although her family had enough money to give her a more comfortable existence. It was only after Paul quarreled with the Louises about the mother's sale of the family home to one of the younger Louise's sons, that Paul realized he had unfairly abandoned his older sister and offered to pay for her movement to first class. Paul was a diplomat and successful author who traveled around the world and had a very large chateau for his family home. He could well afford to pay all of his sister's expenses, but by the time he offered to move her to first class she refused, used to her life and reluctant to change.

Influences on Camille's Creativity

In order to examine the influences on Camille Claudel's creativity, the themes elucidated by Sally Reis in the entry, 'Women and Creativity,' in the first edition of the *Encyclopedia of Creativity* will be used as a template.

Theme One: Personality Characteristics of Creative Women and Internal Barriers to Creativity

Reis explained that introspective analyses indicated that creative women had "the ability to overcome challenges, the need for or absence of support, the opportunity to learn independently in the absence of formal education, and the willingness to live a different life from their peers or counterparts." Camille certainly overcame many challenges in seeking to become a sculptor in nineteenth century France. Women were neither allowed to enroll in art schools, nor allowed to use real nude models for their sculpting studies. Camille, a country girl, found a way to attend a private art school in Paris and employed a male model, in defiance of cultural norms. She certainly did not have the support of her mother or sister, but found support in her father. She learned independently by reading the classics in her father's library, modeling from nature and her family, and learning from the tutelage of Boucher and Rodin. She certainly lived a different life from most other girls in France at the time, and she even differed from her good friend, Jessie Lipscomb, who married and had children. Camille chose her art over the domesticity that was expected of the women of her time.

Reis went on to cite the research of Walberg and his associates that "as girls, notable women were intelligent, hard

working, imaginative, and strong-willed." All of these descriptors certainly applied to the young Camille, especially the last. She was considered to be imperious in her influence over her family, and even dared to stand up to the older and more famous Rodin.

Thus, Camille Claudel certainly possessed the characteristics typical of creative females; she enjoyed the success and suffered the consequences of their manifestations in her time. Her independence and iconoclastic nature allowed her to challenge the mores of her time, but they also isolated her from others of her gender and resulted in disdain.

Theme Two: Societal Factors that Facilitated or Impeded the Development of Women's Creativity and Why There Are so few Eminent Female Creators

That girls were not offered the same educational opportunities as boys in Camille's world is clear. She was very fortunate that her father did not have such narrow gender stereotypes as her mother, and that he encouraged her education and art. However, another major societal factor that impedes many women is the time and commitment to child bearing and rearing. In this sense, Camille seems to have made a Faustian bargain; she gave up her children, through abortions or adoptions, for her art.

The beneficial societal factors include her family's relatively comfortable lifestyle that afforded her the time and opportunity to begin to sculpt, and the opportunities to be mentored by both Boucher and Rodin. Even her family's frequent moves may have been beneficial in affording Camille the comfort of solitude, experiences with nature, and independence from peer pressures.

Theme Three: Gender Differences in Creativity and the Creative Process

Camille wanted to compete with men and sought recognition in a male dominated field. Although the content and style of her art were influenced by her femininity, she attempted to work and live as the male artists did. However, her art was not judged at the time as a male artist's work would be judged. People were scandalized by her bold, overtly sensual depictions of the human body, and her lifestyle as a single woman with a married lover was appalling. Her later works, small and detailed, were not like the bold and grand sculptures of Rodin.

Theme Four: New Initiatives or Research on Issues Relating to Women and Creativity

This theme suggests that women often manifest their creativity in more diverse and diffused ways, whereas men tend to be more single-minded. If this is so, Camille certainly expressed a more masculine type of creativity. She was very focused and driven in her sculpting from an early age, and she became more focused as she matured.

It should not be surprising that Camille expressed a more masculine focus in her creativity. She clearly identified more closely with her father than her mother. Louis-Prosper was intelligent, well-read, sophisticated, and interested in classics and the arts, everything that Camille's mother was not.

Theme Five: Internal and External Barriers to Creative Work in Women

In the years preceding and since Camille's death, much had been made of Rodin's exploitation of her and her family's mistreatment of her. The facts about these situations indicate that all parties had a part in both facilitating and hindering her creativity. But, Camille, herself would have to claim some of the credit and blame for her success and downfall. Her stubbornness and determination fortified her to pursue a career in a very masculine field in the nineteenth century. Yet, these same characteristics estranged people and further isolated her from society. Her behavior before her institutionalization seems by all accounts to have been bizarre and worsening, and she clearly exhibited signs of paranoia. So, her family did not institutionalize a perfectly normal person; though her sequestration seems to have been an extreme reaction.

Yet, Camille did not seem to be held back by many of the other personal barriers that can hinder creative women. Although she clearly had high standards for her work, she was not such a perfectionist that she was unable to complete work. She was a prolific sculptor; so few of her pieces can be found because she did not have the prestige to ensure their preservation and she destroyed so many of them herself in fits of pique.

Nor was she held back by the difference between her ambition and the facts of reality. She defied reality. She did not try to minimize the differences between herself and other women; she did not seem to have a need to be accepted by other women. Her friendship with Jessie Lipscomb was established and maintained because of their similar interests and ambitions; Camille did not change to be more popular with other young women.

She certainly did not subjugate her creative talents, at least not for long. Although she did work under Rodin for a time, her refusal to accept his style and live in his shadow was one of the major sources of contention in their relationship.

Although Camille may have suffered from periodic self-doubt, self-criticism and comparisons to others, her life was marked more by her belief in her talent, feelings of superiority to others, and disdain for those less dedicated to art. This confidence and self-esteem was characteristic of her family, and Camille seems to have gotten a strong dose of both. There is no evidence that she ever doubted her talent; she blamed her failures on Rodin. As her situation worsened, she blamed Rodin's friends as well as part of the conspiracy.

One area Camille may have had in common with other creative females is the loneliness and absence of support by other women. She had few friends as a young girl, and even Jessie Lipscomb, her only true, close female friend as an adult, was distanced from Camille when Jessie chose to marry, have children, and return to her home in England. Her last years living alone were marked by extreme solitude and isolation, then, she was sequestered in the mental institution for 30 years with very few visits from family or friends. Even in the institution, Camille kept to herself away from the other patients.

Finally, Camille certainly shared the satisfaction of the act of creation with other creative women. A study by Kirschenbaum and Reis found that female artists, especially sculptors, enjoyed the physical work of the creative process. One could

not work as long and hard as Camille did without deriving satisfaction from the work. Her satisfaction did not come from wide public acclaim or sales of her work. It probably did not even come from enjoyment of the finished product; she destroyed so many of her sculptures. Yet, she continued to work constantly, as if driven, without any other apparent source of entertainment or companionship, except for her cats. Surely she gained satisfaction from the work.

Mystery and Gamble

In the end, a good part of the interest in Camille Claudel's story is the mystery that still surrounds so much of her life. Of the many letters she wrote, very few remain. Many were destroyed by her family, and others were destroyed by individuals wishing to protect Rodin's legacy. There are continuing questions and speculation about her relationship with Paul. Differing accounts about Camille's pregnancies and whether there were living children who were put up for adoption have left lingering questions. Many of Camille's sculptures, which were not destroyed by her, have disappeared.

Whether Camille Claudel would have developed into as gifted an artist in another time or place is unknown. Whether she would have had a successful career if she had been more conforming, or more sociable, or less defiant, could only be conjectured. Was her meeting with Rodin fortuitous or disastrous? If she had been less beautiful would she have been more accepted? Camille Claudel's talent was surely the result of a number of coincidences of talent, circumstances, time, and events, as well as her actions and those of others. She gambled on living like a man and pursuing her art single-mindedly, and

she wound up paying a high price for it. It is not clear that she really had much of a choice.

See also: Art and Aesthetics; The Dark Side of Creativity; Mental Health: Affective Disorders; Poetry.

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- <http://www.cs.wustl.edu/~louj/camille.html> – Some Beautiful (if tortured) works of Camille Claudel.

Climate for Creativity

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Glossary

Autonomy The perception that one has independence in decision making and goal setting with regard to the accomplishment of work tasks.

Climate The perceptions of environmental conditions that shape individuals' beliefs about the work environment.

Dispositions Underlying psychological processes that, in terms of creative climate, contribute to perceptions of support for creativity.

Participative safety The perception by team members that there is no interpersonal threat for contributing ideas.

Vision A clear, achievable mission that aligns team members toward a goal.

Introduction

It is clear that creativity and innovation are critical to the long-term survival of most modern organizations. However, creativity, or the generation of ideas that are both novel and useful, and innovation, or the implementation of those ideas, are complex and multilevel phenomena. There is a multitude of factors that influence the creative process at the individual, group, and organizational levels, some of which are complex phenomena unto themselves. Climate is one such influence. As Denison pointed out in his 1996 *Academy of Management Review* article about organizational climate and culture, climate is defined generally as the perceptions of environmental conditions that shape individuals' beliefs about the work environment. For instance, this may include perceptions of outcomes, expected behaviors, interpersonal interactions, requirements, and contingencies. Relative to organizational culture, which is a set of organizational values that influence individuals' behaviors, climate is more localized, dynamic, and domain specific. In this article we will review the aspects of a team or organization's climate that may influence creativity, outcomes of a creative climate, potential moderating factors, and ways to assess and develop a creative climate.

Given the cognitive nature of the creative process, it is easy to see that an individual's perceptions of environmental conditions relevant to the creative work will play a role in how the creative process proceeds. For instance, in their 2002 *Harvard Business Review* article 'Creativity under the gun,' Amabile, Hadley and Kramer discuss the negative impact that perceptions of time pressure have on the creative process. Additionally, in another 1998 *Harvard Business Review* article entitled 'How to kill creativity,' Amabile mentions that rewarding individuals for creativity may interfere with their intrinsic motivation and shift their focus to the reward, which decreases their creativity. Given that engaging in the creative process is incredibly cognitively demanding, perceptions of work pressure or being overly concerned about rewards contingent on creative production may overwhelm individuals and make it difficult to devote the cognitive resources needed to solving the creative problem. In this instance, work pressure and contingent rewards are examples of environmental elements that would create a poor climate for creativity.

In their 2007 *Creativity Research Journal* meta-analysis on climate for creativity, Hunter, Bedell, and Mumford demonstrate that evaluating the components of a creative climate is an important endeavor for three main reasons; creative individuals and their creative process are particularly influenced by the conditions of their work environment, climate variables are effective predictors of creativity, and climate measures provide information for specific steps organizations may take to improve creativity. Given the importance of understanding the components of a creative climate, creativity scholars have taken a variety of approaches to interpreting the dimensions, antecedents and outcomes of a climate conducive to creativity. We turn now to a review of these approaches.

Frameworks and Dimensions of Creative Climate

Motivation

Although commonly thought to be a 'light bulb' moment, developing creative ideas is actually a quite difficult and involved process. For this reason, motivation plays a particularly important role in whether individuals are likely to engage in creative problem-solving and their capacity to be successful. In this vein, Amabile, Conti, Coon, Lazenby, and Heron reviewed the development and validation of their measure of organizational factors influencing motivation and creativity in a 1996 *Academy of Management* article entitled 'Assessing the work environment for creativity.' These researchers approached evaluating climate for creativity with regard to the influence aspects of the work environment have on individuals' motivation to engage in the creative process. They identified five general dimensions of the work environment that may facilitate or inhibit individuals' and teams' engaging in creative problem-solving. These dimensions include: (1) encouragement for creativity (organizational encouragement, supervisor encouragement, work group support), (2) autonomy or freedom, (3) resources, (4) pressures (challenging work, workload pressure), and (5) organizational impediments. In general, these dimensions indicate that being encouraged, having control, and being presented with challenging yet personally fulfilling projects will positively influence an individual's motivation to engage in a creative problem-solving endeavor.

Specifically, to engage in the challenge of creative projects, studies indicate that individuals and teams must perceive that the organization is supportive of them spending time on the effort, it is acceptable to take risks, and that creative ideas are valued in the organization. Supervisor support is also critical in that leaders should provide clear, yet not overly restrictive, goals, should give fair and constructive evaluations of creative ideas, and should be willing to reward creativity, particularly with rewards that will not impede intrinsic motivation, such as recognition. For instance, a 1996 study conducted by Oldham and Cummings demonstrated that employees were most creative when they were engaged by challenging tasks, and were supported by their supervisors while not being overly restricted by them. The final element of encouragement involves support at the level of the work team. An individual working on a creative problem can perceive encouragement from his or her work team through a willingness to exchange ideas, sharing a goal to solve the creative problem, and willingness to provide fair and useful evaluations of generated ideas.

Additionally, research indicates that individuals are better able and more inclined to be creative when given autonomy in how to interpret and develop creative problem-solutions. As Amabile notes in her aforementioned 1998 article, not only does autonomy reduce the limitations of how they might go about solving the problem and thus increases the potential for a creative solution, but it also increases the individual's sense of ownership in the process. Perceptions of creative freedom and personal ownership have a positive impact on intrinsic motivation. In addition to autonomy, creative individuals also thrive when challenged. However, if the challenge and work pressure becomes too great, it may impede individuals' ability to focus on the creative problem or will draw cognitive resources away from the resource intensive creative process. Along with cognitive resources, individuals, and project teams must perceive that they have the necessary physical resources that are required. Not only does knowing that adequate resources have been provided ease the cognitive burden of finding them, it also serves as an indicator that the project is valued which has direct implications for an individual's willingness to engage in the project.

On a related note, the final climate dimension suggested to influence motivation is organizational impediments. Often there are conditions affecting the entire organization that may have an impact on individuals' and teams' perceptions that creative problem-solving is possible and valued. These conditions may include turbulence in the market, an overly rigid structure, financial insecurity, or internal conflicts. For instance, individuals in a research and development team for a struggling organization may perceive that engaging in innovation would be fruitless because the organization will ultimately not be able to implement the ideas, thus creating a poor climate for creativity. Based on relevant research, Amabile and colleagues noted this relationship and included it in the development of their previously mentioned measure of organizational climate for creativity.

Team Interactions

While some creativity researchers focused on how perceived characteristics of the group and organization create a climate

for creativity based on their impact on individuals' motivation, West and his colleagues have taken a second approach to evaluating creative climate that has focused on how team-level interactions create a climate for creativity. In their 1998 article describing the development and validation of a measure of team climate for innovation, Anderson and West indicate that members must interact regularly, that there should be an overall goal that focuses their efforts in collective action, and that their tasks are interdependent such that they have come to develop a shared understanding of how the group operates and the ways in which other members work. The specific elements of the team climate that are proposed to be relevant to creativity are (1) vision, (2) participative safety, (3) task orientation, and (4) support for innovation.

A group's vision is important to creativity because it both aligns the members of the group toward a specific goal, and is also motivating by providing focus and direction. In order for the vision to be useful, however, it should be clear, achievable, and agreed upon by all members of the team. Creative tasks are challenging unto themselves, but in a group setting, with multiple individuals working through the creative thought process individually, it becomes exponentially more complex. Along these lines, Pearce and Ensley's 2004 study on shared vision in innovation teams demonstrated that a group's shared vision of a goal was positively related to ratings of innovativeness. Thus, for individuals and groups to succeed, it is necessary that the individuals within the team share a common understanding of what is to be achieved. In addition, the goal must be clear to facilitate coordination of multiple individual efforts, and should also be achievable so that members stay motivated.

In addition to having a shared understanding of the goal, another important aspect of the team's climate for creativity is participative safety, or the perception by members that there is no interpersonal threat for contributing. Edmondson and Mogelof discuss the concept of psychological safety in a chapter in Thompson and Choi's 2006 book entitled *Creativity and Innovation in Organizational Teams*, and indicate that individuals are more likely to contribute ideas or engage in necessary critiquing of others' ideas if it is understood that they will not be judged for doing so. Not only does this result in more ideas being proposed, and a more thorough review of those ideas that are proposed, but it also increases engagement in the outcome of the creative process when the team members participate more in the development.

A third element of team interactions that promotes a climate for creativity is a general orientation of the team towards improving the team's performance on the given task. In this regard, team members are collectively committed to excellence by holding one another accountable, implementing a system for monitoring progress and establishing performance criteria, providing feedback and advice to one another, and maintaining an openness to adopting changes to improve the project outcome. In the dynamic interpersonal environments that are present within teams, it is critical to a creative effort that the focus on the task is maintained and the team be united in a desire to seek the best possible outcome. In his 2002 *Applied Psychology: An International Review* article on characteristics of work teams that promote creativity and innovation, West highlights many of these and other related factors as important for innovation success.

The final element of team interactions relevant to creative climate is support for innovation. Support for innovation can take many formal and informal forms. Formally, the team, or organization more broadly, may clearly articulate expectations and support for innovation through mission statements, job descriptions, reward systems, among others. It is also critical to individual's perceptions of team and organizational support that resources be made available. Specifically, if individuals do not feel that they have the time, technology, or financial support that they need to develop new ideas, they will be less likely to participate in innovative efforts. Informally, members of the team and organization may also create norms that indicate a general appreciation for creativity and innovation. Each of these four team processes, vision, participative safety, task orientation, and support for innovation, plays an important role in creating a team climate that will foster creativity.

Dispositional Factors

The third main approach to evaluating climate for creativity takes into consideration the dispositions, or underlying psychological processes, that contribute to perceptions of support for creativity. Ekvall, in his 1996 article entitled 'Organizational climate for creativity and innovation,' focused on individual psychological factors that may influence these perceptions and identified nine different individual dispositions. Specifically, these are personal psychological factors that are influencing an individual's willingness to act creatively. They include challenge, freedom, idea support, trust/openness, dynamism/liveliness, playfulness/humor, debates, conflicts, risk taking, and idea time.

Similar to the motivational approach, the first two dispositional factors are challenge and freedom. Under challenging conditions, individuals are stimulated, engaged and obtain meaning from doing their work and are thus more likely to put forth additional effort and engage in creativity and innovation. If individuals are distancing themselves from their work or are disengaged because of apathy or lack of a challenge they are less likely to go the extra mile to be innovative. A 2000 study by Andriopoulos and Lowe published in *Management Decision* demonstrated that organizations could promote innovation by continually challenging employees to keep them engaged. Additionally, as mentioned earlier, individuals are more likely to be creative when their behavior is not overly restricted and they are given the freedom and autonomy to find new ways to accomplish their tasks. Individuals become active participants in the work, take ownership of it and are more likely to think of better, alternative ways to accomplish their goals.

The next two dispositional factors overlap somewhat with the team interaction conditions mentioned earlier. Idea support and trust/openness are both critical to ensuring that individuals within the team and organization feel comfortable being creative. Idea support refers to the understanding that it is acceptable to question the status quo and that presenting new ideas is valued and encouraged. Trust or openness is, as mentioned before, paramount to creative climate because individuals should not worry about their contributions being ridiculed, nor should they be concerned about judgment should the new ideas fail. In a 1976 *Journal of Applied Psychology* study, Klimoski and Karol evaluated the relationship between perceived interpersonal trust and creativity and found that more

ideas were generated when individuals perceived higher levels of trust in the group. Both of these conditions create a climate that encourages individuals to voice new ideas and does not break them down for doing so.

Two other dispositional conditions within the team environment that effect creativity are the degree to which it is dynamic, engaging and lively, and the level of playfulness or humor. In a team in which these conditions are present, individuals are stimulated because they must react to a rapidly changing environment and also because the sense of playfulness releases the psychological restrictions of an overly rigid environment. It is proposed that an environment that is designed to be stable, caters to the status quo and is void of humor and levity will hinder the flow of new ideas.

Along those lines, it must also be acceptable within the group and organization to challenge the status quo and each other through constructive debate. Everyone should be given room to have an opinion. However, care must be taken to ensure that fostering debate does not lead to unnecessary and unconstructive conflict. The emotional and psychological turmoil caused by interpersonal conflict within the group can sap valuable cognitive resources and would likely lead to disengagement and a decrease in psychological safety, making it increasingly unlikely that new ideas would be shared. Chen's study on the benefits and detriments of conflict during creative projects, published in 2006 in *Creativity and Innovation Management*, supported the proposition that conflict related to the task or solving the problem can be beneficial but interpersonal conflict is likely to be detrimental to team processes.

Finally, groups and organizations that avoid uncertainty and risk will not be open to innovations. Organizations and groups must be able to respond rapidly to opportunities that call for innovation and thus must be able to accept the risk of responding quickly. All innovations are departures from the norm and thus are, in some way, risky. In addition to being allotted room to take risks, individuals must also be given the time to be creative. Innovation does not happen in an instant, so the organization and team must ensure that individuals are afforded the room to spend time considering alternative ideas. Although there has been substantial overlap in general concepts between the three approaches reviewed so far, they are not entirely comprehensive unto themselves.

An Integrated Framework

There are several other ways that researchers have gone about describing climate for creativity. In addition to the three approaches already discussed, others have focused on organizational learning, appraising the environment, employee engagement, and specific requirements for developing new products. More recently, there has been an effort to integrate the various ways that researchers have described climate factors. In a 2005 article entitled 'Dimensions of creative climate: A general taxonomy,' Hunter, Bedell, and Mumford reviewed available creative climate taxonomies and determined that nearly all of the variables included in the range of approaches could be encompassed within 14 dimensions. These dimensions include: (1) having a positive peer group, (2) having positive relationships with supervisors, (3) available resources, (4) challenging work, (5) having a clear mission or vision,

(6) being given freedom or autonomy over one's work, (7) positive exchanges with other members, (8) being intellectually stimulated by the work and those around you, (9) receiving support from top management, (10) being rewarded, (11) acceptance of risk taking and flexibility in thinking, (12) a focus on products, (13) encouragement of participation, and (14) integration of organizational processes.

This final collection of factors seems most useful because it incorporates both interpersonal elements (e.g., positive peer group, positive supervisor relationships), and task elements (e.g., challenging work, clear goals) but is also multilevel. It demonstrates that developing a climate for creativity involves individual level processes (e.g., freedom or autonomy), group level processes (e.g., positive peer group), and organizational level processes (e.g., top management support). Having reviewed the dominant ways in which the literature has defined the components of a creative climate, we now turn to the critical outcomes of a climate for creativity.

Outcomes of Climate for Creativity

Research on climate for creativity has made it clear that climate does, in fact, have a significant influence on critical creative outcomes. Additionally, these outcomes span all levels of the organization, from the individual to the organization as a whole, and also generalize across types of organizations, cultures, and focus of the work. When teams and organizations take care to establish a climate that facilitates creativity, it has been shown to have significant effects on the creative problem-solving of individuals, project adoption, project success, as well as long-term organizational outcomes.

Much of the climate elements reviewed in the previous sections are focused on the conditions that will encourage individuals to engage in creative problem-solving and help them succeed should they do so. For instance, having challenging work, autonomy and a clear goal to work towards is likely to jump-start creativity. Trust, openness and constructive criticism will keep the creative process moving forward in a positive direction. Finally, having support from team members and supervisors, and the resources required to carry it out will fuel the individual's creative process.

Another significant, and less obvious, outcome of establishing a climate for creativity is the increased chance that a creative project will be adopted. There are several components of the creative climate taxonomy that are specifically relevant, including top management support, flexibility in risk taking, and organizational support for innovation. If it is clear through organizational documents, norms, and discussion that innovation is of value, members of the organization will be more likely to buy-in to supporting the innovation – a critical point due to the level of organizational disruption that innovation often causes. The organizational support is particularly effective if it is communicated by the top management team. Additionally, if the organization is not risk-averse, it will be more receptive to implementing new initiatives.

Along similar lines, not only does a climate that supports creativity facilitate project adoption, it is also likely to increase the chances of project success. If the climate is such that all individuals feel comfortable contributing their ideas, it increases

the chances that a high quality idea will be presented. Additionally, a psychologically safe environment that encourages constructive conflict will increase the evaluation and adjustment of project ideas, resulting in more refined and higher quality solutions. In a study along these lines, Baer and Frese's 2003 *Journal of Organizational Behavior* article on climates for initiative and psychological safety demonstrated the link between critical climate variables, innovation in the organization, and ultimate firm performance.

Finally, by improving creativity and innovation, establishing a climate supportive of creativity will lead to long-term organizational outcomes such as competitive advantage, and survival. The critical role that innovation plays in the overall success of organizations has been regularly documented by organizational research and it is particularly critical in the current dynamic, technology-driven marketplace. Any organizational strategy that improves creative problem-solving and facilitates project adoption and success is a worthwhile intervention. However, while the organization or group may facilitate creativity by developing a climate that supports it, there are several intervening variables that may moderate the relationship between a creative climate and team and organizational outcomes.

Moderators

Based on prior research, it is evident that there is a variety of work, group, organization and environmental variables that may moderate the relationship between creativity and the outcomes discussed in the previous section. Specifically, the effect that climate has on creative outcomes may vary as a function of task conditions, characteristics of the group, characteristics of the organization, or the environment in which the organization is operating. It is critical to understand these moderating variables so as to implement climate characteristics appropriately based on the given situation.

With regard to work task conditions, research indicates that stage of the innovation process plays a role in how great of an impact climate has. For instance, a study published in *Small Group Research* in 2001 by Bain, Mann, and Pirola-Merlo indicates that climate has a stronger effect during research tasks than it does during development tasks and is more critical during the early stages of creative efforts rather than the later implementation stages. Additionally, other research indicates that task complexity or difficulty, and the autonomy that individuals are given may moderate the relationship as well. Specifically, the criticality of the climate variables may have a decreased impact for simpler innovations where engagement is not as critical, or for tasks in which individuals have little control over their work and thus can engage in little innovation regardless of the climate.

Along with characteristics of the work being done, there may also be characteristics of the work group that moderate the relationship between climate and creativity. The findings of a 2001 *European Journal of Work and Organizational Psychology* study by Curral, Forrester, Dawson, and West supports this in that they found that larger groups had weaker team processes as measured by climate indices. Thus, in larger groups it may be more difficult to have a clear and strong climate that would influence individuals to be creative. Additionally, varying

levels of cohesion, coordination and interdependence may impact the relationship between climate and creativity. For instance, in a group with low cohesion or coordination, it may make little difference that team members feel safe contributing ideas because the ideas will not be well integrated with the ideas of other members.

In addition to work and group characteristics, there are also organizational characteristics that may have intervening effects in the climate and creativity relationship. Although a team's climate may facilitate creativity, conditions within the organization may make it more or less likely that the product of the team's creativity can be capitalized on. For instance, Nystrom, Ramamurthy and Wilson's 2002 *Journal of Engineering and Technology Management* study on technological innovations indicated that an organization that is larger or has more available resources will be better equipped to support project ideas than a smaller firm could. In addition to size and resources, an organization's learning orientation, structure and level of professionalization can also play a role. A positive learning orientation will make the organization more receptive to new ideas, horizontal and vertical structures may be differentially appropriate given the type and scope of an innovation, and encouragement of participation may play a bigger role in a highly professional organization where members have the capability to contribute to the creative process.

Environmental factors that are external to the organization may also moderate the climate-creativity relationship. Some potential environmental moderators include turbulence, market demands, and competitive pressure. For instance, if the environment that the organization exists within is rapidly changing with ever-changing demands from customers or pressure from competitors to adapt, it is likely that enhancing a creative climate will be more critical than for an organization in a stable environment in which it is not critical that the organization develop new products or processes to satisfy customers or keep up with competitors. A meta-analysis conducted by Damanpour in 1996 supports the proposition that the environment that the organization is in plays a role such that environmental uncertainty moderated the relationship between organizational variables related to climate (i.e., structural complexity, size) and innovation.

At this point it is clear that climate is a multi-faceted phenomenon that plays an integral role in organizational creativity and innovation, but that the influence of climate may vary depending on work, group, organizational and environmental factors. To determine what the effect is, exactly, it is necessary to evaluate the presence and effectiveness of the climate dimensions. Assessment of climate dimensions also proves important if we hope to ultimately intervene in organizational processes to create a climate that supports creative efforts.

Assessment and Interventions

There are a number of ways in which climate for creativity is assessed within organizations including standardized, validated measures and localized measures used for specific organizations. On the whole, it is clear that climate can be measured; however, it is also apparent that standardized instruments, such as the KEYS: Assessing climate for creativity,

Creative Climate Questionnaire, Situational Outlook Questionnaire, Team Climate Inventory, and the Siegel Scale of Support for Innovation, are the most reliable ways to evaluate creative climate. A recent *Creativity Research Journal* meta-analysis conducted by Hunter, Bedell, and Mumford in 2007 compared the relationship between these measures, localized measures and creative outcomes and found that the standardized measures produced stronger effects sizes in their measurement of creative climate than did locally developed measures. It was thus recommended that standardized instruments be utilized when evaluating climate for creativity.

In discussing the evaluation of creative climate it is also critical to understand the measurement of the outcomes by which the influence of climate is assessed as the differences between the criteria may play a critical role in the overall evaluation of the interventions. At the individual level, creative problem-solving is often evaluated via self or supervisor ratings of creative output. Clearly both of these methods are prone to biases and, whenever possible, should be utilized in conjunction with objective measures of creativity, or at the very least be made with clearly benchmarked rating scales. A more objective criterion measure would be expert assessments of products produced (e.g., professional reviews, publication). At the organizational level, some of the criteria used to assess the contribution of climate to creativity have included innovation adoption rates, return on investment, organizational profits, and market share, among others. When evaluating the relationship between climate interventions and creative performance, it is critical that the criteria be taken into account and ideally selected to be appropriate to the climate element being focused on.

Following an evaluation of a team or organization's creative climate, it may be necessary to improve the climate or to intervene to create a climate for creativity in the first place. Given the multifaceted nature of climate, it may only involve an intervention for one element of the climate (e.g., resource availability) or one level of influence (e.g., the leader). Based on the available research and the dimensions of climate reviewed in the first part of the chapter, recommendations can be made for interventions at the leader, group process, and organizational level.

For a leader of creative efforts, the research on elements of creative climate indicates that he or she should demonstrate support for the creative effort and innovation in general and demonstrate that taking risks and shifting the status quo is something that is desired. Interpersonally, the leader should establish a positive relationship with the subordinates, and engage in a positive interpersonal exchange. In terms of the tasks being accomplished and the structure of the work, the leader should establish a clear goal, but also give individuals the autonomy and freedom to develop unique ways of achieving the goal. The work should be challenging to keep them engaged but also achievable so as to maintain motivation. Finally, if the leader is rewarding creativity, it should be rewards focused on recognition rather than concrete benefits (e.g., bonus) and somewhat distanced from the immediate creative output so that intrinsic motivation is not diminished.

Project teams, themselves, must also take steps to create and maintain a climate supportive of creativity. Although the leader may initiate certain processes, the group members should also seek to establish positive relationships with one another, create

a psychologically safe environment, and encourage participation among team members. Given that much of the creative work in organizations is conducted in teams, it is critical that team processes not interfere with individual creative problem solving, or discourage individuals from engaging in the creative process. Members must perceive that their ideas will be heard without unnecessary ridicule from other members, but should also understand that feedback and constructive criticism should be accepted without any perceived threat.

Finally, the organization as a whole may take steps to improve the creative climate. Senior leaders within the organization can demonstrate support for creativity and appropriate levels of risk taking by discussing it, modeling it and infusing it into the culture of the organization. The organization can be structured such that work flow and management structures allow for autonomy and freedom. Additionally, the organization must provide the necessary time, technology, and human resources necessary to engage in creative efforts. These organizational interventions will give individuals the perception that creativity and innovation are valued, supported, and that they will have what they need to be innovative. As we mentioned earlier in the article, climate is a function of individuals' perceptions of environmental characteristics that play a role in how they behave. Thus, these interventions that the leader, team and organization engage in are only influential if they are perceived as legitimate and genuine.

Conclusions

There are several important conclusions that should be drawn with regard to the influence of climate on creativity. First, it should be noted that climate is a complex phenomenon with multilevel factors playing a role. It can be evaluated through multiple lenses, such as motivation, team processes, or individual dispositions. Additionally, not only does research consistently indicate that climate plays a role in the encouragement, facilitation and success of creative efforts, but it is also an

organizational process that can be manipulated relatively easily to foster innovation. There are, however, moderating factors with regard to the work task, and group, organization and environmental characteristics that should be taken into consideration when determining the potential impact of climate interventions. Finally, it is clear that the elements of climate can be successfully measured and that organizations can use these evaluations to intervene in establishing a climate that will foster creativity and innovation – a worthwhile endeavor in the current dynamic and technology-driven market.

See also: Attitudes and Creativity; Barriers to Creativity and Creative Attitudes; Creative Environments, Conditions, and Settings; Group Creativity; Leadership; Motivation; Organizational Culture; Teams.

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Cognitive Style and Creativity

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Glossary

Cognition The process of perceiving, recording, storing, organizing, and using information.

Cognitive ability Efficiency in the processing and storage of information.

Cognitive strategies Systematic methods people use to process information and solve problems.

Cognitive style Consistent individual differences in the ways people experience, perceive, organize, and process information.

Mediator A given variable may be said to function as a mediator to the extent that it accounts for the

relation between an explanatory variable and a dependent variable.

Moderator A moderator is a human characteristic variable that affects the direction and/or strength of the relation between an explanatory predictor variable and a dependent variable.

Personality trait Consistent individual differences in dispositions for specific classes of behaviors.

Validity Correspondence between what test scores purport to measure and what they actually measure.

The Construct of Cognitive Style and Its Validity

Cognition embraces a wide scope of human information processing, which includes perception, memory, language, learning, thinking, problem solving, and creativity. Over the years researchers have identified many kinds of individual differences in several such aspects of information processing, and some of these dimensions have been construed as dimensions of cognitive style. Researchers have found it useful to make further distinctions within the construct of cognitive style, such as thinking, learning and intellectual styles. Clinical, differential and social psychologists have also used style concepts like coping styles, defensive styles, expressive styles and response styles. Recently, arguments have been made to the effect that cognitive styles and learning styles should be classified under the more general umbrella of intellectual styles. In this article we will primarily focus on the more classic conceptualization of cognitive style and subsequently its relationship to creativity. We recognize the fact that both concepts that are the topic of this entry are difficult to operationally and reliably measure, which makes the discussion of their relationship all the more problematic.

The term 'style' designates a preferred manner or way of doing things. Hence, cognitive style can be defined as consistent individual differences in the ways people organize, and process information. A number of style theories exist and operational definitions of cognitive style have focused on a person's typical mode of cognition as reflected in, for example, his or her main dispositions in perception, the organization of information in memory, the preference for different kinds of general problem solving strategies, the speed and accuracy of decision making under uncertainty, the preference for different types of problems to solve, or the profile of intellectual dispositions, and more. Some of these distinctions describe preferences for different approaches to dealing with the challenges involved in creativity.

While theoretical and operational definitions such as the preceding ones may appear fairly straightforward, it should be appreciated that the construct of cognitive style has been associated with several problems during its tenure in the scientific arena. Such problems impact on the validity of the construct. The more important of these can be grouped into six major issues.

First, most style researchers have made a distinction between cognitive styles and cognitive abilities. While cognitive styles are defined as describing *how to*, or in what way we process information, cognitive abilities are defined in terms of *how well* we process information. Cognitive abilities capture how much, how well, or how accurately we process visual, semantic, or numerical stimuli, and are rooted in structural conditions that do not leave much room for choice. In contrast, cognitive styles describe differences in dispositions to process information in certain ways, and are anchored in functional conditions that provide more room for choice in, for example, the types of general strategies we tend to employ when working on problem solving tasks. Cognitive style may also determine whether we primarily perceive wholes or parts in dealing with tasks of problem solving, learning or creativity. Lack of, or low, correlation between style and ability has commonly been seen as a necessary condition for a style construct to be valid. It seems reasonable to accept that under certain circumstances, cognitive ability and style should be rated. Certain tasks suit certain styles: brighter people may be able to adapt their style to suit the nature of the task. Further, preferences possibly 'grow out of' abilities. Thus, a facility with numbers may lead to a preference for convergent thinking, while a facility with words may lead to a divergent thinking style. Not all the postulated style constructs have, however, controlled for influences from abilities. Some style constructs have also been shown to have alarmingly strong correlations with measures of abilities, which puts them in serious jeopardy in terms of fundamental construct validity – that is the two are essentially indistinguishable.

A second issue is that the psychological basis for many style constructs may be seen as an accumulated personality impact on cognitive processes. This means that our motivational dispositions based on the traits in the five factor model of personality may dispose us toward using certain modes of information processing unless the task demands in the situation 'force' us into other modes of processing. It is just as conceivable that differences in personality profiles may correlate with preferences for cognitive styles. Moderate correlations thus must occur, yet the same requirement for incremental validity in terms of accounting for variance beyond what is explained by relevant personality factors, or other relative advantages, must be shown for cognitive styles to survive as a sound, autonomous construct. Under these conceptual requirements, the construct of cognitive style can be described as being placed at the intersection between personality and cognition. In this capacity it may serve an important function as a bridge concept that may bring personality and cognition together in a concerted way to optimize performance. Indeed, this is how the concept was initially conceived over 80 years ago. An implication of this is that several cognitive styles should be more strongly related to various personality constructs than to intelligence, and that style should be seen as a disposition more than as a situational preference. Very few, if any, style studies have controlled adequately for the effects of personality in the predictions of performance on cognitive tasks.

A third issue is related to a distinction between task specific strategies versus higher order strategies, sometimes called meta-strategies or executive functions. Most researchers in the field have chosen the latter option, where styles are held to be more strongly associated with more general, or higher order strategies, rather than task specific strategies. An implication of this is that styles should be relatively more consistent across tasks and stable over time than task-specific cognitive strategies. This issue has, however, received relatively little attention in research on cognitive styles.

A fourth issue is that style theories have flourished without the existence of any unifying model or framework for the several style constructs. Some progress has nevertheless been made in this regard, and Richard Riding and Stephen Rayner describe a theory where a large number of cognitive style constructs are organized under two superordinate style dimensions called verbalizer-visualizer and analyst-wholist styles. The first of these describes typical modes of mental representations and the second pertains to the way in which the individual organizes information. Other researchers have suggested that style theories can be described as cognition-centered, personality-centered, and activity-centered, whereas a later classification divided style constructs into Type 1 (preference for unstructured tasks, norm breaking and original thought), Type 2 (preference for structured tasks, conformity, respect for rules and authority), and Type 3 (situation specific adaptability of Type 1 and Type 2 styles). Maria Kozhevnikov argued that most style constructs could fit into a model where there are two levels or dimensions. The superordinate dimension was seen as related to executive cognitive functioning (associated with flexibility in the choice of lower level strategies), and (at least) two subordinate dimensions seen as describing either low-level information processing (like perception) or more complex

cognitive activities (like decision making). Despite these attempts, no agreed upon, clear typology of cognitive styles yet exists.

A fifth issue is whether style should be defined as being bipolar or unipolar. In the former case, one end of a style continuum should be associated with certain characteristics, while the other end would be associated with the opposite characteristics. People located in between the extreme scorers are seen as being more flexible or mixed in their dispositions. To investigate this issue more closely requires that each pole is operationalized separately, and that scores on both poles are negatively correlated with each other. Bipolarity can be inferred to the extent that there is a relatively strong and negative correlation between the two polar opposites, with lack of incremental predictive validity for one end of the continuum when statistically controlling for the other. Related to this issue is also the position taken by Eugene Sadler-Smith that, for example, intuitive-analytical cognitive styles actually describe two different cognitive processes, with a versatile style combining the two, or as Chris Allinson and John Hayes have posited, that the analytic-intuitive dimension describe two poles on a continuum. A further distinction in this respect is described as mobility-fixity, where mobile dispositions describe a tendency to use both styles, while fixity describe a tendency to use only one. Associated with the bipolarity issue is also the hypothesis that both poles of stylistic constructs should, in the general sense, be value free. In practice, however, one pole in most style constructs has tended to be more valued than the other, which is rarely the case.

The sixth issue concerns whether cognitive style theories should operate as self-contained models or be related to more general theories of cognition and eventually also linked to theories of personality in a broader perspective. The latter alternative implies that styles should be defined in ways that make their operationalizations meaningful in a perspective defined by the style construct itself. This has not always been the case for style theories, and a large number of theories have been formulated based on loosely defined ideas. Samuel Messick has made important strides in anchoring conceptualizations of cognitive styles more firmly, and suggests that styles evolve around underlying profiles of abilities, traits, or motives, which is strongly akin to the perspective advocated in this article. Moreover, while styles can be quite substantially influenced by both ability and personality, they should also be seen as shaped by individual experiences and adaptations. Finally, based on the review by Kozhevnikov, it can be suggested that cognitive styles have adaptive functions and that they typically describe dispositions towards using different kinds of heuristics that we use to process information about our environment. In this regard, style theories can be naturally related to theories of information processing, for example within the heuristics and bias tradition in the domain of judgment and decision making.

Despite the challenges associated with the six issues above, cognitive style has been a popular construct in psychological and educational research. Since the early 1950s and earlier, a large number of studies on style constructs have been published in journals and in edited and authored books. A number of these have touched on the relationship between cognitive styles and creativity. Moreover, several theories have been

postulated over the years, and cognitive style has indeed been looked upon as a promising construct within the field of creativity. The main reason for this is that it has been seen to have the potential to supply some of the missing pieces of the puzzle from the classic experimental research on human cognition. Here individual differences generally have been perceived as irrelevant, or as a 'nuisance' in terms of error variance. The construct of cognitive style has been used to describe *how* individuals process information in different ways and to show that the inclusion of data on individual differences adds to our knowledge of human cognition beyond the reaches of both classical experimental research and multivariate studies of intelligence. As regards the relationships among cognitive styles, problem solving and creativity, an important issue has been to investigate whether people solve problems or create novel and useful solutions in predictively different ways. Below, we briefly present a number of style constructs, although more such constructs, like convergent-divergent and verbalizer-visualizer styles, could have been presented if space had permitted.

Theories of Cognitive Styles and Their Relationship to Creativity

Classic Theories

Cognitive controls

Work on cognitive controls began in 1951 and was partly based on psychodynamic theory. A cognitive control was seen as a hypothetical construct in the sense of a delay mechanism that directs the expression of needs in socially and situation-specific acceptable ways. Seven different controls were theoretically specified and operationalized: tolerance for unrealistic experiences, conceptual differentiation, constricted-flexible control, levelling-sharpening, scanning, contrast reactivity, and field articulation. These several control constructs were originally measured experimentally, while other measurement methods were developed later. Cognitive styles were defined as patterns of controls.

As regards the validity of the cognitive control theory, several criticisms have been put forward. It has been argued, among other things, that various controls did not appear consistent across different studies, and that correlations with different criteria were generally low, and seldom significant. There have been theoretical inconsistencies associated with cognitive control research, and it has been argued that cognitive controls to a large extent were treated as value directional and unipolar.

The relation between cognitive controls and creativity was investigated in a sample of gifted children. The studies did not yield consistent results concerning the relationship to creativity. It turned out to be possible to isolate three styles (clusters) in this sample, which may imply that there are differences in the stylistic dispositions of gifted students beyond the level of ability. However, based on contemporary standards for validation, the limitations pointed out in the preceding criticism lead us to the conclusion that there is insufficient support for the validity of stylistic constructs associated with cognitive controls. Consequently, the relationship to creativity is also uncertain.

Field dependence–independence

In 1954 research was initiated on field dependence and independence as a stylistic construct. This construct was defined as a process variable, representing the degree of autonomous functioning in assimilating information from the self and field. On the basis of several later theoretical and empirical developments, field dependence–independence was defined as a bipolar construct. Specifically relevant for creativity was the thesis that field-independent subjects are better at cognitive restructuring, while field dependent subjects are more socially adept because they are more sensitive to external referents. Moreover, field-dependent and field-independent subjects could be *fixed* (those who appeared not to have any capacity for the properties associated with their opposite style), or they could be *mobile* (those who appeared to be more flexible with regard to the two types of styles). Thus, some people were seen as more flexible than others with respect to their stylistic dispositions. These stylistic properties were measured with two different tests. One was the Rod and Frame Test, where the task involved ignoring a visual or postural context to locate a true vertical. The other was the Embedded Figures Test, where the task involved locating a previously seen simple figure in a new figure where the simple figure had been embedded within a more complex design.

Results from several studies supported the hypothesis that field-independents are more creative than field-dependents. Moreover, it has been argued that mobile subjects would be more creative because of their ability to move flexibly between the two stylistic modes. While this work seems interesting from a creativity perspective, it is nevertheless necessary to interpret these results and ideas cautiously given the present conceptual status of the theory of field dependence–independence.

The theory of field dependence–independence was very popular and generated a substantial number of studies until around 1980, when interest in the construct declined.

During the eighties serious criticism was raised against this theory, for example, the frequently found high correlations with measures of general mental ability and, particularly tests of spatial ability. Based on such findings a cloud of basic doubt lingers over the concept of field dependence–independence as a pure measure of style versus ability. Several recent attempts to reformulate this theory indicate that research on field dependence–independence might continue in spite of previous challenges and disappointments.

Reflectivity–impulsivity

This cognitive style dimension relies on differences in decision speed under conditions of uncertainty. Its primary measure was the Matching Familiar Figures Test, where individual differences in speed and accuracy of decision making (conceptual tempo) under uncertainty were measured. Time to make decisions and errors in the accuracy of decisions were combined to categorize children as impulsives or reflectives, or more precisely as fast-responding/high-error, fast-responding/low-error, slow-responding/low-error, or slow-responding/high-error types. Previous reviews of this theory brought, on the whole, positive conclusions for reflectivity–impulsivity as a style construct. The overall conclusions from these reviews show that reflectivity–impulsivity is moderately stable and

generalizable across similar tasks. Task performance for reflectives and impulsives seems, however, to be dependent on task demands. Thus, reflectivity–impulsivity may describe a bipolar construct, where each pole has differential value. Impulsivity has, however, been found to be associated with lower intelligence and lower motivation than reflectivity, and the question is whether this cognitive style distinction yields results that are significantly beyond those obtained with measures of general mental ability.

The study of the relationship between reflectivity–impulsivity and creativity has provided mixed results. No significant differences were found among conceptual tempo groups on a series of common creativity and problem solving tasks. It has, however, been shown that fast/accurate and slow/inaccurate subjects obtained greater originality scores than slow/accurate and fast/inaccurate subjects. Significant relationships also have been obtained between reflectivity–impulsivity and some facets of musical creativity, and reflective subjects have been shown to score higher than impulsive subjects on the Torrance Tests of Creativity. Although no clear pattern in these findings has emerged, where significant relationships have been obtained, reflectives have had higher scores.

Recent Theories

Theories in the holist – analytic category

In Richard Riding and Stephen Rayner's organization of style theories a number of style constructs have been placed in the holist-analytic category and some of these bear clear relevance to creativity. Among these, the style theory advanced by Michael Kirton in 1976 has made a special contribution to the study of creativity. In this theory Adaptors and Innovators (A-I) are seen as describing two qualitatively different and consistent individual approaches in preferences for different ways of solving problems and approaching tasks involving creativity and in decision making. Kirton makes a distinction between style and level of creativity. Level of creativity is measured through evaluation of the quality of people's creative ideas or products. Style of creativity is supposed to capture the different approaches of adaptive creativity directed toward improvements within an existing framework, compared with innovative approaches directed towards basic change of the existing state of affairs. However, individuals are not seen as being fixed at either end of the A-I continuum, and when individuals depart from the behavior associated with their preferred style this has been called 'coping behavior.' It is argued that differences along the adaptive–innovative continuum should be unrelated to variations in the level of creative performance.

In several studies, it has been demonstrated that the Kirton Adaptor–Innovator inventory (KAI) typically does not in general correlate with measures of intelligence. On the other hand, a relatively strong relationship has been obtained between scores on several personality traits and the KAI, for example, between KAI scores and the sensation seeking trait. This means that Innovators tend to have a higher need for stimulation and excitement than Adaptors. Other researchers have found that the A-I continuum is positively related to Extraversion and Openness, and negatively to Neuroticism

and Conscientiousness in the five factor model of personality. Based on these style–intelligence–personality correlations, basic requirements for a theory of cognitive style seem to be fulfilled. Yet, there seems to be a need for studies showing that the KAI adds to prediction of creativity by abilities and personality.

As regards creativity, the main bulk of research shows that KAI scores are uncorrelated with various measures of divergent thinking. This has been taken as support for the idea that there are different types of creativity along the adaptive–innovative dimension that are independent of level of creativity. Generally speaking, however, zero correlations as such do not support the hypothesis that there are different types of creativity; they only support the idea of unrelatedness. Moreover, some studies indicate that Innovators obtain higher scores on some measures of creativity. On the other hand, it was found that Adaptors perceived creative products in their workplace as more logical, useful, and adequate than Innovators, while Innovators perceived creative products as more original and transformational than Adaptors. These findings were interpreted as supporting Kirton's theory that there are different types of creativity. However, self-reports on both style and creativity evaluations do not necessarily support this idea.

Although Kirton's theory is interesting, the bulk of research on the theory is correlational or factor analytic. This implies that some of this research may lack the necessary controls to permit making causal inferences. This is a limitation when it comes to testing the main hypothesis in the adaptation–innovation theory. Further efforts should thus be made to demonstrate experimentally that A-I indeed utilize qualitatively different strategies uncontaminated by level of creativity, and that these strategies have different implications for the direction of effort in creativity, problem solving, and decision making. Kirton's idea of a distinction between the style and the level of creativity is useful, but the support for this idea is so far too limited to warrant such a conclusion. Arguments have also been presented to the effect that the distinction may be conceptually flawed. Specifically, it has been argued that the concept of innovation/innovative logically requires the concept of creativity to be involved, whereas the concept of adaptation/adaptive does not.

Another theory in the holist–analyst category of styles is the theory of Assimilator–Explorer (A-E) cognitive styles which has been proposed by Geir Kaufmann and later elaborated by Øyvind Martinsen. The theory of A-E styles describes individual differences in dispositions toward using problem solving strategies, and Kaufmann based his original theory on cognitive schema theory with special reference to Piaget's core concepts of assimilation and accommodation. Assimilators are seen as more rule bound in problem solving behavior, and as having a disposition toward interpreting new events in terms of existing knowledge. In an expansion of Piaget's concepts, Explorers are seen as having a disposition toward novelty seeking, which manifests itself in a search for new types of solutions and new ways of solving problems without any external pressure to do so. The A-E styles have been suggested to be partially rooted in biologically-based preference for stimulus variability versus stimulus stability.

This stylistic distinction also has been found to have several correlations with measures of personality, while they are

uncorrelated with general intelligence. The A-E styles correlates quite strongly with a motivational factor, and also correlates with Neuroticism, Agreeableness, and Conscientiousness, and with Openness in the five factor model of personality. Significant differences have been found in mean scores for students in different types of educational settings, with art students having the highest scores (more explorative). A significant correlation also was found between the A-E styles and scores on a creative activities checklist (Explorers having higher creativity scores), but there was only a weak, yet still significant, correlation with measures of verbal and figural fluency. Taken together, the correspondence between the A-E theory and the pattern of empirical findings is consistent with the requirements in basic definitions of cognitive style.

Other studies have sought to validate core premises of the A-E theory more specifically. It has been found that Assimilators need task-relevant experience to use their preferred mode of processing efficiently, while Explorers are more proficient when exploring the task environment when they have low levels of experience. It has also been found that Explorers and Assimilators performed differently based on instructions to utilize different types of problem solving strategies on creative problem solving tasks. This finding was interpreted as experimental evidence for the idea that people with different stylistic dispositions normally utilize qualitatively different problem solving strategies where the experimental instructions may have compensated for task specific challenges associated with the poles of A-E styles.

In an extension of A-E theory, it has been argued that A-E styles can be seen as a relevant indicator of task-specific competence, but that such task-specific competence does not necessarily lead to superior performance. Other conditions contribute to impairing or facilitating performance beyond the degree of compatibility between stylistic dispositions and task demands. In this regard interactive effects between stylistic disposition, degree of task-relevant experience, cues in the situation such as solution hints, the salience of motivation arousing conditions, as well as positive mood, together may influence performance. This dynamic interplay may be explained by a theory of optimal motivation for the task, where task characteristics, styles, affect arousing conditions, and achievement motives together determine the quality of performance. This indicates the difficulty of research in this area.

In general, it can be argued that the A-E styles seem to have a base in human personality, are orthogonal to measures of general intelligence, and predict performance on creativity tasks in interaction with other influences. The theory has the advantage that it can be coherently integrated with theories of personality and achievement motivation, and recent theories of information processing. In such theories creative problem solving is conceptualized as search in large problem spaces, and/or as diverted search in an incorrect problem space. The perceived task structure is determined by the availability of solution constraints and adequate heuristics in dealing with such constraints. It has been posited that the A-E styles describe individual differences in preferences for such heuristics. Research on A-E styles may also shed new light on the relationship between motivation and creative problem solving, as well as the relationship between positive mood and creative problem solving. Consequently, this theory may have fruitful

implications in several areas of research extending beyond its 'hub' in the domain of problem solving.

Thinking styles

In 1988 Robert Sternberg based his style theory on a governmental metaphor which rests on an assumption that people govern themselves in a similar way to societies. The thinking styles describing different aspects of self-government include: functions, forms, levels, scopes, and leanings. The three major *functions* are the legislative (creative), executive (implementive), and judicial (evaluative) styles. Four major *forms* of government are the monarchic (preference for one goal at a time), hierarchic (preference for multiple goals ordered in a hierarchy), oligarchic (preference for multiple goals, where each is equally important), and anarchic (avoids rules and systems). Two basic *levels* of government are the global (preference for general problems demanding abstract thought) and the local (preference for tasks that require detail and precision). Two domains in the *scope* of government are the internal (preference for tasks that allows people to work alone) and the external (preference for tasks that allow working together with others). Two core *leanings* are the conservative (preference for the familiar and traditional) and the liberal (preference for going beyond existing rules and regulations).

Sternberg's theory shares basic similarities with other theories of cognitive styles: styles are placed at the interface between personality and cognition, express the manner of cognition, and should be uncorrelated with intellectual capacity. However, thinking styles can still be related to more local domains of capacities. Sternberg's theory, like Kaufmann's, has been developed within a theory of intellectual functioning, which may simplify both the operationalization and the evaluation of the stylistic dispositions compared with other style theories. Still, cognitive styles have typically been defined as bipolar constructs, while thinking styles are defined as unipolar constructs that together create a stylistic profile. The bipolarity assumption that is common in most theories of cognitive styles is thus rejected in the theory of thinking styles, although this may be an empirical question.

Sternberg and colleagues Elena L. Grigorenko, Li-Fang Zhang and others, have conducted a number of studies on the theory during the last decade. Among the most central findings are that nonsignificant correlations have been obtained between these stylistic dispositions and measures of IQ and grade point average (GPA). However, correlations between several aspects of thinking styles and grades have been reported, where the direction and magnitude of the correlations were contingent on the type of subject and education the students were taking. This is a finding that supports the idea that styles describe competencies in local domains. A number of correlations have also been found between the various thinking styles and other style measures, as well as with personality types.

In more recent conceptualizations of the theory, three superordinate dimensions of styles have been described, with different aspects of thinking styles included within each. The first of these, labeled 'Type 1 style,' includes the legislative, judicial, global, and hierarchical facets. The second, labeled 'Type 2 style' includes the executive, local, monarchic, and conservative facets. The third style, labeled 'Type 3 style,'

includes the oligarchic, anarchic, internal, and external facets. A number of studies have shown that the Type 1 style is associated with openness to experience and conscientiousness in the five factor model of personality, higher adaptiveness, higher self-esteem, enhancement of positive emotions, the motive to approach success, better mental health, and more. Type 2 style has been associated with neuroticism, the motive to avoid failure, and other typically conceived, negative influences, while tendencies to have higher academic achievements were also evident in association with this style. Further studies have focused on educational issues. The theory has moved away from a position where all styles have equal value.

Sternberg included styles in his theory of creativity and found negative relationships between creativity and the executive, conservative, and monarchic styles. A combined score on these styles was significantly and negatively correlated with an overall measure of creativity. Contrary to theoretical expectations, the legislative style was not correlated with the measures of creativity. However, more recent studies have shown that giftedness was associated with Type 1 style and that creative writers also scored higher on the same type of style.

Taken together, a growing number of studies have strengthened the validity of the theory of thinking styles. The theory of thinking styles also seem to be comprehensive, as other theories, like the A-I and A-E distinctions above, may be more narrowly focused. Yet, there seems still to be a lack of experimental studies in research on thinking styles, and such studies may be necessary to make more valid, causal inferences about core propositions in the theory.

Approaches related to creative problem solving

Other theories of styles have, in various ways, been related to the process of creative problem solving. One such theory has been developed by Min Basadur. This theory maintains that there are two main stylistic dimensions, one describing two different ways of *acquiring* knowledge, and the other relating to two different ways of *using* knowledge. The two different ways of getting knowledge are through experiencing and ideation, and the two different ways of using knowledge are through thinking and evaluation. Various combinations of these stylistic attributes yield different typological interpretations, and these are labeled Generator, Conceptualizer, Optimizer, and Implementor. This measure seems to be based on a measurement technique that has some limitations while the constructs themselves seem to echo the idea of problem finding and problem solving, which is also related to creative producing and creative solving of problems and ideas.

A second theory in this category has been developed by Gerard J. Puccio who maintained that there are four different individual preferences related to the process of creative problem solving. These four preferences were labeled Clarifier, Ideator, Developer, and Implementer. The Clarifier preference describes aspects of data finding and problem finding in the Creative Problem Solving framework. The Ideator preference describes aspects of mess finding and idea finding. The Developer preference describes aspects of solution finding and the planning aspects of acceptance finding. The Implementer preference describes action oriented aspects of acceptance finding. The theory and its measure have been developed in stages, and currently factor analyses and correlational analyses with other

popular and creativity relevant measures have been undertaken. However, it awaits further rigorous analysis.

A third theory has been called VIEW and assesses problem solving style. It has been developed by Edwin C. Selby, Donald J. Treffinger, Scott G. Isaksen, Kenneth J. Lauer, and others as a novel integration of constructs, while it also seems to be operationalized in a way that is close to some existing style and type constructs. Its main focus is individual differences in relevant aspects of creative problem solving, and it measures three styles. The first style is labeled *Orientation to Change* and describes a distinction between Explorers and Developers. The second style is labeled *Manner of Processing* and describes a distinction between External and Internal ways of processing. Finally, the third style is labeled *Ways of Deciding* and describes a distinction between a People and a Task orientation. The items in this inventory represent what may be conceived of as semantic differentials which may represent true opposites or contrasted constructs. Factor analyses support the conceptual three factor distinction, and a number of correlations with type and other style measures support the theory's initial validity. Also this theory seems to generate new research.

Discussion and Future Directions

Although cognitive styles indeed seem to offer an important approach to studying creativity, it is clear that cognitive style can only be part of a theory to explain creativity. This is also evident in several theories of creativity and related processes where cognitive styles have been merged with various personality traits, motives, abilities, experience, and social and training factors. In most of these theories, set-challenging or novelty seeking versus set-accepting and rule following thought have been emphasized as important for creativity.

Even in the present context of many cognitive style theories, varying findings on associations between cognitive styles and creativity, and the various theories of creativity that include cognitive styles, we may still point to some important limitations. In this regard there seems to be *three* major areas that may be improved in future research. The *first* concerns the validity of cognitive style constructs, the *second* concerns the design of studies on cognitive styles and creativity, and the *third* concerns the perspectives on style-creativity research.

First, although interest in style theories may have had an upswing in the last decade, the validity of several cognitive style constructs remains unproven. Through the history of style research, close links have been found both between intelligence and styles and between various measures of styles and personality. Further research is necessary to settle more definitively whether cognitive styles represent an *autonomous* construct, or whether it eventually boils down to a mix of stylistic expressions of ability and personality constructs. The older theories, like field dependence-independence, must be developed in line with newer theories to further validate the uniqueness of this construct. On the other hand, the more recent theories of adaption-innovation, assimilation-exploration, and thinking styles, and problem solving styles stand in need of sharper examination on the merits of their incremental validity against ability and personality factors. That is, does one advance or handicap the field by mixing

personality and ability/preference and power/concepts into style? After all these years the jury remains out on this issue.

One interesting path for future style research can be inspired by research on compound traits, or emergent traits, which has a long history in research on personality. Such traits, like integrity, emotional intelligence, managerial potential and more, are typically measured by criterion referenced tests that purport to measure specific behaviors in applied settings. Common for several such traits is that they are factorially complex and typically related to Neuroticism, Agreeableness, and Conscientiousness. In a related way, styles may be seen as describing specific, cognitive phenomena that mediate profiles of personality traits and/or abilities. Consequently, to the extent that style theories can be placed in a conceptual space with personality and ability constructs and shown to have some kind of advantage beyond the traits that they originate from, it would further validate style as a useful construct in psychology. A clarification of such ideas would also explain further the factorial complexity typically observed for some style measures and the multiple personality correlates for the same measures. In this regard, styles could be classified as Intellectually focused Personality Scales (IPS) with similar potential and limitations as the compound traits previously mentioned, or Criterion focused Occupational Scales (COPS). These ideas have been elaborated by Adrian Furnham and others. Elena L. Grigorenko recently speculated about whether styles actually share some of the genetic influence on intelligence and personality, but pointed out that genetic research on styles remains nonexistent, although it is likely to show heritability.

Second, the research designs that are most frequently applied in stylistic research on creativity still seem to be non-experimental. This limits understanding of the results and the possibilities of making causal inferences about style-creativity relationships. If we are to investigate the possibility that cognitive styles, for example, describe different ways of being creative, it is indeed necessary to apply aptitude-treatment interaction studies to shed light on such issues. In research designs like this, individual differences in cognitive styles are combined with experimental manipulations of task contents, work conditions, or other situation conditions, with the inclusion of necessary controls for alternative interpretations in terms of abilities and personality factors. Such research designs have been rare during the history of style research.

Third, it seems necessary to investigate further the relationship between cognitive styles and creativity based on different conceptions and measures of creativity. Presently we have at least four different perspectives on creativity that are important for stylistic research. The first one of these perspectives is a micro or ipsative perspective, where an individual's creativity is based on a comparison between the degree of novelty in a product or idea and that in the same person's previous products or ideas. This is an individual perspective where everyone can be seen as creative only in the sense of increasing their creativity. A second perspective is a macro or normative perspective, where a person's creativity is compared with other persons' creativity from an objective perspective. This is the invention or innovation perspective, where only a few people are creative – this is the idea of the normal distribution. The third perspective is a component perspective, which can be integrated with either of the two preceding micro and macro

perspectives. Here, the stylistic influence on various subcomponents of creativity (like insight, analogical reasoning, remote associations, ideational productivity, convergent thinking, etc.) can be studied. The fourth and final perspective is the domain specificity of creativity; will some styles predict creativity in certain domains but not in others? Style researchers need to be more aware of the several conceptual and operational distinctions that can be made in creativity research, and to adjust their research designs accordingly. Thus, the criteria and designs in style-creativity research must be specified based on *a priori* theoretical and/or operational definitions of creativity or creativity relevant processes.

Based on this overview of current research on individual differences in cognitive styles, the hypothesis that cognitive styles do indeed have a function in creativity seems quite reasonable. Still, the present theories need to be developed further in order to yield more precise information on the relations between style and creativity. Meeting this requirement also depends on further progress in creativity research where the criterion problem is multifaceted and difficult to solve. The evidence is not clear enough for a reviewer of the relationship between the style and creativity literature to despair or rejoice. The pessimist would point to the endless models, measures and theories of cognitive/learning/thinking styles, none with very impressive evidence of psychometric validity, particularly convergent, divergent, construct, and predictive validity. They would also point to the creativity literature which remains for differential psychologists something of a backwater, with little real development in terms of measurement. In other words, this is the relationship between two conceptually unclear and methodologically weak fields. The optimist on the other hand, may point to a lively applied and cross-disciplinary rather than moribund field using more sophisticated methods of research to investigate the intriguing issue of creativity. Both are very big areas and it may be that the area will best advance by concentrating on a highly specific area. Thus, if we have problem finding versus problem solving and arts versus science (divergent vs. convergent) problems, it is possible we could find the cognitive style associated with divergent problem-finding more convincingly. The importance of this level of analysis has been recognized.

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- <http://www.kaicentre.com/> – Occupational Research Centre & KAI Distribution Centre.
- <http://www.cpsb.com/research/articles/> – The Creative Problem Solving Group, Inc.

Collaboration

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Glossary

Collaboration "The process of shared creation: two or more individuals with complimentary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own."

Complimentarity The ways in which collaborative partners compliment each other in intellectual expertise, working styles, and temperament.

Cultural historical theory Psychological interdisciplinary approach based on L. S. Vygotsky's

ideas with a strong emphasis on the social sources of human development.

Ensemble "A unit or group of complimentary parts that contribute to a single effect."

Networks A group of connected individuals whose closeness or distance is represented by the length of vectors on a graph.

Q sort A method to assess statements drawn from a theoretical source or practical domain along the dimension of most/least characteristic value for a participant.

Collaboration takes many forms in public and private life. In order to discover the commonalities across this diversity, this discussion starts with an introduction which highlights the growing importance of shared endeavors in our contemporary life, followed by definitions and a description of how partnerships vary from intermittent interactions to intense day-by-day transformative interactions. Following this section on patterns of collaboration is an examination of the various challenges of collaboration. These are considerable in a society that primarily emphasizes competition. When studying such a widespread phenomenon, such as collaboration, it is difficult to decide on effective methods that reveal the psychological and organizational complexity of this process. In the discussion on methodological approaches, the author presents some of the ways researchers address this challenge. Finally, we are used to studying human endeavors from the perspective of the individual, but together with the dramatic increase in collaborative activities, there has been a shift in point of view as there are an increasing number of theories which focus on human connectedness and cooperation as the basic conditions for our survival.

We are witnessing a striking increase in collaborative endeavors in the physical and social sciences, in the arts, in management, and in education. The most noticeable shift away from the solo practice of traditional research is in physics and in the biomedical sciences. The importance and the considerable expense of large scale accelerators have contributed to the joint use and coordinated work of physicists whose co-authored publications can reach a listing of hundreds of names on the title page. Biomedical research relies on the close collaboration of clinicians and laboratory scientists on the causes of serious illnesses. One of the many indices charting changes in research practices in the sciences is in the awarding of the Nobel Prize. In the first decades of its existence awards went to one individual in each of the designated domains. For example, the first physicist to receive the prize was Röntgen for the discovery of X-rays. Starting with the second half of the twentieth century, this pattern changed; the single recipients became the exception while most of the prizes are awarded to a group of collaborating scientists. Not all disciplines have

increased collaborative efforts at the same rate. Social scientists and educators do not collaborate as extensively as their colleagues in the physical sciences; however, coauthored papers and books have also increased in these disciplines.

In 2007, Wuchty and colleagues, researchers at Northwestern University, studied close to 20 million professional articles from the last 45 years in the physical, biomedical, and social sciences and in the arts. They found a doubling of the authors in the fields where laboratory research is particularly prevalent. While the role of equipment in physics certainly plays a role, there are similar but less dramatic shifts toward collaboration in mathematics, which has traditionally been considered the domain of the solitary thinker. Here, too, co-authorship has increased; mathematicians increasingly work together through the Internet.

The most recent and dramatic example of such collaboration is the Polymath Project. Timothy Gowers invited contributors online to participate in finding a solution to an unsolved mathematical problem. Just hours after the project was announced, contributions were made. Contributors ranged from high school teachers to a winner of the Fields Medal, the highest honor in mathematics. Six weeks later, Gowers announced that an elementary proof was found and a paper describing it was being written. One of the greatest contributions of this kind of open source collaboration is that it provides a record of how ideas grow, change, and are discarded. This project not only presents a better understanding of mathematical creativity, but it also provides opportunities for novices to work alongside famous mathematicians. As it is an open process, the identity of participants who make a major contribution to the problem solution can be identified.

Definition of Collaboration

One of the best definitions of collaboration was provided in 1990 by Michael Schrage. "Collaboration is the process of shared creation: two or more individuals with complimentary skills interacting to create a shared understanding that none had previously possessed or could have come to on their own."

In emphasizing the benefits of collaboration Schrage highlights the importance of complementarity.

Four patterns of collaboration were identified in 2000 by John-Steiner and coworkers. They are complimentary, distributive, family, and integrative. The most widely practiced mode of collaboration is the complimentary pattern in which expertise and disciplinary training, roles, and temperament are in complimentary relationship with each other. Pierre and Marie Curie illustrate disciplinary complementarity. (Marie's background was in chemistry, Pierre's in physics.) They also assumed complimentary roles. Marie took responsibility for a large part of the organizing work in the laboratory. Her husband provided some of the conceptual scaffolding of their research. They were also complimentary in temperament. He was retiring and cautious, she was quick, determined, and willing to engage in negotiation and compromise.

The complimentary pattern of collaboration is recognized in newer theories of situated cognition, collaborative networks, systemic use of creativity, and cultural historical theory. These new approaches consist of changes in organizational restructuring such as cross-disciplinary research and the explicit recognition of collaboration as a critical site of innovation. The increase in such endeavors reflects the reality that major societal problems cannot be solved without growing multiple-disciplined stakeholders.

Another pattern, integrative or transformative collaboration, is motivated by the desire to profoundly change existing scientific and artistic approaches into qualitatively new paradigms. The partnership of Picasso and Braque illustrates this mode of collaboration. Together they constructed cubism, a new twentieth century approach to painting which focused on the interrelation of objects. Rather than practicing clear division of labor which is common in complimentary collaborations, these partners achieved at times such complete fusion of styles that it was hard to distinguish the work of one from the other. If one partner created a pictorial innovation, the other incorporated it immediately into his own work. They were striving to eliminate individual ambition and focus on their shared vision.

Collaboration is not limited to two individuals working closely together. In 1997, Warren Bennis and Patricia Ward Biederman studied a variety of innovative communities. They refer to these as "Great Groups." Such groups have become more familiar to the general public since the establishment of computer research teams. Bennis and Bierderman describe them as follows:

Great Groups become their own worlds . . . [they] create a culture of their own - with distinctive customs, dress, jokes, even a private language. People who have been in Great Groups never forget them, although most Great Groups do not last very long. Our suspicion is that such collaborations have a certain half-life, that if only because of their intensity they cannot be sustained indefinitely.

Another approach to group creativity is the research of Keith Sawyer who has been primarily interested in improvisational groups such as jazz musicians, theater groups, and conversational partners. The definition that he quotes from the American Heritage Dictionary is that of ensembles, "a unit or group of complimentary parts that contribute to a single

effect." Other authors have focused on long term group collaborations. These include the sociologist Michael P. Farrell who in his book on *Collaborative Circles* in 2001 refers to the French Impressionists. He describes their weekly meetings, outdoor painting sessions and the informal role structure of their group ("which includes hero, jester, devil's advocate, scapegoat, and peace maker"). Members varied in the degree to which their roles were rooted in their personalities. These painters were committed to novel approaches including rejecting classical techniques by using short brush strokes and contrasting colors. "This technique brought a shimmering life to water that no one had ever achieved before. It enabled them to portray the transitory effects of light and atmosphere - goals they had been pursuing for years." The mutual support the painters provided each other helped them deal with the recurrent rejection they experienced from the French painting establishment of their time. Members of many groups who find themselves at the margin of their discipline rely upon each other for encouragement, resources, and a commitment to a shared vision. In 1975, the director Harold Clurman described in his book *The Fervent Years*, a similar pattern in his history of The Group Theater of New York.

From the beginning their emphasis was on joint creativity . . . central to the success of their collective endeavor was the development and practice of a powerful acting technique, Strasberg's adaptation of the Stanislavsky Method. His adaptation included improvisation and the use of affective memory.

Challenges of Collaboration

One of the hardest things to establish for collaborators drawn from different disciplinary traditions is the development of a shared language. Key terms have different connotations in different fields and, thus, necessitate negotiations to achieve a common meaning. This issue becomes particularly challenging when working partners attempt to write together. The term collaboration implies coordinated effort for achieving a solution to a well-defined problem for some, while others interpret it as a more open process where the end result cannot be predicted.

Another challenge is the establishment of trust among collaborators. Scientists as well as artists have more experience with competition in western societies than with working together. To overcome the practice of cautious self-interest requires sustained exploration of ideas, the discovery of complimentary skills and styles of working, and opportunities for relaxed interactions. Working partners who are evaluated for their productivity frequently worry about the ownership of their ideas or discoveries, a concern that can undermine the establishment of trust. Many collaborations emerge where intimacy or friendship is already in existence, or when partners find each other's contributions so stimulating that they work hard to overcome their socialization into competitive practices. In 1999, some studies by Palus found a lower performance in group members than by individuals working alone. These findings are based on situations where strangers spend very limited time with each other and work on problems of limited interest to them. Effective collaborations require trust, complementarity, and a shared vision. These characteristics are hard to achieve in short-term investigations.

Methodological Approaches

The most informative technique for studying group creativity is to monitor collaboration as it occurs in natural settings. In one study of young jazz musicians by Seddon in 2004, the researcher observed and videotaped 6 hour long rehearsals. A retrospective interview was also conducted with the participants who selected their own repertoire in preparation for performance. Both the participants and the researchers viewed the video tapes and helped to identify different communicative modes. In analyzing these tapes the researcher differentiated between cooperation and collaboration. The former dealing more with organizational issues, while the latter addressing the creative features of the musical performance. Of particular interest were the aspects of nonverbal communication of jazz musicians such as body language, eye contact, musical cues and gesticulation. The closest collaboration occurred when the participants took risks with "musical phrases and timing and in so doing challenged each other's musical creativity."

In 2003, Sawyer also used taped rehearsals and performances for examining the interactional features of jazz and theater improvisations. Relying on a variety of disciplines in which contingently generated verbal or musical utterances are created, he provides insight of how each participant scaffolds his/her partner's contribution. "They face a tension familiar to improvising groups: between the need for preexisting structures and the need to leave flexibility for emergent interaction to occur." The availability of audio and visual recording equipment has made it possible to study the way in which participants signal to each other a new turn or phrase in their jointly constructed, open-ended creative interactions. It also makes possible the ability to identify different levels of intensity that characterize improvisations.

A more retrospective approach is used in reconstructing sustained collaborations. The method used by John-Steiner is that of the Q sort and a subsequent joint interview with the partners. The construction of the collaboration Q sort was based on early interviews with collaborators who were asked about their motivation, collaborative roles, and working methods. Fifty statements were fine tuned to provide a broad representation of the collaborative experience. Once these items were finalized, they were printed separately on cards. Each partner is given a stack of cards to be arranged into a bell shaped distribution: a process that can entail multiple ordering. The final distribution ranges from items most characteristic of the collaboration at the high end to those least characteristic at the low end. After completing the Q sort collaborative partners are shown each other's placement of Q sort items. Differences in perception of their joint experience are reflected in the way in which each participant arranged these collaborative statements. The discussion of both agreements and disagreements provide an account and analysis of the partners' view of their shared endeavor. Since John-Steiner's original use of this method others have used it and at times modified the collaborative Q sort.

Researchers have also studied collaborative networks. One of the best known is the collaboration graph developed for the Hungarian mathematician Paul Erdős who was known for his extraordinary number of partnerships. Individuals who have worked directly with Erdős received the number '1' (they number almost 500) and those who have worked with

one of Erdős' collaborators received the number '2'. Five thousand people have been identified with that number:

In the history of scholarly publishing in mathematics, no one has ever matched Erdős' number of collaborators or papers (about 1500, almost 70 percent of which were joint works).
(De Castro and Grossman, 1999)

Researchers pursuing this method can examine the connections among collaborators both within a discipline and interdisciplinary collaborations. In Erdős' case, these included physics, economics, chemistry, philosophy, biology, and psychology.

Sociologists and the creativity researcher Dean Keith Simonton used biographic entries and published papers for their examination of coauthorship and its relationship to academic success and productivity. A related method is to look at how often a publication is cited and whether the work is solo authored or written by a team. In 2007, Wuchty and coworkers found that team authored papers are more frequently cited and that this trend has become more prevalent in recent years:

By the most recent period, a team authored paper has a higher probability of being extremely highly cited. For example, a team authored paper in science and engineering is currently 6.3 times more likely than a solo authored paper to receive at least 1000 citations.

Some researchers rely on linguistic techniques of discourse analysis in examining the reconstruction of joint experiences. These include looking at the length of utterances, sentence fragments, as well as joint productions where partners complete each others' utterances. One finding in looking at interviews dealing with collaboration by John-Steiner and co-workers is that the more highly integrated two collaborators are, the more they finish each others' sentences.

Another linguistic method also used by these authors is the examination of metaphors capturing the quality of the collaborative experience. One example of metaphors describes the costs and benefits of collaboration.

It is kind of like the (extended) Chinese family. You give up some of your freedom in a sense. On the other hand, you expand your research by such a great amount.

Theoretical Perspectives

Most theories in the human sciences address individual development. To date, the role of collaboration in human development and creativity has barely been explored. An important exception is cultural historical theory in which thinking is viewed as rooted in social practice. This approach is based on L. S. Vygotsky's theories. He proposed that people come to know the world through transforming information received in social interaction with others, and that in synthesizing diverse influences, individuals construct new concepts and strategies. Collaborative activities embody Vygotsky's social theory of human cognition.

Among contemporary writers, Howard Gardner emphasized the importance of collaborative support at the early stages of creative endeavors. His theoretical approach is a

synthesis of cognitive and Freudian approaches. He argued that the uncertainty of early explorations “in uncharted waters” requires intellectual (or artistic) and affective support. Without such support, creative individuals may experience some kind of breakdown. Gardner further wrote:

My claim, then, is that the time of creative breakthrough is highly charged, both affectively and cognitively. Support is needed at this time, more so than at any other time in life since early infancy. The kind of communication that takes is unique and uniquely important, bearing closer resemblance to the introduction of a new language early in life, than to the routine kind of conversations between individuals who already share the same language. The often inarticulate and struggling conversation also represents a way for the creator to test that he or she is still sane, still understandable by a sympathetic member of the species.

A different theoretical approach is proposed by the sociologist Michael Farrell. He is interested in the roles of leadership, marginality, and the concept of networks in investigating what he calls “collaborative circles.” He suggests that most novices within a discipline receive limited support from high prestige mentors at the beginnings of their career and turn, instead, to their peers. The connection between the individuals who eventually form a circle is at first a shared rebellion against the establishment. When dominant groups and new groups confront each other, their respective visions become more crystallized. As demographic and cultural contexts to innovation change, so does “the generating conflict over visions at the center.”

Collaborative circles provide the context to explore new ideas, and they protect participants from pressures toward conformity. Farrell also sees a role for charismatic leaders whose vision and impact help cement shared visions, but such leadership functions within a group that strives to attain relative equality, trading on each other’s particular resources. Farrell identifies a sequence of stages: the *formation* stage where members who have similar interests coalesce. The next, the *rebellion* stage is one where a dense network of participants focus on a charismatic leader. During the following *quest* stage, the circle’s own vision is developed as different members assume roles which contribute to articulating the circle’s shared perspective. Subsequently, in the *creative work* stage participants work in pairs as well as in a group and individually. Pairing is governed by the perception of equity between partners “... there is a sense that each gets a fair share of the rewards and costs.” The last two stages are the *separation* stage, and eventually, a meeting of the participants in the *reunion* stage. Throughout these stages, Farrell emphasizes roles as a central, sociological concept.

Organizational theorists have also contributed to the theoretical and applied literature on collaboration. In 1989, Barbara Gray proposed that independent actions by businesses and institutions are counter productive in turbulent times and during such times these groups are also faced with finite resources. Among the contextual factors which create incentives to collaborate, she lists global interdependence, rapid economic and technological change, and increasing competitive pressures.

While Gray recognized that there are significant differences among collaborations, she proposed a general, three-phased model of problem setting, direction setting and implementation for successful, large-scale partnerships. Collaborations are frequently beset by conflict; Gray describes a variety of

methods (including dialogs and negotiated rule-making) for overcoming discord.

Conclusions

The practice of collaboration has increased at a dramatic rate in recent decades. Projects range from two-person partnerships (like the famous joint discovery of DNA by Crick and Watson) to large-scale scientific projects, and multi-stakeholder endeavors addressing environmental and public health challenges. Nevertheless, our detailed knowledge of the processes involved in effective joint endeavors is still limited, particularly in creative domains. More research that documents and analyses ongoing collaborative projects, rather than our current, primary reliance on retrospective analyses, would provide the detail needed for a deeper understanding of this promising, and in many cases, essential activity.

See also: Group Creativity; Innovation; Pablo Picasso 1881–1973; Teams.

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Componential Models of Creativity

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Glossary

Component In the context of this article, one of the elements that in some combination constitute creativity in a person or product.

Domain An area of creative endeavor, such as physics or painting. There is no generalized agreement as to what the domains of creativity are.

Intelligence The ability to learn and to adapt to environments.

Knowledge The organized body of information that serves as a jumping-off point for creative thinking. It is a prerequisite to creative thinking.

Motivation One's level of involvement in an activity; the energy one brings to one's creative or other activities.

Style A preference in the use of one's thinking or learning.

Definition of Componential Models

A componential model of creativity is basically one that seeks to specify the basic components, or elements, that work together to produce creative behavior. Some works on creativity hypothesize that multiple components must converge for creativity to occur.

Components Derived from Folk (Implicit) Conceptions of Creativity

Robert Sternberg, for example, examined laypersons' and experts' conceptions of the creative person. People's implicit theories contain a combination of cognitive and personality elements, such as "connects ideas," "sees similarities and differences," "has flexibility," "has aesthetic taste," "is unorthodox," "is motivated," "is inquisitive," and "questions societal norms." This work suggests that the basic components of creativity are not to be found within any single branch of psychology or any other field – cognition, personality, or social psychology, for example – but rather cross these different branches.

Components Derived from Explicit Theories of Creativity

Amabile

At the level of explicit theories, Teresa Amabile and her colleagues have described creativity as the confluence of intrinsic motivation, domain-relevant knowledge and abilities, and creativity-relevant skills. The creativity-relevant skills include (1) a cognitive style that involves coping with complexities and breaking one's mental set during problem solving; (2) knowledge of heuristics for generating novel ideas, such as trying a counterintuitive approach; and (3) a work style characterized by concentrated effort, an ability to set aside problems, and high energy. An important feature of this model is that it points out that creativity involves styles as well as abilities – that is, preferences in ways of thinking. It also points out the importance of sheer hard work in achieving creative solutions to problems.

Baer and Kaufman

John Baer and James Kaufman have proposed an amusement-park model of creativity, wherein the researchers analogize the components of creativity to the components of moving around through an amusement park. For example, one has to pick a section of the amusement park in which to walk and then has to pick specific things to do within the amusement park, just as one has to pick a domain in which to do creative work and then a specific problem or set of problems within that domain.

Gruber

The late Howard Gruber and his colleagues proposed a developmental *evolving-systems model* for understanding creativity. A person's knowledge, purpose, and affect grow over time, amplify deviations that an individual encounters, and lead to creative products. Developmental changes in the knowledge system have been documented in cases such as Charles Darwin's thoughts on evolution. Purpose refers to a set of interrelated goals, which also develop and guide an individual's behavior. Finally, the affect or mood system notes the influence of joy or frustration on the projects undertaken. Gruber's model emphasizes that components of creativity cannot be understood merely additively. That is, one cannot simply list components and ask a person whether he or she is at some reasonably high level on some or all of them. Rather, one must look at how they interact systemically in order to determine whether a person does and is likely in the future to continue to produce creative work.

Csikszentmihalyi

Mihalyi Csikszentmihalyi took a different "systems" approach and highlighted the interaction of the individual, domain, and field. An individual draws upon information in a domain and transforms or extends it via cognitive processes, personality traits, and motivation. The field, consisting of people who control or influence a domain (e.g., art critics and gallery owners), evaluates and selects new ideas. The domain, a culturally defined symbol system such as alphabetic writing,

mathematical notation, or musical notation, preserves and transmits creative products to other individuals and future generations.

Gardner

Other work complements that of Csikszentmihalyi. Howard Gardner and his various colleagues over the years conducted case studies suggesting that the development of creative projects may stem from an anomaly within a system (e.g., tension between competing critics in a field) or moderate asynchronies between the individual, domain, and field (e.g., unusual individual talent for a domain). In particular, Gardner analyzed the lives of seven particular individuals who made highly creative contributions in the twentieth century, with each specializing in one of the multiple intelligences: Sigmund Freud (intrapersonal), Albert Einstein (logical-mathematical), Pablo Picasso (spatial), Igor Stravinsky (musical), T. S. Eliot (linguistic), Martha Graham (bodily-kinesthetic), and Mohandas Gandhi (interpersonal). Charles Darwin would be an example of someone with extremely high naturalist intelligence. Gardner pointed out, however, that most of these individuals actually had strengths in more than one intelligence, and that they also had notable weaknesses in others (e.g., Freud's weaknesses may have been in spatial and musical intelligences). In the case of Gardner's model, the components are not so much additive as threshold determined. That is, the outstanding individuals Gardner cites are all people who excelled in one of the components of Gardner's model. They were not necessarily distinguished or even good at other components. For example, there is no reason to believe that Martha Graham would have excelled as a physicist, or Einstein, as a dancer!

Although creativity can be understood in terms of uses of the multiple intelligences to generate new and even revolutionary ideas, Gardner's analysis goes well beyond the intellectual. For example, Gardner pointed out two major themes in the behavior of these creative giants. First, they tended to have a matrix of support at the time of their creative breakthroughs. Second, they tended to drive a "Faustian bargain," whereby they gave up many of the pleasures people typically enjoy in life to attain extraordinary success in their careers. However, it is not clear that these attributes are intrinsic to creativity, per se; rather, they seem to be associated with those who have been driven to exploit their creative gifts in a way that leads them to attain eminence. Gardner further followed the path of collaborator Csikszentmihalyi in distinguishing between the importance of the domain (the body of knowledge about a particular subject area) and the field (the context in which this body of knowledge is studied and elaborated, including the persons working with the domain, such as critics, publishers, and other "gatekeepers"). Both are important to the development, and ultimately, the recognition of creativity.

Sternberg and Lubart

A final confluence theory considered here is Robert Sternberg and Todd Lubart's *investment theory of creativity*. According to this theory, creative people are ones who are willing and able

to "buy low and sell high" in the realm of ideas. Buying low means pursuing ideas that are unknown or out of favor but that have growth potential. Often, when these ideas are first presented, they encounter resistance. The creative individual persists in the face of this resistance, and eventually sells high, moving on to the next new or unpopular idea.

Research within the investment framework has yielded support for this model. Some of this research has used cognitive tasks such as (1) writing short stories using unusual titles (e.g., "the octopus' sneakers"), (2) drawing pictures with unusual themes (e.g., "the earth from an insect's point of view"), (3) devising creative advertisements for boring products (e.g., cufflinks), and (4) solving unusual scientific problems (e.g., how we could tell if someone had been on the moon within the past month). This research showed creative performance to be moderately domain specific, and to be predicted by a combination of six distinct but interrelated resources: intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment.

In recent work, Sternberg and colleagues showed that it was possible to distinguish a factor for creative thinking from factors for analytical and practical thinking. Including creative items in assessments for college admissions increased prediction of freshman-year success in college and also reduced relative differences among students of different ethnic groups.

Concerning the confluence of components, creativity is hypothesized to involve more than a simple sum of a person's level on each component. First, there may be thresholds for some components (e.g., knowledge), below which creativity is not possible regardless of the levels on other components. Second, partial compensation may occur in which a strength on one component (e.g., motivation) counteracts a weakness on another component (e.g., environment). Third, interactions may also occur between components, such as intelligence and motivation, in which high levels on both components could multiplicatively enhance creativity.

General Aspects of Componential Theories

In general, confluence theories of creativity offer the possibility of accounting for diverse aspects of creativity. For example, analyses of scientific and artistic achievements suggest that the median rated creativity of work in a domain tends to fall toward the lower end of the distribution and the upper – high creativity – tail extends quite far. This pattern can be explained through the need for multiple and often diverse components of creativity to co-occur in order for the highest levels of creativity to be achieved. As another example, the partial domain specificity of creativity that is often observed can be explained through the mixture of some relatively domain-specific components for creativity, such as knowledge, and other more domain-general components, such as, perhaps, the personality trait of perseverance.

The various theories described above suggest at least six distinct but interrelated resources: intellectual abilities, knowledge, styles of thinking, personality, motivation, and environment. Although levels of these resources are sources of individual differences, often the decision to use the resources is the more important source of individual differences.

Intellectual Abilities

Three intellectual skills are particularly important: (a) the synthetic ability to see problems in new ways and to escape the bounds of conventional thinking; (b) the analytic ability to recognize which of one's ideas are worth pursuing and which are not; and (c) the practical-contextual ability to know how to persuade others of – to sell other people on – the value of one's ideas. The confluence of these three abilities is also important. Analytic ability used in the absence of the other two abilities results in powerful critical, but not creative thinking. Synthetic ability in the absence of the other two abilities results in new ideas that are not subjected to the scrutiny required to make them work. And practical-contextual ability in the absence of the other two may result in the transmittal of ideas not because the ideas are good, but rather, because the ideas have been well and powerfully presented. To be creative, one must first *decide* to generate new ideas, analyze these ideas, and sell the ideas to others.

Some studies have sought to test the role of intelligence in creativity through a variety of studies. Sternberg and colleagues presented 80 individuals with novel kinds of reasoning problems that had a single best answer. For example, they might be told that some objects are green and others blue; but still other objects might be *grue*, meaning green until the year 2000 and blue thereafter; or *bleen*, meaning blue until the year 2000 and green thereafter. Or they might be told of four kinds of people on the planet Kyron: *blens*, who are born young and die young; *kwefs*, who are born old and die old; *balts*, who are born young and die old; and *prosses*, who are born old and die young. Their task was to predict future states from past states, given incomplete information. In another set of studies, 60 people were given more conventional kinds of inductive reasoning problems, such as analogies, series completions, and classifications, but were told to solve them. But the problems had premises preceding them that were either conventional (*dancers wear shoes*) or novel (*dancers eat shoes*). The participants had to solve the problems as though the counterfactuals were true.

In these studies, Sternberg and his colleagues found that correlations with conventional kinds of tests depended on how novel or nonentrenched the conventional tests were. The more novel the items, the higher the correlations of our tests with scores on successively more novel conventional tests. Thus, the components isolated for relatively novel items would tend to correlate more highly with more unusual tests of fluid abilities than with tests of crystallized abilities. Sternberg and his colleagues also found that when response times on the relatively novel problems were componentially analyzed, some components better measured the creative aspect of intelligence than did others. For example, in the "grue-bleen" task mentioned above, the information-processing component requiring people to switch from conventional green-blue thinking to grue-bleen thinking and then back to green-blue thinking again was a particularly good measure of the ability to cope with novelty.

Other studies by Donald McKinnon and Frank Barron have suggested that there is a threshold effect for the role of intelligence in creativity. They suggested that intelligence is moderately correlated with creativity up to an IQ of about

120, but that after that, the two constructs are largely unrelated. More recently, however, David Lubinski and Camilla Benbow have argued that the relation between intelligence and creativity remains moderate to strong throughout the entire range of IQ.

Knowledge

Concerning knowledge, on the one hand, one needs to know enough about a field to move it forward. One cannot move beyond where a field is if one does not know where it is. On the other hand, knowledge about a field can result in a closed and entrenched perspective, resulting in a person's not moving beyond the way in which he or she has seen problems in the past. Thus, one needs to decide to use one's past knowledge, but also decide not to let the knowledge become a hindrance rather than a help.

Work by Robert Weisberg and David Perkins has suggested that knowledge plays a strong role in creativity. They have found that when more creative people are compared to less creative ones, a major difference is in the depth and breadth of their respective knowledge bases. Peter Frensch and Robert Sternberg have suggested, however, that expertise can lead to entrenchment, and hence that experts who are very knowledgeable can become susceptible to being less creative because they are used to thinking in traditional ways.

Thinking Styles

With regard to thinking styles, one kind of style is particularly important for creativity, namely, a preference for thinking and a decision to think in new ways. Sternberg has referred to this as a "legislative style." John Cacioppo has spoken of need for cognition. Joseph Fagan has found that even infants can differ in their preferences for novelty. This preference needs to be distinguished from the ability to think creatively: someone may like to think along new lines, but not think well, or vice versa. It also helps, to become a major creative thinker, if one is able to think globally as well as locally, distinguishing the forest from the trees and thereby recognizing which questions are important and which ones are not.

Personality

Numerous research investigations by Frank Barron, Donald MacKinnon, and others have supported the importance of certain personality attributes for creative functioning. At one time, the Institute for Personality Assessment Research at the University of California, Berkeley, was devoted to uncovering the personality traits linked to creative performance. These attributes include, but are not limited to, willingness to overcome obstacles, willingness to take sensible risks, willingness to tolerate ambiguity, and self-efficacy. In particular, buying low and selling high typically means defying the crowd, so that one has to be willing to stand up to conventions if one wants to think and act in creative ways. Note that none of these attributes are completely fixed. One can *decide* to overcome obstacles, take sensible risks, and so forth. However, there can be little doubt that people differ in their general predispositions toward the personality attributes of creative thought.

Motivation

Intrinsic, task-focused motivation is also essential to creativity. The research of Teresa Amabile, Beth Hennessey, and others has shown the importance of such motivation for creative work, and has suggested that people rarely do truly creative work in an area unless they really love what they are doing and focus on the work rather than the potential rewards. Motivation is not something inherent in a person: One decides to be motivated by one thing or another. However, the environment, discussed below, can play a major role in motivating people in one direction or another.

Environment

Finally, one needs an environment that is supportive and rewarding of creative ideas. One could have all of the internal resources needed in order to think creatively, but without some environmental support (such as a forum for proposing those ideas), the creativity that a person has within him or her might never be displayed. Teresa Amabile has found that in environments that do not encourage creativity, creativity is much rarer than in supportive environments.

Confluence

Concerning the confluence of components, creativity is hypothesized to involve more than a simple sum of a person's level on each component. First, there may be thresholds for some components (e.g., knowledge) below which creativity is not possible regardless of the levels on other components. Second, partial compensation may occur in which a strength on one component (e.g., motivation) counteracts a weakness on another component (e.g., environment). Third, interactions may also occur between components, such as intelligence and motivation, in which high levels on both components could multiplicatively enhance creativity.

Components of Creative Products

Robert Sternberg and his colleagues James Kaufman and Jean Pretz have proposed that not only persons, but products, can be understood in terms of different components.

First, some kinds of creativity accept current paradigms or try to extend them.

1. *Replication*. The contribution is an attempt to show that the field is in the right place. The propulsion keeps the field where it is rather than moving it. This type of creativity is represented by stationary motion, as of a wheel that is moving but staying in place.
2. *Redefinition*. The contribution is an attempt to redefine where the field is. The current status of the field thus is seen from different points of view. The propulsion leads to circular motion, such that the creative work leads back to where the field is, but as viewed in a different way.
3. *Forward incrementation*. The contribution is an attempt to move the field forward in the direction it already is going. The propulsion leads to forward motion.

4. *Advance forward incrementation*. The contribution is an attempt to move the field forward in the direction it is already going, but by moving beyond where others are ready for it to go. The propulsion leads to forward motion that is accelerated beyond the expected rate of forward progression.

Second, other types of creativity reject current paradigms and attempt to replace them or put them together in some way.

5. *Redirection*. The contribution is an attempt to redirect the field from where it is toward a different direction. The propulsion thus leads to motion in a direction that diverges from the way the field is currently moving.
6. *Reconstruction/redirection*. The contribution is an attempt to move the field back to where it once was (a reconstruction of the past) so that it may move onward from that point, but in a direction different from the one it took from that point onward. The propulsion thus leads to motion that is backward and then redirective.
7. *Reinitiation*. The contribution is an attempt to move the field to a different as yet unreached starting point and then to move from that point. The propulsion is thus from a new starting point in a direction that is different from that the field previously has pursued.
8. *Synthesis*. The contribution attempts to move the field by putting together ideas from a variety of paradigms and integrating them into a single conceptual framework.

The eight types of creativity described above are viewed as qualitatively distinct. However, within each type, there can be quantitative differences. For example, a forward incrementation can represent a fairly small step forward, or a substantial leap. A reinitiation can restart a subfield (e.g., the work of Leon Festinger on cognitive dissonance) or an entire field (e.g., the work of Einstein on relativity theory). Thus, the theory distinguishes contributions both qualitatively and quantitatively.

Domain Generality Versus Domain Specificity of Components of Creativity

An important question is whether the components of creativity are domain general or domain specific. The greatest challenge in understanding the domain generality versus specificity of creativity is in understanding the concept of a domain itself. Is literature a domain, or German literature, or modern German literature, or modern German literature in its original language, or what? Is cognitive psychology a domain, or psychology, or behavioral science, or social science? Because we have no good definition of a domain, we cannot, at this point in time, have a clear sense of exactly what domain-specificity means. Here, we recognize that domains may themselves be defined at varying levels of generality or specificity. There is not, at this time, any consensual definition of a domain.

First, creativity is, in part, an attitude toward life. This attitude can but does not necessarily extend across a variety of domains. That is, someone might adopt the mindsets that lead to creative thinking across domains, but they do not necessarily do so. Whether they do so or not will be one factor in determining the extent to which creativity is domain-general

for a given individual. For example, one such attitude is that creative ideas do not necessarily sell themselves, and hence it often is necessary to sell one's creative ideas. One might adopt this attitude, say, in one's work, but not in one's personal life, or vice versa. Even within one's work environment, one might adopt this mindset, say, in one's interactions with objects but not with people, or vice versa. So domain generality will be a function of the extent to which an individual thinks with a creative mindset across domains. More of these mindsets will be described shortly.

Much of the attitudinal effect is captured through what was called above a *legislative style* of intellectual inquiry. A person with a legislative style is someone who enjoys coming up with new ideas. The ability to generate new ideas does not necessarily go along with a desire to generate such ideas. Someone may be more comfortable in thinking in traditional ways, even if he or she has the ability to think nontraditionally. In this case, the issue is not how well one can think creatively, but rather, how much one desires to think in this way. This desire may be mediated, in part, by socialization. In some societies and some religions, creativity is discouraged. The individual may come to believe that one's conformity to existing norms is a good test of one's responsibility as a citizen. Extreme right-wing governments, for example – whatever they may call themselves – may encourage extreme conformity to a societal norm, which may or may not be for the common good.

A second variable in determining the extent to which creativity is domain-specific is knowledge. Typically, to think creatively in a domain, one has to know what is known in a domain to go beyond what is known. Someone who is knowledgeable is at an advantage to be creative in a domain. But the advantage is tempered by several factors.

First, some domains require very intensive knowledge, whereas other domains require more extensive knowledge. For example, to be creative today in neuroscience, one must be intensively knowledgeable about the workings of the brain and about the research that has been done to date on the brain. The research in this domain is expanding at a rapid rate, so one must constantly be working to keep up to date.

But in many domains, the most creative people are those who are broadly knowledgeable and whose expertise is not limited to one domain. For example, in psychology, many of the most creative scientists have been very broadly trained, often initially studying a discipline other than their primary one. For example, John Gabrieli, one of the most well-known of contemporary neuroscientists, majored in English as an undergraduate. The advantage that broadly trained people have is that they can bring ideas from one field into another. For example, Herbert Simon brought ideas from economics into psychology in his concept of satisficing. George Miller borrowed many of his ideas in psychology from linguistics. So being broadly as well as deeply educated enables one to enhance one's creative thinking, at the same time that it may mean that the individual gets a somewhat later start in his or her contributions to the field.

The situation becomes even more complicated, because expertise in a field can impair as well as facilitate creativity. One can become so used to seeing things in a certain way that one becomes less, not more creative with the development of expertise. So the acquisition of specialized knowledge does not necessarily facilitate creativity. It also can diminish it. Whether it enhances or diminishes it is largely a matter of attitude, as discussed below.

A third variable that affects the domain generality of creativity is the extent to which the environments in which one lives support creativity. An individual does not live in one environment, but rather, in a multitude of environments. For example, one's family may encourage creative thinking, but one's workplace may not, or vice versa. Certain religions are extremely intolerant of deviations from norms, and may even punish such deviations with death. So one might be allowed to be creative in one's work, but not one's religious beliefs, or vice versa, in the case that an organization for which one works insists on blind conformity to a set of norms. Someone may have creative attitudes and an extensive knowledge base, but not be allowed to use them in order to be creative.

Conclusion

Students of creativity generally agree that creativity is not a unitary phenomenon, but rather, a complex one involving distinct components. These components appear not to be strictly additive, but rather, interactive. Although there is some disagreement among theorists, there is general agreement that the components involve cognition, knowledge, personality, motivation, and environment, as well as perhaps other things.

See also: Asynchronicity; Cognitive Style and Creativity; Creative Environments, Conditions, and Settings; Definitions of Creativity; Domains of Creativity; Evolving Systems Approach; Knowledge; Personality: Autonomy and Independence; Problem Solving; Theories of Creativity.

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Computers and Creativity

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Glossary

Artificial Intelligence It is the science and engineering of making intelligent machines, especially intelligent computer programs.

E-learning It comprises all forms of electronically supported learning and teaching. Applications and processes include web-based learning, computer-based learning, virtual classroom opportunities, and digital collaboration.

Elaboration A person's ability to add pertinent details (more ideas) to the minimum and primary response to the stimulus figure.

Flexibility A person's ability to produce differences in the trend of thought. All those ideas that differ in approach or trend are treated as one for the purposes of flexibility scoring.

Fluency In scoring for fluency, a scorer goes through the responses to the item in question carefully and strikes off those that are irrelevant and/or have been repeated.

The remaining number of responses is the fluency score.

Four P model A conceptual model for integrating four main approaches in the identification of creative talent in terms of "4 Ps", that is, 1P. Creative Person; 2P. Creative Process; 3P. Creative Product; and 4P. Creative Press (environment).

H-creativity Historical Creativity (H-Creativity) refers to something that is created or discovered which no one has ever created or discovered before (Boden, 1990).

Information processing Information processing consists of locating and capturing information, using software to manipulate it into a desired form, and outputting the data.

Originality The uncommonness of a given response. Responses given by less than 5% of the group are included and are given different weights.

P-creativity It refers to individuals who create or discover something that they themselves have never done before, even though others may have done it before them (Boden, 1990).

Simulation Simulation is the imitation of some real thing, state of affairs, or process. Computer simulations are used to study the behaviour of objects or systems that cannot be easily or safely tested in real life, such as weather patterns or nuclear blasts.

Technology Technology is the usage and knowledge of tools, techniques, crafts, systems, or methods of organization. It also refers to the application of knowledge to the practical aims of human life or to changing and manipulating the human environment.

Introduction

With the explosion of new knowledge and the expansion of global linkages, it has become essential to learn new techniques and skills for this technology dominated world. Computers are being used by people of all ages and in every profession, in their work as well as in their leisure. Many of the routine activities in today's society are performed by computers. Computers and software can also play a major role in improving the educational skills of our youth and in preparing them for the future. Our work has just begun. With computers, software, and people working together, the possibilities are endless.

The computer is becoming almost invisible and omnipresent. Washing machines, microwave ovens, cars, and televisions have already been computerized. This is the beginning of the invisible computer, which will result in virtually every electronic device known, or to be invented, being similarly computerized. Computer technology also represents access to new worlds. Computers provide information – text, audio and graphic-based – about new areas of learning, new places, new shapes, and new worlds. They stimulate new ways of thinking and analyzing problems. With computers, people are free to manipulate the information and look at facts and ideas in different ways. With increased storage capabilities, the computer is able

to take on even more critical roles as 'information grabbers' and organizers for individuals, schools, and businesses.

Hamza and Alhalabi anticipated that the 'virtual world' grows stronger and, hopefully, smarter and wiser as educators, engineers, computer scientists, and researchers of diverse disciplines attempt to locate better, more powerful ways to synthesize 'Artificial Intelligence' on the Net in order to increase productivity and efficiency in meeting future demands. Technology is in essence a manifestation of human creativity. Thus, an important way in which students can come to understand it would be by engaging in acts of technological creation. Lewis opines that technology as a context for creativity is an important area of research. Romeike emphasizes that everyday life requires creativity – and so does Computer Science.

The Computer – Its Functions

A computer is a device that computes, especially a programmable electronic machine that performs high-speed mathematical or logical operations or that assembles, stores, correlates, or otherwise processes information. A computer can do a variety of tasks easily. It works under a set of instructions, automatically accepts supplied data, processes and analyses the data and

produces the information. It does any complex problems speedily and perfectly if proper instructions or programs and data are introduced. Such unimaginable functions are possible because of its exceptional characteristics such as high speed, large memory and data storage capacity, accuracy, reliability, endurance, versatility, automation, and diligence.

Computer technology includes four basic functions: input, storage, control, and output.

1. *Input.* Input entails entering information or data into the computer, for example, keyboard, mouse, scanner, joystick, touch screen, barcode readers, optical/magnetic character recognizers (OCRs), etc.,
2. *Storage.* Once information is inputted, it is stored for eventual use on hard disks, floppy disks, compact disks (CDs), flash drives, etc.
3. *Control.* Control of stored information, as well as new input, is achieved through programs written in one of several possible computer languages that are translated by the computer's controller to the computer's assembly languages.
4. *Output.* The output or retrieval process transfers the processed information or data from the computer to the researcher, using one of a number of devices to communicate the results. The output may be displayed on a monitor, printed on paper, or recorded on disks.

In 1998, UNESCO identified 15 special properties of computers, which enhance student learning processes on a number of orthogonal dimensions. Dwight Egbert et al. believed that using computer vision research results could provide a high level of motivation to students. It is also an excellent learning tool for teaching students to integrate and use their acquired knowledge.

Computers – Its Application

Computers have entered all walks of human life across the world. They are used in a wide range of activities such as scientific research, business applications, office automation, the electronic office, stock control and sales, banking, insurance and stock-exchanging, industrial applications, space technology, communications, etc. Computers free our minds by alleviating the daily chores of writing (word-processors), making figures (drawing programs), time management (electronic calendar), communication (e-mail), information retrieval (Internet and database), presentations (MS-Powerpoint), mathematical/statistical calculations and graphs (spreadsheets), regression and predictions (multilevel modeling programs), air traffic control data, and multivariate education data (LLISREL), etc.

As observed by Maddux, Johnson and Willis, there is growing interest in the application of computer-based tools to support higher level thinking and metacognitive processes. Fitzgerald and Findlay stated that the application of computers is to enable organizations and individuals to 'learn faster' to cope with accelerating social and technological change. They also provide various possibilities for group learning, and self and peer evaluation. Computer networks, or teamwork at the terminal, open up prospects for communication, joint planning, mutual help, and moral support.

McLeod and Cropley believe that computer applications have an important role in maintaining interest, developing curiosity, and fostering the desire to master problematic situations. Computers can effectively promote learning, but only if they are used in ways which are consistent with the natural processes of learning. The analysis of several Computer-Assisted Instructional (CAI) projects reveals that computer-related learning environments are most successful when they closely resemble the natural learning environment found in the nonschool world, thereby capitalizing on the student's inherent motivation to learn. Bell suggests that educators should adhere to the following principles when utilizing computers:

- First, the computer-related learning environment should be interactive and subject to learner control, thus permitting creativity. This means that students will help plan lessons, define problems and solutions, use tests as learning experiences, and judge their own success.
- Second, students must be given the opportunity to make things work – to write and debug computer programs, for example – and should receive realistic recognition and rewards according to their degree of success.

Computers and the Internet have brought about a revolution in the world of information technology by providing searching facilities for exploring or seeking information from all over the world. Vernor Vinge states that the Internet is an international network connecting a large number of smaller networks that link computers at academic, scientific, government, and commercial institutions. The Internet provides convenient connections between computerized labs, simulations, and research databases. It also represents an enormous financial investment that is driven by the demands of hundreds of millions of consumers.

The Internet is a source of information, like a vast library which holds bundles of information in the form of texts, graphics, sound, video, etc. It also provides searching facilities for exploring or seeking information from all over the world and facilitating virtual online shopping accessible to purchasers all around the world.

E-learning is a flexible, quick and high quality learning method, which uses various learning tools of the Internet. Worldwide video conferencing is an emerging service on the Internet, which allows a group of users located around the globe to talk and interact with each other as if they were sitting and discussing in a single room. The Telnet and Usenet services allows a group of Internet users to exchange their views/ideas/information on some common topic, which is of interest to all the members belonging to the group. Such groups are called *newsgroups*.

The Computer as Productivity Tools

The computer itself is called a tool, tutor, and tutee. Hunt and Shelley believe that the computer can ease the load of administrative duties, leaving the teacher more time to concentrate on teaching. Scales and Snieder emphasized that modern experimental science would be impossible without computers. The key technologies inculcate the Internet and the applications enable the network, such as audio conference,

videoconference, e-mail, and collaborative software. Activities such as writing, literature searching, information management, idea management, and data analysis are the main functions of the computers.

According to Saunders and Thagard computers are unusual machines in being not only tools but also tools for making tools. The computer has its key metaphor of a carpenter's workshop (wood-working), which is similar to building a machine capable of designing furniture, and then building the product. When we want to make things with wood, we are allowed to use the brace and bit for drilling holes, and the handsaw for cutting. The manufacturers of Apple Macintosh computers stated that the ability to produce and the time taken were limited to the power of the tools and our energy in operating them. Now we use an electric drill, power sander, and circular saw, enabling us to make many more things in less time, with greater precision, and using much less energy. Similarly, computer software could be used as an efficient tool in problem solving for affluent outcome. Computers can be used as research tools to carry out various tasks. The use of software and the Internet deserve special mention here. The Internet is the newest innovation in the world of educational computing and it is being promoted by many as the most powerful tool for learning ever invented.

UNESCO opines that the computer is evolving into a tool to facilitate learning of most of the educational properties of older technologies (books, radio, film strips, phonograph records, television) with at least equal if not greater convenience of use plus communication capabilities. Computers can also be very accommodating – they can reach students at different study levels, any time of the day or night. Additionally, the sense of independence and accomplishment a computer offers children helps fuel their self-confidence. Alden has expressed that relying on a computer as a tool may be one of the most effective ways to build both a child's learning skills and self-esteem.

Spender appraises that as we move from book culture to digital culture, we are on the brink of being able to rethink the entire process of teaching and learning. Adler strongly believes that the challenge is in helping children learn to use a home computer to bring out their imagination and curiosity – and learn when to turn it off in favor of more traditional playthings.

Computers are tools, not slave-masters, are inert, unresponsive, incapable of thought, but we can accomplish much through and with them. Wilson says, that if you are a creative writer, you'll make the best use of whatever is the current writing tool – and that is now the word-processor. In much the same way that a word-processor does not directly help a writer create a better story, the computer is a tool enabling the writer to do some things better, such as moving text around, easy deletion, and inserting text in the middle of sentences.

Sally Bowman Alden, the Executive Director of the Computer Learning Foundation, has identified six key areas that all children should be exposed to in using computers and software as tools – tools for learning, creativity, productivity, research, communications, and entertainment.

1. As a learning tool, computers can help develop memory skills, offer after-school study or tutoring sessions, allow children to experiment, and investigate abstract science and math concepts through simulations.

2. As a creativity tool, computers provide access to an infinite color palette and a fine-tuned keyboard keeps children busy creating art and music.
3. As a research tool, computers offer children access to information that wasn't available at their school or local library.
4. As a communications tool, computers and software can enable children to share experiences with their next door neighbor or with other children as far away as Europe or China, all electronically.
5. As a productivity tool, computers and software programs such as word processing, databases, and spreadsheets can also help children work more efficiently.
6. And, as an entertainment tool, computers and various game software keep children involved for hours; and just like Monopoly, many entertainment programs help children develop important skills.

Saunders and Thagard speculated that computers often do unexpected things, but rarely in a way that leads to new discoveries. According to Boden, creativity is just an unpredictable combination of ideas. If so, computer modeling of creativity could be simple, and could combine ideas at random until something creative emerged. If not, we must find a more adequate theory of creativity before computer creativity is possible.

Creativity – Its Definitions

Guilford viewed creativity in terms of his theory of the structure of the intellect (SOI), derived from factor analytic procedures that divergent thinking enables the individual to be more flexible and fluent, involving a richer flow of ideas and resulting in some novel or creative solution. Creative thinking is problem solving. In convergent thinking the person follows the prevailing mode of thought, information, and action to arrive at one right answer, which could also be attained by other individuals. Taylor suggests that creativity operates at five levels: (1) expressive creativity, (2) productive creativity, (3) inventive creativity, (4) innovative creativity, and (5) emergentive creativity.

Repucci reviewed 50–60 definitions and classified them into six major groups or classes. These groups are not mutually exclusive, since each definition may contain elements which fall into different classes. The first class of definitions are labelled as: (1) Gestalt or perception, (2) end product or innovation oriented, (3) aesthetic, (4) psychoanalytic or dynamic, (5) solution thinking, and (6) varia.

Welsch reviewed 22 definitions of creativity and proposed the following definition:

Creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator.

Phyrooj reveals that all are creating something. Their creative energies are being manifested in different ways and styles. According to de Bono creative thinking is concerned with changing concepts and perceptions (i.e., lateral thinking). Lateral thinking is reserved for the specific techniques and

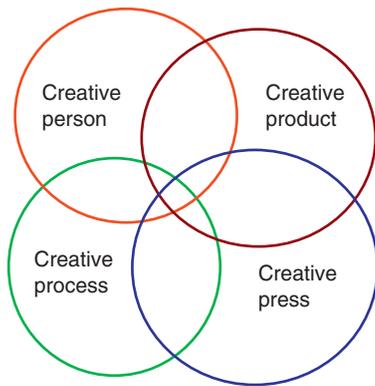


Figure 1 4 Ps (Person, process, product, and press).
(Source: Firezti, 1993, p. 262).

tools that are put forward as a systematic way of getting new ideas and new concepts.

In fact, as Gulati says, creativity makes an object or activity better, richer, more productive, fruitful, and aesthetically satisfying. Creativity is multifaceted. According to Runco the generation of new and valuable ideas is a core component in the ability of individuals and groups both to respond adaptively to change and to envision and bring about change.

Isaksen, Murdock and others revealed that creativity research, rather than having one universal definition, has used a variety of definitions, theories, and assessment approaches. Despite the apparent confusion and contradictions resulting from the use of multiple definitions, some degree of agreement has been reached.

A widely known and accepted concept of creativity, called the 'Four P' model, is based on the assumption that creativity can be defined as a holistic multidimensional concept. Rhodes developed a framework for a unifying approach to creativity; he collected 56 different definitions (40 of creativity and 16 of imagination) and observed that these definitions overlapped and intertwined, forming four strands: (1) creative person, (2) creative process, (3) creative product, and (4) creative press or environment.

Similarly, Mooney hypothesized a conceptual model for integrating four main approaches in the identification of creative talent: (1) the environment, (2) the person, (3) the process, and (4) the product. Further, Isaksen (1987) extended Rhodes's approach when he introduced the concept of the '4 Ps' (creative person, creative process, creative product, and creative press (environment)) of creativity as an overlapping Venn diagram (see Figure 1).

1. *Creative person*. Clustered around personality-related traits and abilities, motivational and affective states, and behaviors of the person to create something new (e.g., Torrance, Barron, Sternberg, Walberg, Amabile)
2. *Creative process*. The cognitive and social dynamics governing the creating ideas, expression and acceptance or adaptation of new ideas in the creative person, for example, searching, combining, and synthesizing (e.g., Graham Wallas, Rogers, Mackinnon, Hallman, Torrance, and Myers).
3. *Creative press (or environment)*. The influence of the ecological press on the person and upon his mental processes and

outcomes (e.g., Tardif and Sternberg, Csikszentmihalyi, Floistad, and Weisberg)

4. *Creative product*. Outcome or product being original, unique, valuable, and novel. The products of creativity can include behaviors, performances, ideas, things, and other kinds of output, through any channel or type of expression (e.g., Parnes, Taylor, Perkins, Torrance, and Johnson-Laird).

Criteria for Establishing Creativity

Shallcross states that the criteria for creativity are novelty or unusualness, appropriateness to the context in which it is placed, and transformation of materials or ideas that overcome conventional constraints. Johnson-Laird view that creative thinking must not be produced by recall from memory, rote computation, or any other simple deterministic process.

Gowan, Demos, and Torrance define human problem-solving as creative to the extent that one or more of the following conditions are satisfied:

1. If the product of the thinking has novelty and value either for the thinker or for his society.
2. If the thinking is unconventional, in the sense that it requires modification or rejection of previously accepted ideas.
3. If it requires high motivation and persistence, taking place either over a considerable span of time or at a high intensity.
4. If it deals with or solves a problem which, initially, as it was posed, was vague and ill-defined, so that part of the task of the creative thinker was to formulate the problem itself, to give it structure.

Torrance outlines criteria indicating a lack of novelty or a lack of invention: (1) changes requiring only mechanical skill; (2) change in size; (3) duplication of parts of a device; (4) omission of an element of a device or step of a method; (5) reversal of parts; (6) change of material; (7) use of an old process or method to a different but analogous object or material; (8) making a device adjustable; (9) change in an element of an old combination; and (10) aggregation of elements.

Moss, in examining the criterion problem, concluded that unusualness, usefulness, and combining unusualness and usefulness were the defining characteristics of the creative product produced by industrial arts students.

Murray and Stein opine that the criteria for establishing creativity are multidimensional and appear to depend not only on the end-product but also on the process involved.

Besemer and Treffinger reviewed the criteria of creativity set out in the literature (about 125) and developed a theoretical model, the creative product analysis matrix (or CPAM), which the creative product could be identified and measured in three general dimensions:

1. The novelty dimension: (a) germinal, (b) original, and (c) transformational.
2. The resolution dimension: (a) adequate, (b) appropriate, (c) logical, (d) useful, and (e) valuable.
3. Elaboration and synthesis dimension: (a) attractive, (b) complex, (c) elegant, (d) expressive, (e) organic, and (f) well-crafted.

Approaches to Creativity

Associationistic Approach to Creativity

Associative theory, as developed by Mednick defines the creative thinking process as “forming new combinations of associative elements which either meet specified requirements or are in some way useful.” Koestler’s bisociative theory claims that a creative act involves linking together two previously unconnected ‘frames of reference’ or ‘two separate entities’ (cf. Kohler’s theory of insight). Wallach and Kogan proposed that “creativity involves the ability to produce more associations and to produce more that are unique.” A similar view is asserted by Cartier that “there is only one way in which a person acquires a new idea: by the combination or association of two or more ideas he already has into a new juxtaposition in such a manner as to discover a relationship among them of which he was not previously aware. An idea is a fit of associations.”

Psychoanalytic Approach to Creativity

Psychoanalytic theorist Freud has emphasized the unconscious rather than the conscious. Creative activity is a form of daydreaming. According to Jung, creative people tend to suffer from emotional disturbances and are prone to be mentally ill. Freud argues that the creative process depends mainly on defence mechanisms, which are unconscious attempts to prevent the awareness of unpleasant or unacceptable ideas. The creative act is seen as transforming an unhealthy psychic state into a healthy one. Dacey intensify that an extreme position argues that “creativity is next to madness.” Kris, Kubie, and May state that though the source of creative thought may be unconscious, it is necessary for these thoughts to become conscious, otherwise they remain unrecognized and incommunicable.

Humanistic or Holistic Approach to Creativity

Humanistic psychologists feel that creativity develops throughout life and can be cultivated throughout the life span. They believe that humans, not divine, cosmic, or other forces determine their own fate. This is not to say that humanism is atheistic, but that self-reliance is a natural human trait. Rogers and Maslow take a holistic approach since they see the creative product as the result of an interaction between the creative person and his/her situation. Dacey states that “They see creativity as more conscious, cognitive and intentional than do the psychoanalysts.” The humanistic concept is that creativity is born through a striving for the highest possibilities in life, rather than as a defence against neurosis.

Gruber’s Piagetian Approach to Creativity

Gruber has analyzed Darwin’s evolutionary theory from a Piagetian point of view. He points to the long time periods involved in developing significant new ideas, emphasizes the slowness of changes according to Darwin’s system of ideas, and interprets the process of the changes in terms of Piagetian notions such as assimilation (incorporation of new information

into existing conceptual structures) and accommodation (changes in conceptual structure brought about by new information). Gruber argues that what appear to be dramatic breaks with the past, can be seen as the culmination of numerous small changes. This approach places ‘moments of insight’ within their long-term context and would suggest that little understanding of higher order creativity will result from laboratory studies of small-scale problem-solving. Gilhooly assumes that “If this approach is accepted, laboratory analysis of high level creativity would seem to be ruled out in favour of meticulous case studies.”

Information Processing Approach to Creativity

In the opinion of Gilhooly, the information processing approach takes the computer as its key metaphor for the mind, seeing people as computer-like systems that code, store, retrieve, and transform information. Information-processing technologists describe thinking as ‘dynamic processes.’ They equate the architecture of the brain with the computer and explain the process of thinking in terms of computer programming (algorithms and flowcharts).

Simon has indicated how the information processing approach might tackle the topic of creativity in science. Thinking is seen as a hierarchical organization of elementary process carried out one at a time. In a problem solving program, the solution efforts are guided and controlled by a hierarchy or ‘tree’ of goals and subgoals.

In a similar manner, Weisberg suggested that creative solutions develop as problem solvers acquire information indicating that their initial solutions were inadequate. In attempting to overcome these inadequacies, individuals try things they have not tried before. Finally, novel solutions to problems also arise in response to information that becomes available as the person works on the problem.

Boden’s Impossibility Theory to Creativity

Boden divides creativity into two categories: H-creativity (historical creativity) and P-creativity (psychological creativity). H-creativity refers to something that is created or discovered which no one has ever created or discovered before (e.g., Newton’s, Mozart’s, Picasso’s, Walt Whitman’s, Einstein’s), whereas P-creativity refers to something an individual creates or discovers, something they themselves have never done before, even though others may have done it before them. She notes that it is difficult to conclusively prove H-creativity, due to events such as the destruction of the great library at Alexandria.

An important aspect of either kind of creativity (‘H’ or ‘P’) is the ability to find new ways of looking at what is familiar and to find new connections between previously unrelated things.

1. Copernicus looked at the familiar sun in a new way and revolutionized astronomy.
2. Archimedes, in an inspired flash of insight, made the connection between his own body’s displacement of water in the bath, and the specific gravity of metals.
3. Kekulé discovered the ring structure of benzene while thinking about a ring of snakes chasing each others tails. He had actually seen such a ring some years before.

Computers and Creativity

According to Virtual Music Composer V3.0, the relationship between computers and creativity is a never ending story. And it will remain the same: things can always be better. And, we continue work on improving operating efficiency through new algorithms.

Essentially, there are two issues here. First, we need to define what creativity actually is. Second, we need to address whether this process can be done by a computer, or whether it is an inherently human ability. I have sidestepped this second issue by redefining the question slightly – can a computer do things that would be considered creative if a human did them?

Romeike explains that the term creativity is used with different meanings and is discussed controversially in psychology. Common speech usually defines something as creative when it comes from the arts or is something extraordinary. But not only artists can be creative. Everyday life requires creativity – and so does computer science. There is agreement in psychology that something is creative if it is new, original and useful.

Biggs reveals that the computer is a modeling machine, a language machine, and in this sense and by a stretch of the imagination, it is possible to conceive of a machine that in principle could model the human in sufficient detail to replicate the processes of creativity – if we accept a questionable concept of creativity founded on a linguistically heuristic system. Rather, it might be that the real value of the computer is not as a modeling machine, but as a metaphorical machine.

According to Margaret Boden, computers can generate novel ideas in all three ways, though they are best at modeling exploratory creativity. They can also aid human creativity.

Three types of creativity are:

1. Combinational creativity is the production of (valuable) unfamiliar permutations/combinations of familiar ideas.
2. Exploratory creativity involves exploring an unknown space, that is, a dimension or variable that has not been used before. Most professional artists and scientists engage only in exploratory creativity.
3. Transformational creativity involves thinking new thoughts which were previously impossible, with respect to the previous style of thinking. The conceptual space concerned must be transformed, by dropping/altering one or more of its dimensions. Then, new structures can arise which couldn't have arisen before.

Olson, in recognizing the importance of allowing students to create new products, stated:

Technology was born of creativity. . . . The creative imagination is the highest level of the intellect. . . . Emphasis on intellectual development, to think creatively, is the great imperative of industrial arts [technology education]. It draws out the individuality, discovers idiosyncrasy, establishes identity, and demonstrates potential, all essential to realization of self. . . . Designing with materials, tools, machines, energies, ideas is the way of technology and the way for industrial arts [technology education]. (p. 22)

Do Computers Think?

Do computers generate new ideas? Or help the people to think of new advertising slogans, write novels, or business plans, or think of new uses for things, or find a new way of doing things? Well, setting aside all these questions, we need to think how the people think about computers? As Sydney J. Harris, an American journalist, quoted: "The real danger is not that computers will begin to think like men, but that men will begin to think like computers."

Marvin Minsky views that most people think computers will never be able to think. That is, really think. Not now or ever. To be sure, most people also agree that computers can do many things that a person would have to be thinking to do. What the computer is doing is merely a superficial imitation of human intelligence. It has been designed to obey certain simple commands, and then it has been provided with programs composed of those commands. Because of this, the computer has to obey those commands, but without any idea of what's happening. Computers are good at storing information and retrieving this information. According to the manufacturers of Apple Macintosh computers the computers are also very good at manipulating information – sorting, selecting, and picking random items from lists.

The computer is not an especially visual machine. It has no special facility for imaging above that of other representational strategies. In a sense the computer is not a machine at all. It is a meta-machine, a control system for other machines. Biggs reveals that the computer can be employed with any machine or media, altering the manner in which it is organized and controlled.

In the opinion of Apple Macintosh computer manufacturers, the field of Artificial Intelligence (AI) is endeavoring to make computers emulate the human brain. AI may shed more light on how the brain works, but the view of using computers in thinking is that the computer is the tool and not the creator. The pioneers of AI see that computers might possibly go beyond arithmetic, and may imitate the processes that go on inside human brains. Marvin Minsky states that today, with robots everywhere in industry and movie films, most people think AI has gone much further than it has. Yet still, 'computer experts' say machines will never really think. If so, how could they be so smart, and yet so dumb?

AI indeed could solve problems that Frederick Brooks indicated as essential complexity in software development (source: softwarecreation.org):

- **Complexity:** computers could handle much more information than our individual brains, carry knowledge about all possible states of the system and effectively manipulate it.
- **Conformity:** computers could seamlessly conform to interfaces of the other system and support rules of interactions with brother computers.
- **Changeability:** computers will have full intellectual control over the system code and can quickly understand what should be modified and effectively support change requests.
- **Invisibility:** our brains are specialized on particular processing of information influenced by our biological origin. Computers don't have this problem and could naturally

manipulate information without need to visualize and limit scope for better comprehension.

Do Computers Think Creatively?

It is only natural to ask whether computers can think creatively. Many feel, in fact, that whereas computers can excel in well-structured areas of problem solving – for example, logic, algebra, etc. – they have little hope of ever producing truly creative work. For a work to be creative, it must be novel and useful – this represents an enormous challenge for artificial intelligence.

If creativity is the ability to produce different and varied solutions, which for computers is just a matter of seconds, the problem is that it has no idea what the solution means or implies. Butler views that “Many people would claim that a computer can never capture the essence of the mind because a computer could never, in and of itself, be creative.” Boden expresses that humans on the other hand, are creative in an aware fashion, prompted by heavy emotional baggage.

Computers are able to carry out well-defined tasks, but are of little use in solving the more vaguely defined problems common in research, or in the creative process generally. An ability to ask the right question is essential in doing innovative research. Computers can generate questions by drawing pre-defined questions from an existing database, but are unable to pose fundamentally new questions. The reason for this is that these machines can only carry out predefined numerical operations, whereas we do not have any algorithm that can translate our ability to ask exploratory questions into numerical operations. The over-intensive use of computers as a research tool may actually prevent us from posing the creative questions that drive innovation.

Do Computers Enhance Creativity or Destroy Creativity?

Creativity might be viewed as any process which results in a novel and useful product. People use computers for creative tasks; they flesh out ideas for text, graphics, engineering solutions, etc. Computer programming is an especially creative activity, but few tools for programming aid creativity. According to Selker, computers can be designed to foster creativity as well. In the opinion of Mills computers have traditionally been used as tools to raise efficiency. To realize the true value of computers, one should view them as tools to enhance human creativity.

As Hamza and Alhalabi state, technologies can be educators’ tools in finding creative ways that encourage students to self-test, self-question, and self-regulate learning in helping them to create solutions to complex problems. Application of ICT as a tool or medium for supporting or enhancing creative activity, and automation to attempts in artificial intelligence to replicate creative activity in machines.

Scragg et al. argue that computer science is a fundamentally creative endeavor. Students need to be encouraged to discover insights in the creative process of problem solving. Hill

describes open-ended problem solving and design processes in technology education as creative processes that engage exploration. She suggests moving away from making models to making prototypes for real-life contexts.

Computers are a wonderful interactive tool for making demonstrations. However, the danger is that the student only watches demonstrations without actively exploring the system that is simulated by the computer. Some researchers speculate that computer simulation technology may have a positive effect on creativity (e.g., Betz, Gokhale, Harkow). However, these researchers offer no empirical evidence to support their claim.

Some criticize computer use because computers – by their very nature are mechanistic and algorithmic – support only uncreative thinking and production. However, adults increasingly view computers as valuable tools of creative production. Educational research indicates that there is no single effect of the computer on creativity; technology can support either uncreative drill or creative production.

In the opinion of Eaglestone and Ford, it may at first sight appear that computers are irrelevant to creativity in that they are better at convergent than divergent information processing tasks, therefore having little if any role to play in supporting creative thinking.

Computers by their very nature are inherently algorithmic; and often the mechanical nature of algorithms is considered an anathema to creativity. As Bipin Indurkha questions, how can any creative insight result from following a predetermined set of instructions in a blind and seemingly mindless manner?

Clements states that computers have been found to be a fertile tool for supporting creativity. Many articles address IT supports for creative practice; however, there are just a few related to computer science education in schools. Research also provides strong evidence that certain computer environments, such as Logo, word processing, and design tools, hold the potential for the computer’s facilitation of creativity. There is equally strong evidence that the curriculum in which computer programs are embedded and the teacher who chooses, uses, and infuses these programs, are essential elements in realizing the full potential of technology.

As stated earlier, there are relatively few empirical studies on the effects of computers on creativity. The lack of research may be because instructional computing has only thrived over the last decade. The following are the few empirical studies found to date that address computers and creativity as measured by the creative product.

A study conducted by Joram, Woodruff, Bryson, and Lindsay found that average students produced their most creative work using word processors as compared to students using pencil and paper. Based on these results the researchers concluded that word-processing enhances the creative abilities of average writers. A reason for this result may be that word-processing helps average writers generate a number of ideas knowing that only a few of them will be usable and the rest can be easily erased.

However, the researchers also found that word-processing had a negative effect on the creativity of above average writers. These mixed results suggest that the use of word-processing may not be appropriate for all students. However, due to the

small number of subjects used in the study, results should be generalized with caution.

In a similar study conducted by Howe, two advanced classes in graphic design, consisting of 28 undergraduate students, were randomly assigned to one of two treatments. The first treatment group was instructed to use a computer graphic program to complete a design project whereas the other group was asked to use conventional graphic design methods to design their product. Howe concluded that computer graphics technology may enable graphic designers to generate an abundance of ideas, then capture the most creative ones and incorporate them into their designs. However, due to the small sample size and a lack of random assignment, results of the study should be generalized with caution.

However, an empirical study by Michael was to compare the effect of a computer simulation activity versus a hands-on activity on students' product creativity, originality, and usefulness. Fifty-eight middle-school technology education students from Northern Virginia participated in the study. Subjects were randomly assigned to either a computer simulation or hands-on treatment group. The computer simulation group used a Lego-type brick simulator to construct creative products on the computer; whereas, the hands-on treatment group used real LEGO® bricks to construct their creative products. The hands-on groups' products were collected by the researcher and copied into the computer simulation program. Both groups' products were printed using a color printer. The printed products were evaluated by expert judges using a creative product semantic differential scale. This study showed that there was no significant difference in product creativity scores among the computer simulation and the hands-on treatment group. The null hypothesis was accepted. Findings suggested that it was possible to use a computer simulation activity in place of a hands-on activity and still maintain product creativity, originality, and usefulness.

An exploratory study of Benedek et al., examined a computer-based divergent thinking training program with respect to its effectiveness in enhancing ideational fluency and originality on the basis of practice. Two training versions were developed: (a) a training of verbal creativity and (b) a training of functional creativity. Both training versions consisted of nine sessions with eight divergent thinking tasks each. Two training groups (consisting of 11 participants each) and a control group ($n=14$) were matched for creativity, intelligence, age, and gender; the groups were tested in a pre-posttest design. The findings point to the usefulness of a computer-based training to enhance creativity-relevant abilities.

Hinton combined the creative process and problem-solving process into what is now known as creative problem-solving. He believed that creativity would be better understood if placed within a problem solving structure. Creative problem solving is a subset of problem solving based on the assumption that not all problems require a creative solution. He surmised that when a problem is solved with a learned response, then no creativity has been expressed. However, when a simple problem is solved with an insightful response, then a small measure of creativity has been expressed, and when a complex problem is solved with a novel solution, then genuine creativity has occurred. Genuine creativity is the result of the creative process that manifests itself into a creative product. Understanding the

creative process plays an important role in enhancing the production of creative products produced within the technology classroom.

Scales and Snieder have the impression that computers often are a sink of valuable human time. Every computer system requires a certain amount of effort to make it operate. In addition, researchers often spend an inordinate amount of time tailoring their computer to their taste at a level of detail that is not required by the work that needs to be carried out. Of course, the investment of time up front in customization can pay long-term benefits in efficiencies, but it's easy to go overboard. The worries of using the computer can actually clutter the mind to such an extent that it makes creative thinking impossible. However, we also have the impression that present-day researchers might be much more creative if they would switch off their computer for one day per week.

Much like word processing and computer graphics technology, simulation technology is another type of computer application that allows users to freely manipulate and edit virtual objects. However, due to a lack of research, the true effect of simulation technology on creativity is still unknown and can only be surmised.

Summary and Conclusion

Computers are tools, not slave-masters, computers are inert, unresponsive, incapable of thought, but we can accomplish much through and with them. A computer can do a variety of tasks easily, which works under a set of instructions, automatically accepts the supplied data, processes and analyses the data, and produces the information.

Computer programming is an especially creative activity, but few tools for programming aid creativity. Computers can be designed to foster creativity as well. The steps of the creative process where software can be used include generating ideas, recording ideas, manipulating ideas, and implementing ideas. Many thinking techniques which are performed manually, maybe with pen and paper, can potentially be encapsulated in a program. The main benefits are the compact storage and ease of access.

The computer doesn't think; it can only execute the direction of a thinking person. If poor data of faulty programs are introduced into the computer, the data analysis will be meaningless. The expression *garbage in, garbage out* describes the problem quite well. It is critical when using canned programs to carefully follow the appropriate program syntax. If a comma or slash is missing, the program may stop processing the data, or worse yet, process the data incorrectly (e.g., Best and Kahn). Rather than knowing how to program a computer, most computer users simply need to understand how a computer functions, and what it can do. Even those who need to program a computer can do their job more effectively, with better understanding of how computers function, and their capabilities and limitations.

The computer is merely doing a superficial imitation of human intelligence. It has to obey the instructions encapsulated into the programs without knowing any idea of output. It is implicit that the computers are better at convergent (converges to one right answer) than divergent information processing

tasks, therefore having little if any role to play in supporting creative thinking.

Creativity cannot be derived in a logical way, in a step-by-step fashion. Computers by their very nature are inherently algorithmic; and often the mechanical nature of algorithms is considered an anathema to creativity. The reason for this is that these machines can only carry out predefined numerical operations, whereas we do not have any algorithm that can translate our ability to ask exploratory questions into numerical operations. The basic question as Bipin Indurkha posed was how can any creative insight result from following a predetermined set of instructions in a blind and seemingly mindless manner?

Creativity has different meanings, at different times, and in different contexts. Creativity is complex in nature. It is difficult to understand it by adopting one single definition. Different viewpoints have been put forward to explain the concept, emphasizing different aspects of creativity. Generally, creativity has been discussed in terms of its end product, the creative person, and also of the creative process and creative environments. There is agreement in psychology that something is creative if it is new, original, and useful. By and large, psychologists seem to agree that creativity involves the ability to produce original ideas and to perceive new relationships among unrelated things.

The associationistic theories emphasize that forming new combinations of associative elements which either meet specified requirements or are in some way useful or act involves linking together two previously unconnected 'frames of reference' or 'two separate entities.' Creativity involves the ability to produce more associations and to produce more that are unique. Psychoanalytic theorists have emphasized the unconscious rather than the conscious. The humanistic concept is that creativity is born through a striving for the highest possibilities in life, rather than as a defence against neurosis. Creativity develops throughout life and can be cultivated throughout the life span. Gruber points to the long time periods involved in developing significant new ideas.

P-creativity is more possible than H-creativity while working with computers, because P-creativity refers to when an individual creates or discovers something they themselves have never done before, even though other may have done it before them.

The most related approach to creativity is 'information processing' which takes the computer as its key metaphor for the mind, seeing people as computer-like systems that code, store, retrieve, and transforms information. They equate the architecture of the brain with the computer and explain the process of thinking in terms of computer programming (algorithms and flowcharts). Information-processing technologists describe thinking as 'dynamic processes.' Novel solutions to problems may arise in response to information that becomes available as the person works on the problem.

Creativity is the process of generating unique products by transformation of existing products. These products, tangible and intangible, must be unique only to the creator, and must meet the criteria of purpose and value established by the creator. In fact, creativity makes an object or activity better, richer, more productive, fruitful, and aesthetically satisfying.

As psychologists defined human problem solving as creative to the extent that one or more of the conditions are

satisfied. Creativity must not be produced by recall from memory, rote computation, change in size, aggregation of elements or changes in old combinations, duplication of parts of a device, or any other simple deterministic process.

According to McGuinness, computers are seen to be very smart, but they have no imagination. They can only slavishly follow instructions and rules – which means they can't think for themselves and generate original thoughts. What the computer is doing is merely a superficial imitation of human intelligence. It has been designed to obey certain simple commands, and then it has been provided with programs composed of those commands. Because of this, the computer has to obey those commands, but without any idea of what's happening.

Computers are good at storing information and retrieving this information. They are also very good at manipulating information – sorting, selecting, and picking random items from lists. Computers could handle much more information than our individual brains, carry knowledge about all possible states of the system, and effectively manipulate it. Our brains are specialized on particular processing of information influenced by our biological origin, whereas computers don't have this problem and could naturally manipulate information without need to visualize and limit scope for better comprehension.

For a creative work the product must be novel and useful. The ability to produce different and varied solutions, which for computers is just a matter of seconds has the problem that it has no idea what the solution means or implies. Computers can never capture the essence of the mind because a computer could never, in and of itself, be creative. However, humans on the other hand, are creative in an aware fashion, prompted by heavy emotional baggage, motivation, etc., and also the product of the thinking has novelty and value, either for the thinker or for his society.

Sally Bowman Alden identified six key areas that all children should be exposed to in using computers and software as tools – tools for learning, creativity, productivity, research, communications, and entertainment.

Except for a few educational researchers discussed earlier, there is no substantial research directly measuring the effect that the computer simulation technology can support either uncreative drill or creative production. Very few researchers speculate that computer simulation technology may have a positive effect on creativity.

Creativity, one of the hallmarks of the human spirit, has yet to travel deep into the domain of artificial intelligence and computers. As Bossomaier and Snyder opined that: "the major paradigm shifts of the future may be created by computers rather than people, in analogy with how acts of genius can arise from an autistic mind."

See also: Problem Finding; Problem Solving; Systems Approach.

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Conformity

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Glossary

Acceptance Conformity that involves both acting and believing in accord with social pressure.

Compliance Conformity that involves publicly acting in accord with social pressure while privately disagreeing.

Conventionality Adherence to convention, or the normal ways people do things.

Ego-involved motivation In which action is prompted by an ulterior desire for social approval or a positive self-image.

Informational social influence Conformity that results from accepting evidence about reality provided by other people.

Interpersonal climate The sense of pressure versus freedom promoted when authority figures are controlling versus autonomy-supportive.

Normative social influence Conformity based on a person's desire to fulfill others' expectations, often to gain acceptance.

Reactance A motive to protect or restore one's sense of freedom in the face of normative influences.

Task-involved motivation In which action is prompted by an intrinsic interest in the task itself.

Defining Conformity

According to Merriam-Webster's on-line dictionary, conformity is "action in accordance with some specified standard or authority." As this definition implies, people may be powerfully influenced by social forces. Social influence can be *informational* or *normative*. Informational influence leads individuals to alter their behavior to accord with new knowledge obtained from others, whereas normative influence leads individuals to alter their behavior to accord with the conventional beliefs or practices of others. Informational social influence can aid the creative process, by enhancing a person's perception. For example, thoughtful criticisms of an artist's work from other members of a workshop may help to sharpen the artist's vision. In contrast normative social influence often works against creativity, in part by producing inaccurate perception. For example, Asch's classic studies in the 1950s showed that participants will agree with an incorrect group consensus regarding the length of presented line segments, ignoring the clear evidence of their own senses. Because it has received the most attention I will focus on normative conformity, and its potentially negative effects on creativity.

Another important distinction in the conformity literature is whether or not conformists actually believe the normative opinions that they espouse. Some individuals may be sufficiently lacking in self-confidence that they endorse a group's incorrect opinion both inwardly and outwardly. This form of conformity is termed *acceptance*. Research has made it clear that individuals who do this are unlikely to be creative. Other individuals may toe the party line in order to avoid making waves, while still maintaining a private, countervailing opinion. This form of conformity is termed *compliance*. The potential for individual creativity is more likely to be maintained in the compliance case, although by withholding their true thoughts from others, such 'expedient' conformers risk missing important feedback and information.

With more careful analysis the neat distinction between private acceptance and mere public compliance blurs. In most cases, normative influences concern more than simple perceptual judgments that have clear correct answers (e.g., the Asch line-length experiments). Group-level normative forces are most likely to play a role in the case of complex, many-sided issues, which have tangled ethical and doctrinal implications. Because of the ambiguity of many normatively informed issues, individuals may 'mistakenly' accept a prevailing opinion without realizing that it does not accord with their own prior inclinations or creative interests. Also, individuals may come to unwittingly accept a normative attitude that they originally merely complied with, because of self-perceptual or dissonance–reduction processes. In either case a danger is that over time people may lose, or fail to develop, the ability to discern their own values and interests. The inimical effects of such an occurrence are discussed below.

Another definitional issue concerns that of *conventionality*. This refers to the tendency to view or do things in the usual, socially accepted way. Conformity and conventionality are similar, but not necessarily the same; conformists may conform to conventions, but they may also defy conventions if the context establishes such defiance as normative. In contrast, a conventional person might conform to conventions in order to achieve social acceptance, but they may also do so out of habit or lack of imagination.

A final definitional issue concerns that of *reactance*. Those faced with strong normative pressure have a third option besides public compliance and private acceptance: they can resist, putting up a struggle against group norms. Although such counter-conformity can serve many useful functions, one danger is that the potential creator may become distracted by rebelliousness for its own sake. In other words, those who make a point of going against group opinion may, ultimately, be just as controlled by group processes and forces as those who passively go along with group opinion.

Why Conformity and Creativity 'Don't Mix'

Most commentators agree that there are powerful conflicts between creativity-related and conformity-related motives. Behavioral conformity typically involves a desire to be approved of by others, along with a corresponding fear of being rejected or ostracized by others. This desire is deeply rooted: given the importance of maintaining cohesive functioning within the small groups in which our ancestors lived, there is good reason to believe that evolutionary pressures selected for a strong motive to be approved of by 'the group.' Peoples' fears of being rejected by social groups if they do not conform are often justified – many experiments have demonstrated that those who persistently flout normative opinion are punished by, and finally excluded from, the groups of which they are a part. Interestingly, such results suggest that humans, besides having a built-in (or evolved) motive to seek approval by groups, also have a built-in motive to 'stifle' those who challenge the status quo of their social groups. This tendency to resist others' *non*-conformity is also likely to be antithetical to creative accomplishment, insofar as it prevents individuals from thinking about the new ideas or possibilities suggested by others.

In an influential early (1962) chapter, Richard Crutchfield described conformist motivation as *ego-involved*. Conformists are strongly focused on how they are perceived by other group members, and their primary goal is to protect or enhance their self-image and self-esteem. In contrast, creative performance tends to require strong *task-involvement* – that is, an exclusive focus on the problem at hand, in combination with a desire to get to the bottom of things no matter where the search leads. Unfortunately, the 'search' may often lead in directions which contradict or upset established beliefs, practices, or bureaucracies. In order to develop and market their new ideas individuals must often be willing to diverge strongly from group norms and accepted behavior, risking alienation and potentially drawing the group's wrath. Thus, one way in which conformist pressures may inhibit creativity is by reducing a person's willingness to follow through with a new idea or course of action. This may occur to the extent that a person's task-involved motivation is overwhelmed by his or her approval motivation.

A second potential negative effect of conformist pressures, alluded to above, is that they may cause people to lose touch with their own perceptions and thought processes. Creative activity depends on individuals' ability to access, and engage in open dialog with, their own experience. Very often the first glimmerings of a new idea or approach are subtle and evanescent, at the 'fringes' of consciousness. To the extent that individuals rely on others for guidance on how to think and behave, they may lose the ability to recognize and grasp such glimmerings within themselves. For example, one important first step in the creative process involves explicitly recognizing that there is a problem to be solved. Group mentalities are notoriously resistant to such recognition (i.e., when John F. Kennedy's 'group-thinking' advisors did not perceive the obvious flaws in the Bay of Pigs plan). Those who are over-invested in group approval may fail to notice their own nagging doubts or reservations regarding a course of action, or fail to recognize the seeds of a promising new idea when it occurs to them.

Thus far in this entry, the negative effects of conformity upon creativity have come about because group minds tend to resist or discourage innovation. However, it is also possible for negative effects to occur even when groups openly *welcome* creativity. For example, art professors may encourage students to compose works which are unusual and original, and students may receive many kinds of social rewards for succeeding in this aim. However, research by Amabile and colleagues indicates that creative functioning can be impaired to the extent that people become explicitly oriented towards such extrinsic rewards. Specifically, reward- or approval-oriented motivation has been associated with less cognitive flexibility, more shallow processing of new information, less integration of new information with preexisting knowledge, and less creativity in general. These decrements occur in part because thoughts of reward may intrude into actors' minds, distracting them and dividing their attention. In contrast those who can remain intrinsically or task-motivated are more likely to maintain access to their own deeper cognitive resources, and thus are more likely to be creative. Readers should know, however, that the question of whether rewards have detrimental effects upon creativity remains controversial, as Eisenberger and Cameron have shown that rewards can facilitate creativity under certain conditions, and even Amabile has suggested that in some cases of entrepreneurship, extrinsic motivation can have 'synergistic' positive effects in combination with intrinsic motivation.

To summarize, excessive concern for group norms and opinions is likely to inhibit a host of motivational, cognitive and self-regulatory processes essential to innovation. Such concerns may reduce the *quantity* of one's motivation to pursue an innovative line of thinking, as when one fears rejection by the group; or, such concerns may detract from the *quality* of one's efforts, when they involve excessive focus on receiving anticipated social rewards or avoiding anticipated punishments. It is worth noting at this juncture, however, that social groups need not *necessarily* pull for conformity. Some research suggests that group processes can even enhance individual creativity, such as group brainstorming techniques, or corporate climates which intentionally focus on change and encourage unconditional respect for each group-member's creative efforts (see Paulus and Brown's 2003 review of the group brainstorming and creativity literature). However, ego-involved motivations easily emerge even in the most egalitarian of social contexts, perhaps explaining why group contexts have a negative effect upon creativity, on the whole.

Conformist Forces Within Situations

Research on the contextual determinants of creativity has focused on the impact of authority figures upon creative performance. In 1995, Sternberg and Lubart noted a variety of perplexities in this literature. For example, some research suggests that creativity is *enhanced* when authorities set limits, explicitly structure the task, set up competitions, spell out criteria for evaluation, and render judgment upon individuals' performance. However, other research indicates that external constraints, competition, and evaluation pressures all *detract* from creativity. Sternberg and Lubart suggested that these contradictory research findings are in part due to differences in the

difficulty of the creative tasks employed in different studies, differences in subjects' prior experience with the tasks, or differences in subjects' initial arousal levels.

In addition to these possibilities, an important general factor determining when external constraints are detrimental may be the *interpersonal climate* in which they are administered. The theories of Amabile, Deci, and Ryan suggest that whenever constraints are viewed as controlling, they will tend to reduce task-motivation and hence creativity. Presumably this is because a controlling authority's demeanor induces reactance or approval motives, or leads individuals to become overly focused on extrinsic rewards or punishments. As noted above, any of these foci can drain away cognitive and self-regulatory resources. In contrast if evaluations and constraints can be delivered in a noncontrolling, information way, helping to better define the task while still supporting personal autonomy, an optimal context for intrinsic motivation and creativity may result.

Much research, conducted in both educational and work environments, is consistent with this conclusion. For example, teachers who conduct classes informally, welcome unorthodox views, and allow students to choose what to investigate, and treat students as individuals, are most likely to produce creative students. Similarly, 'open' classrooms, in which students are allowed considerable flexibility and individualized effort is encouraged, tend to produce more creative students than do traditional classrooms which rely on drill, large group instruction, carefully prepared curricula, and which emphasize exams and grading. Paralleling these findings, Amabile has identified manager characteristics conducive to creativity. Managers who set challenging goals and then grant employees substantial freedom and control over their work, who are not overly strict and who can evaluate work nonthreateningly, and who encourage new ideas, are most likely to engender creative performance in their subordinates. In contrast, organizations in which there is defensiveness, a lack of freedom, and an unwillingness to risk change, do not function as creatively; in such contexts, conformity and rigidity are likely to 'rule the day.'

Normative forces work not only at the level of the group, classroom, or organization. Increasing attention is being given to *cultural* differences in conformity, and the effects of such differences upon the creativity of citizens within various cultures. For example, recent research has examined aspects of Japanese, Chinese, Turkish, Senegalese, Hong Kong, Sudanese, Iranian, and Israeli culture which may predispose citizens of those societies towards greater conventionality and reduced creativity. Kaufman and Sternberg's 2006 *Handbook of International Creativity* contains more information on these issues.

Conformist Forces Imported into Personality

Besides studying social contexts which increase conformity and thus detract from creativity, researchers have also studied personality traits and styles related to conformity. In other words, conformity can be an enduring state of mind, not just a product of momentary situational influences. Such personality styles may develop when a child's efforts at independent self-expression are repeatedly punished or discouraged by parents or peers, or when love and affection are given only when the child conforms to rigid rules and regulations. This treatment may

create an abiding insecurity and anxiousness regarding the approval of others, crippling the growing person's ability to be creative (although some have argued that early experiences of alienation can catalyze the formation of powerful creative personalities). Sulloway's 1996 work indicates that birth order may also influence the acquisition of conformist traits. First-borns, being more naturally aligned with parents, are more likely to uphold the status quo. Although they tend to become high career achievers, they do so through relatively low-risk ventures and tend to resist important innovations in their fields. In contrast later-borns, having less power and receiving less attention, may be 'born to rebel' against the familial status quo. Later, they may be more likely to make innovative contributions to their fields, and quicker to recognize and support legitimate paradigm shifts within their fields.

Little research has directly studied the relation of conformist traits to creativity. Instead, research has focused on the opposite pole, personal *autonomy*, considered one of the 'core characteristics' of the creative personality. Autonomy refers to the preference for regulating oneself, instead of being regulated or controlled by social forces. Related personality traits include Independence of Judgment, Self-Directedness and Self-Determination, Self-Sufficiency, Self-Assertiveness, and Individuation. Such traits have been repeatedly shown to predict both momentary and lifetime creativity. This is because those high on these dimensions tend to (a) show less suggestibility and less need for the approval of others; (b) more courage and persistence in the face of criticism and pressure from others, and more willingness to express dissenting opinions; (c) more ability to maintain their task-involved or intrinsic motivation, and less susceptibility to ego-involved or performance motivation; and (d) more ability to maintain contact with and behave on the basis of enduring personal feelings and attitudes, rather than responding in a chameleon-like manner to momentary contingencies and norms. Although most of the above findings are correlational, some experimental work has been conducted. For example, Crutchfield and his associates demonstrated in the late 1950s that those high in autonomy-related traits are much less likely to conform to the (incorrect) group opinion in the Asch line-length paradigm, compared to those low in such traits.

One way of explaining the autonomy-creativity relationship is to posit that autonomous individuals are more inclined to perceive potentially controlling social environments primarily in informational terms. This could give them at least two extra resources in their creative efforts. First, because they are not heavily dependent upon others' approval, autonomous persons may be better able to take what is useful from the comments and opinions of their peers, while rejecting and discarding that which is not useful. That is, their autonomy may 'inoculate' them against the danger of losing touch with their own perceptions as they make contact with others' ideas. Second, the ability to perceive potentially controlling events in informational terms is likely to help individuals to maintain their intrinsic or task-focused motivation, and thus maintain full access to cognitive resources. Individuals do in fact differ in the ability to shrug off potentially coercive input. For example, Deci and Ryan reported that women are more likely to interpret ambiguous social feedback as controlling, detracting from their intrinsic motivation and perhaps creativity.

Another way of understanding the relationship between personal autonomy and creativity is in terms of an 'evolving systems' model. Gruber's psycho-biographical studies revealed that important new themes and realizations tend to emerge slowly within the work of notable innovators, rather than occurring in moments of sudden insight. For example, although the first inklings of the theory of evolution appear in Charles Darwin's notebooks early on, the model matured slowly and required much of Darwin's life span to be worked out fully. This indicates that lifelong persistence and dedication to self-posed and self-defined problems may be crucial for the development of extraordinary creativity. Such long-term task-involved motivation is unlikely to be manifested in those who are easily swayed by popular opinions of the moment, and who take the cue for their work from current fads and trends.

A related perspective concerns the progression of an organismic integration process, occurring in a deeper way or at a faster rate within notable creators. Sheldon proposed an 'attunement' hypothesis, in which autonomous persons are in better touch with the inner organizational tendencies that are inherent in developing life. Although such integrative tendencies are natural they are also fragile, and may be forestalled to the extent that the person cannot detect his or her own authentic reactions amidst the din of social influence. Creative accomplishment may thus be viewed as a mere side effect of a more general integration process, which occurs automatically to the extent that people are fully 'in touch' with themselves. This understanding of creativity is similar to that advocated by Maslow and Rogers, with their concepts of self-actualizing or fully functioning persons.

Creative Personality Development as the Overcoming of Conformist Tendencies

As suggested by the above, a number of theories posit that exceptional creativity occurs only after would-be creators have succeeded in psychologically differentiating themselves 'from the crowd.' Most prominent among these is the psychodynamic model of Otto Rank, published in 1932. Rank proposed three *types* or *stages* of personality: a *conformist*, adapted type who takes their cues from those around them; a *conflicted* type, who has broken free of norms, but is confused and unhappy; and a *creative* type, who has gone through both of the latter stages, to emerge with a powerful creative voice of their own.

A substantial body of research supports Rank's conception. For example, MacKinnon used the typological model to characterize the three groups of architects examined in the well-known IPAR studies. The nationally renowned creative architects in this sample were a good fit to Rank's 'creative' prototype; the less renowned associates of these architects fit the 'conflicted' prototype; and a control group of ordinary architects fits the adapted or 'conformist' prototype. Consistent with Rank's developmental assumptions, notable innovators often report an early sensitivity to controlling influences, which results in early rebellion against the *status quo*. For example, Hammer, in his extensive 1984 study of adolescent artists, found that the most gifted among them were experiencing profound conflict and emotional turmoil, and were also engaged in a retreat from their peers. These efforts at

detachment were motivated by an attempt to "resist the corroding effects of over-conformity." Similarly, Getzels and Jackson's comparisons of highly creative and highly intelligent youths in the early 1960s showed that creative youths were more mocking of conventional aspirations and beliefs, and were much less popular with their teachers, despite the fact that their level of academic achievement was no less than the high IQ group.

Creative individuals may begin to resist conventional thinking at a relatively early age, in response to particular developmental crises or environments. For example, in 1966 Torrance identified a 'fourth grade slump' in creativity, driven by children's increasing sensitivity to peer opinion at this age. A young child's ability to stand up to such early conformist pressures may represent a significant developmental achievement, and may serve as an important predictor of later creative achievement by that person. To be creative, one must sometimes 'defy the crowd' – perhaps the sooner this occurs, the better. As noted above, however, those seduced into pursuing nonconformity for its own sake, rather than as a way of gaining the freedom to work, may yet be slaves to group opinion.

Recent Priming and Small Group Research Relevant to Creativity and Conformity

Now, we return to the domain of 'conformist forces in situations,' focusing on subtle cognitive influences rather than interpersonal influences. In the last ten years, new methodologies have been developed for studying situational priming effects upon behavior. Several experimental studies with college students have shown that creative performance can be influenced by both conscious and nonconscious conformity-relevant priming manipulations. For example, Wiekens and colleagues showed that priming 'I' produced more divergent thinking than priming 'We'; Galinsky and colleagues showed that priming social power in participants through relevant semantic primes, autobiographical memories of power, or role manipulations of power, produced greater creative production, compared to participants in a control group; and Forster and colleagues showed that priming 'deviancy' or 'punk' produced more creative thinking compared to a control group. All of these studies indicate that creative performance can be enhanced when participants are cognitively primed with concepts that counteract or mitigate against conformity pressures. In other words, although people may automatically tend to follow the crowd and think inside the box, in some cases, the social or informational environment can work to *reduce* these unfortunate tendencies, rather than increase them (as was described earlier). Teachers, coaches, and leaders would do well to keep this in mind; 'the power of the situation' can be positive as well as negative.

In addition, the last ten years has seen an increase in studies of group creativity and problem-solving. What allows groups (not just individuals) to be most creative? Once again, results support the notion that situational influences can sometimes enhance, rather than detract from, creativity. Nemeth and colleagues found that allowing or encouraging dissent or conflict within groups promotes improved creative group cognition; Paulus and colleagues concluded that although greater group

diversity produces more conflict and frustration at first, later group creativity is enhanced; De Dreu and colleagues demonstrated that higher levels of minority dissent within groups predicted greater creative performance by groups as a whole; and Jung and colleagues showed that transformational (inspirational) leadership produced more group creativity than transactional (directive) leadership styles. This research is similar to research examining factors which prevent 'group-think,' but focuses on enhancing creativity as the outcome, rather than preventing premature or myopic group decision-making as the outcome.

Conclusion

In this entry I discussed both situational (priming, group context, reward structure, leader communication style) and personal (dispositional, motivational, and developmental) factors that influence conformity and creativity. The research suggests a variety of approaches that authorities and leaders can take in trying to maximize the creativity of their subordinates, and also suggests a variety of attitudes and approaches that subordinates can take to protect their creative abilities when leaders and groups fail to support them. Obviously, creativity is multiply determined, and there will always be exceptions to the 'rules' I have put forth – as when a highly controlled individual finally 'busts loose' from confining restrictions, producing a creative product that would not have happened without those restrictions; or when a conventionally oriented individual discovers their creative side only after an external incentive is provided to reward creative solutions. Still, in order to maximize creativity

on average, it is probably a good idea to design social environments and personal attitudes in the ways suggested by this review of the research. Authorities should support the autonomy and personal power of subordinates; should de-emphasize norms, conventions and rewards, at least during idea generation phases; and should be sensitive to developmental processes within subordinates that may lead to creative breakthroughs. Creativity by definition involves going beyond the norm and the known, and is very difficult to achieve if the norm and the known dominate the individual's thinking.

See also: Barriers to Creativity and Creative Attitudes; Climate for Creativity; Creative Environments, Conditions, and Settings; Deviance; Group Creativity; Motivation; Personality: Autonomy and Independence; Social Psychology.

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Confucianism

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Glossary

Confucianism An intellectual and spiritual tradition based on Confucius' teachings that emphasize self-cultivation through effortful learning and the attainment of social harmony through virtuous and beneficent rule by the government.

Li (1) The Confucian notion of proper behavior. It refers to propriety (the right thing to do) as well as to the proper rites or ritual. (2) Reason or principle. It is the central construct in the study of Confucianism by Chinese scholars in the Song and Ming dynasties. (In written Chinese, these words are written with different characters.)

Ren The most important and supreme Confucian virtue. It is often translated as humanness, goodness, or benevolence, but can be better understood as the respect for and love of humanity.

Ru The Chinese word for Confucianism. It may refer in different contexts to the Confucian school of thought as in *ru-jia*, the Confucian religious tradition as in *ru-jiao*, or the study of Confucian classics as in *ru-xue*.

Xiao The Confucian emphasis on respect and love for one's parents and elder relatives. It is often translated as filial piety, and is the cornerstone of family and social order.

Introduction: Confucius and Confucianism

Throughout history, Confucianism has been one of the most influential systems of thought in China. It has continued to evolve during the past three millennia, and represents an integral and important part of Chinese civilization. Over the years, its influence has extended far beyond the borders of China, into Korea, Japan, Vietnam, and large parts of Southeast Asia, and more recently, into Europe and North America. The extensiveness of its influence can be attributed to the comprehensive system of ideas and beliefs that provides not only a philosophy of life for many millions of people but also a guiding ideology for some states, including the Chinese empire in pre-modern China and the governments of modern Singapore and South Korea.

Given that Confucianism is a major intellectual and spiritual tradition in the world, it is natural to ask whether Confucianism offers a distinct way of looking at creativity, and whether Confucianism values and encourages creativity. Interestingly, there is no exact word equivalent to creativity in Chinese. Yet, Confucianism has often been looked upon by scholars as a system of thought that goes against novelty and creativity. It is therefore somewhat puzzling to find that China as the country where Confucianism has its roots has a history of flourishing art and invention. To understand this paradox, the basic ideas of Confucianism will be introduced in this entry. We will first discuss the multiple meanings of Confucianism, the life and work of its founder, and the evolutionary history of Confucianism, to set the stage for understanding the importance of studying the Confucian texts as a path to self-cultivation and enlightenment, which could be interpretable as the wellspring of creativity. We will then explore why Confucianism has often been regarded as a conservative force against creativity. Finally, we will turn to the consideration of how Confucianism could be interpreted to inform our understanding of novelty and creativity from the Chinese perspective.

The Multiple Meanings of Confucianism

Even for Chinese scholars, Confucianism has multiple meanings. Confucianism (or *ru* in Chinese) may refer to *ru-jia* (Confucian school of thought or approach), *ru-jiao* (also *kong-jiao*; Confucian cult or religious tradition) or *ru-xue* (studies of Confucian classics and their annotations and commentaries). Tracing the original use of *ru* from different sources, scholars have found that *ru* was used to refer at different times to specific groups of people who were dancers and musicians in religious ritual, or who were masters of ritual and ceremonies, or who were teachers or trainers of dancers, musicians, and performers in ritual, rites, and ceremonies. Subsequently, *ru* was gradually extended to refer to specialists or experts with skills of ritual, history, poetry, music, mathematics, and archery. By the time of the Warring States period in Chinese history, Confucius, whose name gives rise to the naming of Confucianism, was recognized as the best representative in the *ru* tradition. Thus, *ru* came to be identified with the teachings or doctrines propagated by Confucius.

Confucius: His Life and Work

Confucius (551–479 BCE) is the Latinized form of Kong Zi (also Kong Fuzi; Master Kong) whose real name was Kong Qiu or Kong Zhongni (Figure 1). He was born in Qufu in the small state of Lu (in present-day Shandong province in Eastern China), and lived in the Spring and Autumn period of the Zhou dynasty. Although he was a descendant of aristocrats from the royal house of the Shang dynasty, he was brought up in poverty. It was said that his family declined and his grandparents were forced to migrate from the state of Song to the state of Lu. His family suffered further decline as his father died when he was three years old, and he was raised and educated by his mother. As a young man, he witnessed the downfall of the Zhou dynasty and the resulting social disorder and military conflicts among the many feudal states. Along with many thinkers from different schools of thought at the



Figure 1 The Statue of Confucius at New Asia College of the Chinese University of Hong Kong, Hong Kong.

time, Confucius attempted to provide an explanation for the social chaos and sought to put forth his ideas to the ruling autocrats for restoring social order and harmony. He believed that social disorder was developed from the misuse and abuse of *li* (ritual/propriety) and *yue* (music), and the restoring of social harmony required the ruler to govern by virtue, starting with the appropriate use of ritual and music, which reflected the cultivation of moral excellence on the part of the ruler.

Despite his vision of transforming government and restoring social order, Confucius held office for only a few years at Lu. His first important appointment was as magistrate of the district Zhongdu (501 BCE). Because of his successful administration, he was promoted to Minister for Construction (500 BCE) and Chief Justice, and he possibly served as acting Prime Minister for a short period (499 BCE). Realizing the difficulty in putting his ideas into practice in Lu, he left his home state and started his 13-year tour to different states, trying in vain to convince rulers of these states to adopt his ideas in governing and in social reform. With a change of the political climate at Lu, Confucius returned home, dedicating the rest of his life to teaching students and editing ancient classics. He died at the age of 73, and it was said that even the Duke Ai of Lu came to express his condolences. He was hailed as the Supreme Sage by historian Sima Qian who wrote his biography in the Han dynasty. However, as a sage and a great teacher, Confucius has left behind very few written works. The most important source of knowledge of his ideas and teachings

is *Lunyu* (*The Analects*), which is a compilation of conversations between Confucius and his disciples and other people.

It was said that Confucius had 3000 students, among whom 72 were more well-known disciples. After the bereavement period of three years (six years for his favorite disciple Zigong), his disciples and students went afar to different states to spread his teachings, either acting as administrators of states or as teachers who set up schools to teach the principles of the *ru* tradition. Gradually, *ru* became a name attached to a scholar who followed the footsteps of Confucius to teach and interpret the classics, and to engage himself in administration, education, and the preservation of ancient ritual and music. Since followers of Confucius might develop different understandings and interpretations of the master's ideas and teachings due to the multidimensional themes in the master's conversations in *Lunyu*, different sub-schools of *ru* emerged with slightly different methods of learning and practice, all considering themselves to be faithful followers of Confucius and his school of thought or *ru-jia*. A brief description of the evolution or development of Confucianism may be helpful for us to understand the emergence of the different sub-schools in *ru-jia*, and their possibly different views on creativity.

Brief History and Development of Confucianism

While Confucianism was named after Confucius, the core of Confucian thought can be said to go back to the time before Confucius, possibly to 1100 BCE after the Zhou people had conquered the Shang people. Confucius also talked about himself as a transmitter rather than a creator of the *ru* tradition. He believed that he was merely teaching the *Dao* (The Way) of the ancient legendary sage-kings, the three sovereigns (Fu Xi, Shen Nong, and Huang Di) and the five emperors (Yao, Shun, Yu, King Tang of Shang, and King Wu of Zhou). He further believed that these sage-kings had *de* (virtues) and therefore *tianming* (the Mandate of Heaven) to rule. Therefore, the mission of Confucianism or Confucian teachings was aimed at promoting the self-cultivation of virtues and the revival of the ethics of the early Zhou dynasty to restore social harmony. After the death of Confucius, Confucianism was spread by his followers, giving new characteristics to the Confucian doctrines, with an enriched content of Confucian practices and a broadened range of interpretations of Confucian teachings. Taken together, it is no surprise that Confucianism tends to regard nothing as novel, and it would be appropriate to attribute novelty to the results of a revival or continuation of what happened in the past.

Scholars examining the history of Confucianism tended to classify the development of Confucianism into stages. One simple, perhaps oversimplified, classification is to divide the development of Confucianism into a formative or creative stage characterized by the enriched elaborations of Confucian teachings by different philosophers before Confucianism became the state ideology in the Han dynasty, as opposed to the interpretative stage characterized by the emergence of different interpretations of Confucian teachings in a period of classical learning after the Han dynasty.

Perhaps, a more useful classification is one that expands the two-stage approach into a three-epoch approach with

sub-stages or transition periods to take into account the interplay between Confucianism and the many other traditions that also existed through the long history and development of Confucianism. The three epochs are the Pre-Qin *Ru-xue*, the Song-Ming *Ru-xue*, and the Modern New Confucianism.

Pre-Qin *Ru-xue*

The first epoch is the period of the *Ru-xue* of the Pre-Qin Scholars. This is the formative stage in which Confucianism took shape with the teachings of Confucius based on the teachings of the pre-Qin scholars during the Spring and Autumn period (770–476 BCE), through the modification, elaboration, and clarification by scholars such as Meng Zi and Xun Zi in the Warring States period (475–221 BCE), to the time of Dong Zhongshu in the Han dynasty when Confucianism was first declared the mainstream and state ideology.

A marked transition period between this first epoch and the second epoch was the reformation and revival of Confucianism in the interaction between Confucian schools and the schools of Legalism, Yin-Yang and the Five Elements (metaphysical forces), Moism (the teachings of Mo Zi) and Daoism (the teachings of Lao Zi and Zhuang Zi). This took place mainly in the Han dynasty when Confucianism recovered gradually from the setbacks under the Qin persecution and the Legalist discrimination. The revival was characterized by a more established theological and metaphysical doctrine of interaction between Heaven and human beings. The continuing debates on the interpretations of the Confucian classics inevitably led to a period of emphasis on the scholastic studies of words and sentences in the classics, which in turn led to further new developments in the second epoch. In a broad sense, this period lays the foundation for the notion that what is old encompasses what is new, and novelty emerges from the old only through active human efforts.

Song-Ming *Ru-xue*

The second epoch is the period of the Song-Ming Study on Principle (*Song-Ming Lixue*; *li* meaning principle as distinguished from the homonym *li* meaning ritual). Confucianism at this epoch is also known to Western scholars as Neo-Confucianism. In this epoch, Confucianism was faced with challenges from Buddhism and Daoism. Inspired by Buddhist philosophy and Daoist spirituality, Confucian scholars started to reformulate the Confucian view of the universe, society and the self, while at the same time removing elements that they considered to be Buddhist–Daoist superstitions from Confucian doctrines. Indeed, Confucian concerns were expanded to include metaphysics and new methods for self-cultivation and enlightenment. Consequently, a comprehensive system of new emphasis in Confucian learning called *Lixue* (the Learning of the Principle/Reason), or *Daoxue* (the Learning of the Way) emerged from this movement. Notable scholars of this epoch were Zhu Xi and Wang Yangming, and the two advocated somewhat different approaches. This period is marked by the initiation of the belief that, in addition to effortful learning, self-reflection or meditation is a path to achieve enlightenment, which could be the wellspring of creative work.

Although historical records suggested that Confucian doctrines and institutions were introduced to Vietnam, Korea, and Japan as early as the Han dynasty, it was in this epoch that Confucianism was introduced more formally to these East Asian countries, and appeared as new forms of presentation after integrating with local cultures and traditions to satisfy the social and political needs of their own countries. This epoch ended with the decline of the dominance of Confucianism in China and East Asia, corresponding roughly to the beginning of the twentieth century.

Modern New Confucianism or *Xiandai Xin Ru-xue*

The third epoch started to take place in the twentieth century, marked by the critical reflection on traditional doctrines initiated in the May 4th Movement (CE 1919). With the influence of Western thought, modern Confucian scholars started to reinterpret Confucian doctrines in the light of Western traditions and other world philosophies, especially European philosophical traditions and Christian spirituality in the modern age. Singapore (under Lee Kuan Yew) and Taiwan have looked to the ideas of Confucianism as crucial in morality and social harmony. In recent decades, Confucianism has also been identified as a vital part contributing to the booming economies of East Asian countries before the onset of the more recent worldwide financial turmoil, despite the claim that Confucianism is an obstacle to innovation and China's modernization. Contemporary scholars, including Mou Tsung-san, Carsun Chang, and Tu Weiming, have contributed to the revival of Confucian values and the transformation of Confucian doctrines, and they have named this rejuvenated Confucianism *Xiandai Xin Ru-xue* (Modern New Confucianism).

The Confucian Texts: The Five Classics and the Four Books

Despite the fact that Confucianism has undergone evolutionary changes throughout the years, a number of Confucian texts remain at the heart of the Confucian tradition. These texts are generally referred to as the Five Classics (*Wu Jing*) and the Four Books (*Si Shu*). It is believed that immersion in the study of these texts provides the path to self-cultivation, and therefore enlightenment.

The Five Classics

The recordings of the culture and wisdom of the sage-kings of antiquity, once edited and interpreted, became known as *Jing* or a classic. There are five of these texts: *Shijing* (*The Classic of Poetry*), *Shujing* (*The Classic of Documents* or *The Classic of History*), *Yijing* (also *I Ching*; *The Classic of Changes*), *Liji* (*The Record of Rites*), and *Chunqiu* (*The Spring and Autumn Annals*). Traditionally, Confucius was credited with writing *Chunqiu* as well as the *Shiyi* (*Ten Wings*), the commentaries on *Yijing* or *Zhouyi* (*The Yi of Zhou*), and with editing the four other classic texts. There was also a sixth text, the *Yuejing* (*The Classic of Music*), which was lost before the third century BCE. Each of the texts is said to capture an important component of ancient wisdom. Therefore, for Confucian scholars, ancient

wisdom could be made accessible through the study of these texts for the promotion of social harmony and order, and for the provision of the means to self-cultivation and becoming fully human. Accordingly, the Five Classics (*Wu Jing*) could be viewed as five perspectives or lenses in understanding the Confucian tradition.

Shijing is a collection of 305 poems ranging from court hymns to folk songs. This classic provides the poetic lens of the Confucian valuation of common human feelings. The verses generally represent emotions and sentiments of people from all walks of life expressed on different occasions. Many of the poems could be read as allegorical commentaries on the community and the government.

Shujing is a record of historical events and political treatises, dating to the time of China's remote past with legendary sage-kings and the three dynasties (the Xia, the Shang, and the Zhou). By referring, for example, to the time of Yao, Shun, and Yu, whose sagacity, filial piety, and dedication to work enabled them to rule on the basis of responsibility and trust by the people, this classic provides the political lens on the Confucian vision on moral behaviors and good government.

Yijing consists of a handbook of divination (*Zhouyi*) and the commentaries (*Shiyi* or the *Ten Wings*). The commentaries are believed to have been added by Confucius or Qin-Han scholars to help decipher the abstruse and opaque judgments of the text. This classic provides the metaphysical lens, as it not only captures the ancient practice and theory of divination but also underscores the intimate connection between the human and the natural realms. The system of divination is based on 64 hexagrams representing various combinations of the two interacting and vital forces of *yin* and *yang*. It was believed that the hexagrams and their transformations represented all possible conditions and scenarios in the constantly changing world, making it possible to seek guidance from Heaven.

Liji is a collection of materials that include comprehensive discourses on ritual, rites and learning, interpretations of ancient rites, recordings of the sayings and affairs attributed to Confucius and his disciples, ancient ritual or ceremonies, and ancient proverbs, maxims and aphorisms. It provides the social lens on society as a community of trust with emphasis on communication and appropriate behaviors, and articulates the basis of Confucian self-cultivation.

Chunqiu records political, economic, natural, and diplomatic events for a period of 242 years from 722 BCE to 481 BCE. It follows the chronicle of events in the state of Lu, the home state of Confucius. The annals could be read for moral judgments and guidance for rulers, providing the historical lens that reanimating the old could be regarded as the best way to attain the new.

The Four Books

From the Han and the Tang dynasties, the Five Classics were the key texts for Confucian teachings and for state examination. In subsequent years, other texts, including *Lunyu* (*The Analects*), *Mengzi* (*Mencius*), and *Xiaojing* (*The Book of Filial Piety*), were added to augment the teachings of the Five Classics, with a total of 13 texts identified by the ninth century CE.

In the Song dynasty, Zhu Xi took on the task of integrating different presentations of Confucian teachings by singling out four texts that he believed could represent the core of Confucian canon. Since then, they have been known as the Four Books (*Si Shu*): *Daxue* (*The Book of Great Learning*), *Zhongyong* (*The Doctrine of the Mean*), *Lunyu* (*The Analects*), and *Mengzi* (*Mencius*). Both *Daxue* and *Zhongyong* were originally written as chapters in *Liji*, and were selected for their philosophical and metaphysical import. Starting in the Yuan dynasty (CE 1313), the Four Books became the core texts of Confucian teachings for state civil examination in imperial China up to the time when the system of examination was abolished in 1905, with Zhu's commentaries considered orthodox.

Daxue consists of two basic parts: Confucius' teachings, and the commentaries by Zeng Zi, one of Confucius' students. The text provides the student a good foundation for learning. It teaches that self-cultivation is the first step in bringing the world into harmony, and describes how to cultivate one's own moral values and to exert moral influence on others. Thus, it could be said to be an exploration for the way of leadership in governing the world. It is now believed that this could be the work of Qin-Han scholars.

Zhongyong explores how one should cultivate oneself and strive to become a sage. *Dao* (the Way) figures prominently in the text and is defined in terms of *zhong* (centrality) and *he* (harmony). The notion of the triad of heaven, earth, and sage was accepted as the supreme ideal in orthodox Confucianism. In modern day language, we may consider *Zhongyong* as a human psychology text that has influenced the way the Chinese understand human nature, human aspiration, human relationships, and human learning.

Lunyu is a record of Confucius' sayings and the conversations between Confucius and his disciples. The dialogues and anecdotes could be regarded as showing Confucius at the center of relationships, and in thought and action dealing with moral and historical topics.

Mengzi consists of the recording of Meng Zi's discussions with disciples and political leaders. Meng Zi was said to have been the student of a disciple of Confucius' grandson Zisi. In this text, Meng Zi developed his teachings beyond those of Confucius, such as the original goodness of human nature, the possibility for everybody to become a sage, and the importance of humane government.

The Confucian Teachings

Song Confucian scholar Zhu Xi elevated the Four Books above the Five Classics as texts that summarized Confucian teachings. These texts, because of their complexity and because they were written in the terse and refined language of classical Chinese, have given rise to a tradition of commentaries aimed at elucidation and interpretation. In addition, the multiple meanings in the same word used to represent a construct, when applied to different contexts, often generate confusion. For example, the most important Confucian construct *ren* (translated as goodness or benevolence) might carry in different contexts the meanings of love, kindness, sympathy, warmth, tolerance, respect, caring, openness, altruism, and so on. In *Lunyu*, Confucius used some fifty applications in life situations to illustrate

the meanings of *ren* to students. Indeed, *ren* could be said to be central to Confucian teachings. We will discuss in a somewhat oversimplified way the two major themes of self-cultivation and social harmony in Confucian teachings.

Self-Cultivation

Broadly interpreted, *ren* could be said to be the quality of goodness in a person that makes the person truly human. A *junzi* is a person who practices *ren* or whose action displays *yi* (righteousness) and other virtues. Therefore, it is not surprising to find that the intrapersonal attribute of *ren* could give rise to multiple interpersonal behavioral manifestations as embodied in multiple virtues. Indeed, when Zeng Zi, a disciple of Confucius, attempted to clarify to other students what Confucius meant by the theme that ran through the teachings of Confucius, he referred to *zhong* (loyalty) and *shu* (consideration). Thus, it could be said that goodness is the one theme and that loyalty and consideration are basic manifestations of goodness.

More specifically, *zhong* (also translated as conscientiousness) could be interpreted as loyalty or being true to others as well as being true to oneself and to the true humanity in oneself. In order to be true to oneself, one has to learn to exercise self-control or self-regulation. Thus, Confucius explicitly suggested that goodness is to control oneself and subject oneself to *li* (rites). On the other hand, *shu* (also translated as altruism) could be interpreted as extending one's true self in one's behaviors towards others or to behave to others as a true human being should behave. In response to disciple Zigong's request for a saying that could always be acted upon, Confucius highlighted *shu* as to "never do to others what you would not like them to do to you."

In Confucian teachings, it seems that to be truly human is to desire spontaneously what is good, and to achieve self-cultivation requires effortful learning and education or meditation. While the path to self-cultivation is open to every individual, the process suggests a gradual and long-term development. Self-cultivation allows one to achieve enlightenment through unity with the universe, and therefore is also a process of creativity, as it is said that many great Chinese poets and artists have produced truly great art works through self-cultivation. In *Lunyu*, Confucius offered his self-cultivation as an example. The quotations are my free translation from the Chinese text.

At fifteen, I set my heart on learning.
At thirty, I established my goals in life.
At forty, I had a good understanding of people and things and was no longer perplexed.
At fifty, I accepted the givens of life, and knew what could and what could not be changed.
At sixty, I attended to truth readily and accepted them as they emerged.
At seventy, I felt free to do what I desired and was mindful not to overstep traditional rules.

Although self-cultivation could be directed intrapersonally for personal enlightenment as in the self-description of Confucius, it could also be extended to areas to allow one to become truly human at a more interpersonal or transpersonal level when the focus is on social harmony.

Social Harmony

Confucius believed that the world was controlled by an all-powerful deity, *Tian* (Heaven). It was assumed that *Tian* was aligned with moral goodness, and *tianming* (the Mandate of Heaven) was dependent on human agents to actualize. *De* is the virtue of successful rulers, without which they could not rule at all because they would not be able to maintain *tianming*. The early Zhou dynasty was the time when the ruler ruled with *de* and social harmony prevailed, in contrast to the social disharmony in the time of Confucius. To return to the social harmony of the early Zhou dynasty, Confucius was convinced that the improvement of society had to begin with the self-cultivation of the individual. Therefore, self-cultivation through learning should not only aim at achieving personal enlightenment or becoming *neisheng* (sagely within) but also should aim at contributing to society by offering meritorious services or becoming *waiwang* (kingly without).

For Confucius, the family, and relations within the family, could be regarded as a microcosm of society at large. Consequently, to achieve social harmony, relationships in society should be modeled on the ideal harmonious relationships in the family in which *xiao* (filial piety) in the parent-child relationship provided the paramount example. Within a society, there were different roles to be performed, and they were often defined in relation to other roles, giving rise to similar hierarchical relationships between ruler and minister, teacher and student, and so on. In order for the society to function harmoniously, it was vital that all members learned through self-cultivation to practice what was required of them in their various roles. Attention to rank, obligations, and ritual duties as they observed *li* would lead ultimately to the perfection of individuals and the improvement of society. The ideal social harmony or the age of great harmony (*da tong*) was described in *Liji* as a world that belonged to all people (*tianxia wei gong*). Confucius believed that *da tong* was realized at the time of Yao, Shun, and Yu. My free translation of the following quotations from the Chinese text should be illustrative (Figure 2).

When the Great Way was practiced, the world belonged to all people. The worthy and the able held government positions, and people trusted each other and lived together in harmony. Therefore, people took care of others' parents as their own parents, and others' sons as their own sons. They looked after the old. They helped the able-bodied to secure proper employment. They nurtured the young. They provided care for widows, widowers, the orphaned and the sick. Men and women worked as they took up their roles at home and outside of home. People did not allow the wasting of resources, yet they did not allocate resources only to themselves. They disliked not being able to do more for others, knowing that what they did might not benefit themselves. Therefore, there would be no plotting of wrongdoing by thieves and rebels, and people could even leave their outer gates open. This was the age of *da tong*.

Confucianism as a Conservative Force against Creativity

Confucianism was inextricably linked with the social structure and political system of imperial China. It has been used as a tool by political leaders to legitimize their rule since the Han dynasty. On this basis, modern Chinese intellectuals

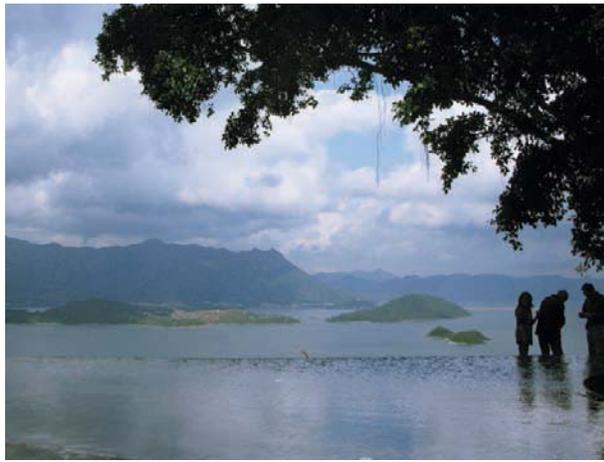


Figure 2 Heyi Pavilion, the site of Tian-ren-he-yi (One with Nature – the ultimate harmony in Confucianism) at New Asia College of the Chinese University of Hong Kong, Hong Kong.

have come to identify Confucianism with state power, with authoritarian relationships, and with rigid social hierarchies. Consequently, Confucianism is generally looked upon as a conservative force safeguarding and perpetuating the traditional order and a resistant force against China's modernization.

From *Wu Lun* to *San Gang*

A good example is provided by the legitimization of social and hierarchical relationships in society based on Meng Zi's discussion of moral and appropriate behaviors among members in society. Meng Zi referred to *wu lun* (the five relationships) as a microcosm of how individuals performed their roles in family and in society. These relationships referred to the love between father and son, the duty between ruler and subjects, the distinction between husband and wife, the precedence of the old over the young, and the faith between friends. With the exception of the relationship between friends, these relationships could be regarded as hierarchical in nature. But the hierarchy had to do with the roles and not the individuals in the relationships as they should be considered as equals in that each individual was considered to be endowed with the capacity to develop into a sage. Despite the distinctions made by Meng Zi, in later Confucian discourse starting as early as the Han dynasty, these relationships were used to legitimize a hierarchical social structure in the form of *san gang* (the three bonds) of society. The first and foremost one was the subordination of a subject or minister to the ruler, which was followed by that of a son to his father, and of a wife to her husband.

By transforming *wu lun* into *san gang*, political leaders managed to extend the boundaries of individual moral codes to social and political areas. In this way, Confucianism not only provided the state with an ideological format but also equipped the authority with the standards to judge individuals' behaviors and thoughts. Specifically, what the superiors did to the inferiors in these hierarchical relationships was interpreted as gifts (*en*) to which the inferiors should respond with gratitude (*gan'en*) and grateful behaviors (*bao'en*). Thus, *zhong* (loyalty) was the subject' grateful behaviors toward the ruler

(*bao-jun-en*); *xiao* (filial piety) was the son' grateful behaviors toward the father (*bao-qin-en*); and *jie* (faithfulness) was the wife's grateful behaviors toward the husband (*bao-fu-en*).

For many modern Chinese thinkers, especially those who came under the influence of Western education, *san gang* represented the state Confucian emphasis on the legitimized and unquestioned authority in hierarchical relationships that demanded obedience and conformity. The oppression could be regarded as discouraging individual initiatives and inhibiting creativity that involves bringing something new and useful into being.

Beyond *San Gang*: Teacher–Student Relationship

Since learning is strongly emphasized in the Confucian tradition, the hierarchical relationships in *san gang* could be readily applied to the teacher–student relationship. Thus, it is said that teachers in the Confucian tradition can be authoritarian and not allow their authority to be challenged, producing students who are docile and teachable. These teachers also tend to believe in the importance of inculcating discipline and morality in students, encouraging them to be hardworking, disciplined and respectful to teachers.

Based on these considerations, the teaching and learning of teachers and students in the so-called Confucian-heritage cultures that include China, Hong Kong, Japan, Korea, Singapore, and Taiwan has generated many research studies on Chinese learners and their academic achievement. It is said that the authoritarian nature of learning is based on a set of dogmas or assumptions regarding learning. First, education is perceived as the acquisition of correct knowledge in contrast to the conception of the discovery and generation of knowledge. Second, the written word is accepted as superior to oral discourse. This implies that a written text that is accepted as orthodox will be a text with authority that should not be challenged. Third, the teachers are regarded as the repository of knowledge to be transmitted to students. Thus, an older teacher should have a greater repository of knowledge, and should be more respected by students. However, as part of the Confucian tradition, the hierarchical teacher–student relationship might provide learning conditions that are not conducive to creativity. Indeed, the hierarchical relationship could constrain freedom of expression, self-assertion, and development of individuality in students, thus inhibiting their creativity. To counter this hierarchical and authoritarian teacher–student relationship, it is suggested that there should be a restructuring of the teacher–student relationship to one that might be considered more reciprocal and egalitarian.

Confucianism and Creative Building on the Past

Respect for Tradition

Respect for tradition is evident in Confucian teachings, which do not seem to encourage the introduction of anything new or any innovations. However, respecting tradition does not necessarily imply going against creativity. Confucius, while respecting tradition, did go against traditional or customary practices of his time in discouraging the extravagant celebration of festivities and extravagant performance of elaborated

ritual for funeral services. When his favorite student Yan Hui died, and he was in deep grief, he would not consent to an extravagant and elaborated performance of ritual in the funeral services despite the earnest requests from his students and Yan Hui's father. Thus, Confucius did not blindly insist upon returning to the ancient customs and tradition.

Although some scholars have suggested that Confucius was a creator who transformed several key traditional ideas, and the Confucian teaching of following the *Dao* could have its own sense of creativity, Confucius said the opposite. He was quoted in *Lunyu* as saying, "I transmit traditional wisdom and do not create new ideas. I believe in and admire the experiences and insights of our ancestors." However, Confucius also cautioned that to become a teacher of oneself and a teacher of others, one should always acquire and build new knowledge on the basis of what was known. In his own words in *Lunyu*, one should "review and reflect on the old in order to find out the new." Thus, Confucius seemed to imply that the study of the past was a prerequisite for the creation of new knowledge or more generally creativity.

Building on the Past

Perhaps, the conception that the new emerges from the old, or the old encompasses the new could be interpreted as the typical Chinese paradoxical thinking that denies the polarities of the old and the new. Accordingly, there should be no contradiction between respect for tradition and promotion of creativity, innovation, and invention. Indeed, in the opening paragraph of *Daxue*, the importance of learning in enabling individuals to constantly break new grounds is stressed. In a way, this learning process could be interpreted as the path of self-cultivation and the path to creativity. Again, I use my free translation from the Chinese text in the following quotations.

The way of *Daxue* is to enable the learner to recognize his inner virtues so as to bring the best out of his potentials, to inspire fellow human beings so that everyone will advance with new progress, and to facilitate this pursuit to achieve the highest level of perfection.

Zeng Zi's corresponding commentaries are also illustrative in highlighting the importance of constant self-renewal.

King Tang of Shang was said to have the following inscriptions on his bathtub to remind himself that he should "respectfully do a self-renewal once a day, do the renewal every day, and repeat renewing the renewal day after day." In addition, the Kang Pronouncement (quoting from *Shujing*) said that a good leader should encourage his people to habitually renew themselves. Further, it was said in the poem (quoting from *Shijing*) that the old state of Zhou obtained the Mandate of Heaven to rule from Shang because of its renewal.

Throughout Chinese history, there can be no doubt that art and invention have flourished even when Confucianism was dominant. There are examples of literary and artistic creativity in poetic verses of the Tang and Song dynasties, and the songs and operas of the Yuan dynasty. Gunpowder, silk weaving, paper and printing, clockwork, the waterwheel, the horizontal loom, the seismograph, and various astronomical instruments are other well-known examples of Chinese invention and innovations. While Confucianism has emphasized the call to return to the ancients, it could also be understood as a

renewing or transforming force that seeks to build on tradition and accomplishments of the past. Confucianism has demonstrated its success in assimilating or incorporating outside influences such as those from Daoism and Buddhism in the Tang, Song, and Ming dynasties, and those from systems of Western thought in the modern world. In this context, tradition is not perceived as the opposite of creativity. Rather, respect for tradition and past knowledge forms the basis for self-cultivation to achieve enlightenment, which could be the wellspring of creative work. Thus, the argument that individuals do not create and should not take credit for their creations since they only follow *Dao* or nature and discover the existing truth seems to make sense in this light.

In summary, Confucianism does not seem to have provided a well-defined perspective on creativity, nor does it seem to address explicitly any specific components of creativity, such as creative process, product, person, or press in the Western sense of the word. The question whether Confucianism could become an obstacle to creativity or could be used to promote creativity depends on how we choose to interpret Confucianism and creativity. If creativity means bringing something new into being in the Western sense, novelty is certainly not what is valued in the Confucian tradition. Indeed, in the Confucian tradition, creativity may have somewhat different meanings, and may take the form of modifications, adaptations, renovations, redirections, reconstructions, or re-interpretations, which could be perceived as the creative integration of the commitment to the past and the push for the future. These forms of transformations might serve to maintain stability and change through continuity with the past and the tradition. Thus, with this conception of creativity, Confucianism could be viewed not as an obstacle to creativity but as a potential force that has often been overlooked in efforts to promote creativity in our contemporary societies.

See also: Cross-Cultural Differences in Creativity; Cultural Diversity and Creativity; East vs. West; Moral Issues in Creativity; Teaching Creativity.

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Relevant Websites

- <http://www.confucius.org/> – This site contains some Confucian texts, including *Lun Yu (The Analects)* in 23 languages.
- <http://www.confucianstudies.com> – This site contains information on Confucianism and Confucian studies, and useful websites relevant to Confucianism.

Consensual Assessment

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Glossary

Conceptual definition of creativity A product is considered creative to the extent that it is both a novel and appropriate, useful, correct, or valuable response to an open-ended task.

Construct validity The strength of the link between the term used to refer to a particular phenomenon or construct (e.g., 'creativity') and the actual features of the behavior or outcome being measured (e.g., 'degree of novelty,' 'degree of appropriateness'). Considerations of construct validity are sometimes further broken down into questions concerning both the predictive and the concurrent validity of a measure.

Convergent validity A means of establishing a test's validity by demonstrating the degree of relationship between a variety of measures of the same construct.

Ecological validity The generalizability of an experimental result to a relevant real-world population, setting, or situation.

Operational definition of creativity A product or response is considered creative to the extent that appropriate observers independently agree that it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated.

Reliability The reliability of a measure involves its consistency. In the case of the consensual assessment technique, reliability is measured in terms of the degree of agreement among raters as to which products are more creative, or more technically well done, or more aesthetically pleasing than others.

Validity The validity of a test or procedure refers to whether it is measuring what it is purported to measure.

Consensual Assessment is a technique used for the assessment of creativity and other aspects of products, relying on the independent subjective judgments of individuals familiar with the domain in which the products were made.

Introduction

Creativity is a concept that is difficult to define and even more difficult to measure. Since the *Encyclopedia of Creativity* was first published in 1999, the field of creativity research has seen a gradual shift away from an almost exclusive emphasis on the creative person towards a more balanced inquiry that centers both on individual difference issues and questions about the nature of creative products and the conditions that facilitate the creation of those products. But how are we to decide whether one product is more creative than another? Is it appropriate for such creativity criteria to be laid out by the researcher? Or perhaps the creators themselves should have the final say? The consensual assessment technique (CAT) for assessing creativity is based on the assumption that a panel of independent raters familiar with the product domain, persons who have not had the opportunity to confer with one another and who have not been trained by the researcher, are best able to make such judgments. Over 30 years of research have clearly established that product creativity can be reliably and validly assessed based upon on the consensus of experts. Although creativity in a product may be difficult to characterize in terms of specific features, it is something that people can recognize and agree upon when they see it.

The CAT has been successfully used in hundreds of between-subjects designs focused on the question of whether some conditions are more conducive (or detrimental) to creativity than others. The conditions to be experimentally compared can be naturally occurring (as in field studies conducted in industrial/organizational studies) or artificially created and manipulated by an experimenter in a laboratory setting. Study participants can be drawn from a single, underlying population or they might represent persons coming from different backgrounds, cultures, etc. Within-subjects designs can also incorporate the CAT to explore whether some conditions are especially conducive to or detrimental to creativity. And, again, these conditions could be naturally occurring or manipulated in the laboratory. In addition, the CAT can be used to compare product ratings made by different groups of judges. Ratings made by experts in a field can be compared to ratings made by novices. Ratings made by supervisors in the workplace or teachers in schools can be compared to ratings made by employees or students. Ratings made by children can be compared to ratings made by adults. And ratings made by judges in one culture could be compared to ratings made by judges in another culture.

The Unique Assessment Concerns of Creativity Researchers

Many empirical investigations of personality traits or cognitive styles associated with creative performance employ some form of paper-and-pencil creativity test. A variety of personality checklists, developed by Gough, Torrance, Cattell, and

others, have often been used to identify highly creative persons; however, some creativity indices have focused on behavioral factors. These behavioral assessments, such as the Torrance Test of Creative Thinking (TTCT, also known as the Minnesota Test of Creative Thinking), have typically built on Guilford's theory of divergent thinking; they elicit oral, written, and drawn (nonverbal) responses from participants.

What does it mean when someone scores high (or low) on these creativity tests? Should high scorers be considered 'creative persons'? Many creativity measures might accurately tap one or more creative abilities or predispositions, but it is most unlikely that a single test could be developed that would capture the full range of creativity components. Also troublesome is the fact that a variety of social and environmental factors have been found to influence test results. A number of studies have revealed that study participants' scores can be improved simply by telling them that creative responses will be valued. Testing environments can also influence test outcomes, and many investigations have shown variability in creativity test scores under different testing conditions and time constraints.

Even if these contextual and situational factors could be controlled for, the construct validity of many of these tests has been seriously questioned, as has the convergent validity of different test procedures considered together. This validity issue is especially problematic given the fact that many of the leading creativity tests have been validated against one another. Finally, one additional concern involves the fact that while the scoring procedures utilized in many of the creativity tests are purported to be objective, performance is often rated according to criteria based upon the test constructor's own, intuitive notion of what is creative.

Early Applications of Consensual Assessment

Mindful of these and other difficulties inherent in the creativity testing process, a number of researchers have chosen to follow a very different path. It is this group's conviction that creativity judgments can ultimately only be subjective. Rather than attempting to objectify the creativity rating process, these investigators rely on the consensual assessment of persons or products. Although, in the past, this approach was used much less frequently than creativity tests, the subjective assessment process has a long history. As early as 1870, Galton was relying on biographical dictionaries to select outstanding literary men and scientists – a technique that depended on both the subjective assessment of Galton and those who had compiled the dictionaries. Castle also used biographical dictionaries to construct an initial sample of subjects for a study of highly accomplished men and women and Cox drew her pool of geniuses for a personality study from a list of the 1000 most eminent individuals in history that had been formulated by Cattell. More recently, Simonton, in studies of sociocultural influences on creativity, developed a measure of creativity based on frequency of citation in histories, anthologies, and biographical dictionaries.

Other investigations have relied on the judgments of a select group of experts to assess the creativity of particular individuals. For example, an expert-nomination procedure

was carried out by MacKinnon and his colleagues for a series of studies in the 1960s at the Institute for Personality Assessment and Research in Berkeley, California. In order to gather their subjects, these researchers asked the dean and four colleagues at the College of Architecture at the University of California to list and rate the 40 most creative architects in the United States. Similarly, Helson and Crutchfield gathered mathematicians' nominations for the most highly creative women in their field; and Barron requested that three professors of English and one editor of a literary review suggest names of creative writers.

Shifting their focus away from the creativity of persons, some researchers have asked raters to make assessments of the creativity of particular *products*. In the majority of investigations of this type, the researcher has either presented judges with his own definition of creativity for them to apply or has trained them beforehand to agree with one another. While such methodologies may successfully avoid many of the problems inherent in paper-and-pencil creativity tests, the fact that judges have been carefully instructed in the rating process calls into question both the claim of judge-based subjectivity and the meaning of interjudge reliability. Rather than impose specific definitions of creativity or related dimensions, researchers would be better served if they allowed judges to make their own, independent product assessments. In this way, creativity assessments will more closely mirror real-world assessments.

In 1976, Getzels and Csikszentmihalyi did just this when they requested that four different groups of judges (two expert and two nonexpert) use their own individual criteria when rating subjects' drawings on originality, craftsmanship, and overall aesthetic value. Sobel and Rothenberg (1980) also utilized this subjective assessment technique when they asked their raters, two accomplished artists, to judge sketches on originality, value, and overall creative potential guided only by their own subjective definitions of these dimensions.

Investigations such as the ones described above managed to overcome much of the criticism levied against the earliest applications of consensual assessment to product creativity, yet a variety of difficulties still remained. First, many of the procedures being utilized failed to differentiate between the creativity of products and other related constructs such as technical correctness or aesthetic appeal. Further, most researchers using consensual assessment procedures did not clearly state an operational definition of creativity in their publications, even when they had trained their judges to recognize specific creativity criteria in products. Nearly all contemporary definitions of creativity are conceptual rather than operational. They were never intended to be translated into actual assessment criteria. Either investigators failed to explicitly state the definition of creativity guiding their research or they presented conceptual definitions that did not adequately reflect the rating procedures they had chosen to utilize.

Systematizing the Consensual Assessment Technique in Creativity Research

The consensual assessment of creativity was formalized and systematized by Amabile's work in the social psychology of creativity, beginning in the late 1970s. When this program of

investigation was begun over 30 years ago, existing creativity measurement tools, including available subjective assessment methodologies, could not meet the unique research requirements of investigators interested in the social psychology of creativity. The majority of available assessment techniques resembled personality or IQ tests, in that they viewed creativity as an enduring personality trait. Whether they requested that a picture be completed, unusual uses for a brick be generated, adjectives describing the self be selected, or remote associations be discovered, most paper-and-pencil measures had been specifically constructed to maximize individual differences. Even existing subjective assessment methods relied on products or entire bodies of work that depended heavily on an individual's level of expertise. Prior methods had been constructed to do exactly what social psychologists try to avoid.

Social psychologists often investigate the effect of the social environment on a person's motivation for creativity, assessing both motivation and product creativity. Effects of the social environment on product outcomes are best revealed when individual difference effects are minimized. In other words, creative performance on the task must not depend heavily on participants' specialized skills. For this reason, social psychological research requires either that the task not depend heavily on special skills, or that all study participants have roughly the same skill level. If these requirements cannot be met, then the researcher should at least assess initial skills levels so they may be controlled for in analyses.

Prior to Amabile's work, the literature had not identified a methodology that could de-emphasize individual differences between subjects. In addition, researchers had not agreed upon and consistently employed an operational definition of creativity. Amabile's first step was to adopt two complementary definitions of creativity: an underlying conceptual definition to use in building a theoretical formulation of the creative process and an operational definition to apply in empirical research.

Amabile developed the following conceptual definition of creativity: a product or idea is creative to the extent that it is a novel and appropriate response to a heuristic task. This definition is similar to a number of others that came before it. Despite the implicit emphasis on the person in creativity assessment, most explicit definitions have used the creative product as the distinguishing sign of creativity. Indeed, the criteria of product novelty and appropriateness have long been seen as the hallmarks of creativity by a number of theorists.

The CAT is grounded in the original operational definition that Amabile developed: a product or response is creative to the extent that appropriate observers agree it is creative. Appropriate observers are those familiar with the domain in which the product was created or the response articulated. Importantly, this consensual definition is based on the creative product rather than the creative process. In fact, the majority of creativity assessment techniques require that subjects produce something – a list of ideas, a series of pictures, or the like. What does set this methodology apart from the rest is that, rather than responding to a series of predetermined items or questions, subjects simply produce an actual product such as a poem, a collage, or a story.

Perhaps the most important feature of this consensual definition is its reliance on subjective criteria. In this way,

it overcomes the difficulty of attempting to specify 'ultimate' objective criteria for identifying products as creative. Indeed it may be impossible to articulate such ultimate criteria. Just as the judgment of attitude statements as more or less favorable or the identification of individuals as 'physically attractive' depends on social context, so too does the judgment of creativity. Certainly, there must be particular characteristics of attitude statements or persons or products that observers systematically look to in rating them on scales of favorability or physical attractiveness or creativity, but in the end the choice of these characteristics is a subjective one. Important writings by Gardner, Csikszentmihalyi, and others argue that creativity arises from a combination of three sources: a cultural/historical context that imposes specific symbolic rules on the creator, the creator who introduces novelty into that symbolic domain, and a field of experts who point out and validate the creative accomplishment. Thus, all judgments of creativity are necessarily relative and bounded by time and place. Creativity should not be seen as residing inside the head of the artist or scientist. Nor does it reside in a particular culture or time period or with judges representing a field of expertise within a particular era or culture. Instead, creativity must be seen as the result of a complex interaction between these three components of creator, domain, and field.

Amabile and her colleagues have attempted to capture the essential characteristics of the conceptual and operational definitions of creativity in the CAT as used in experimental studies of creativity. First, subjects are presented with tasks that leave room for considerable flexibility and novelty of response (open-ended, heuristic tasks). Second, these are tasks for which the range of appropriate responses has been clearly identified in subjects' instructions. Finally, in employing the CAT, researchers do not impose on raters their own specific views of what is creative or allow raters to influence each other; rather, raters work independently and are guided by their individual subjective conceptions about creativity.

Refining the CAT

The CAT rests on two important assumptions. First is the assumption that it is possible to obtain reliable judgments of product creativity, given an appropriate group of judges. In other words, although creativity in a product may be difficult to characterize in terms of specific features, it is something that people can recognize when they see it. Furthermore, people familiar with such products can agree with one another on this perception. A second assumption is that there are degrees of creativity such that observers can say, at an acceptable level of agreement, that some products are more or less creative than others.

Procedural Requirements

Researchers deciding to utilize the CAT should make certain that a number of requirements are met. First, the judges should all have had some experience (and roughly equivalent experience) with the domain in question. When Amabile was first developing the CAT, she and her colleagues sometimes relied

on the notion of 'expert' to describe an appropriate body of raters. Over the years, extensive work with this methodology has, however, brought about a tempering of this view. Basically, the method requires that all those rating products be familiar enough with the domain to have developed, over a period of time, some implicit criteria for creativity, technical goodness, and so on. For example, when asked to rate the creativity of paper collages, both children and adults from a variety of backgrounds have produced highly reliable assessments. When dealing with a more specialized and esoteric field, such as physics or computer programming, however, the range of 'experts' (i.e., appropriate observers) would certainly have to be considerably narrower. In either case, it is the judges' familiarity with the domain that is important, not the fact that they, themselves, may have produced work rated as highly creative.

A second requirement is that the judges must make their assessments independently. They are not trained by the experimenter to agree with one another; are given no specific criteria for judging creativity; and are not allowed to confer in their assessments.

Third, judges should be instructed to rate the products relative to one another, rather than rating them against some absolute standards they might hold for drawing, sculpture, poetry, and so on. This is important because, for most studies, the levels of creativity produced by the 'ordinary' subjects who participate will be very low in comparison with the greatest works ever produced in that domain.

Fourth, each judge should view the products in a different random order. If all judgments are made in the same order by all raters, high levels of agreement might reflect methodological artifacts.

Finally, if this technique is to be used to evaluate performance on a task to which it has not been applied in the past, judges should be asked to rate the products on other dimensions in addition to creativity. Minimally, they should make ratings of technical aspects of the work, and if appropriate, its aesthetic appeal as well. These additional assessments make it possible to examine the degree of relatedness or independence of these dimensions in subjective judgments of the products in question.

Once the judgments are obtained, ratings on each dimension should be analyzed for interjudge reliability. In addition, if several subjective dimensions of judgment have been obtained, these should be entered into a factor analysis to determine the degree of independence (discriminant validity) between creativity and the other dimensions investigated. Finally, if the products lend themselves to a straightforward identification of specific objective features, these features may be assessed and correlated with creativity judgments. Prior studies have identified some physical features of collages and some verbal features of stories that correlate with creativity judgments.

Reliability

Given the consensual definition of creativity, the most important criterion for the results of this assessment procedure is that the product ratings be reliable. In order to compute reliability, Amabile originally utilized the Spearman-Brown prediction

formula that is based on the number of judges (n) and the mean interjudge correlation (r):

$$\text{reliability} = \frac{nr}{1 + (n - 1)r}$$

This technique yields results highly similar to the Cronbach's coefficient alpha as calculated by the 'reliability analysis' procedure in the Statistical Package for the Social Sciences (SPSS). In the interest of simplicity, in recent years researchers employing the CAT have relied upon the SPSS calculation as their measure of interrater agreement. In most instances, a reliability figure of 0.70 or higher can be considered evidence of an acceptable level of agreement between judges. Once such a level is reached, it is then appropriate to compute a sum (or an average) across all ratings given each product. These sums (or averages) then constitute the unit of analysis for further computations.

By definition, interjudge reliability in this method is equivalent to construct validity: if appropriate judges independently agree that a given product is highly creative, then it can and must be accepted as such. In addition, it should be possible to separate subjective judgments of product creativity from judgments of technical goodness and aesthetic appeal. Within some domains, it may be difficult to obtain ratings of product creativity that are not highly positively correlated with judges' assessments of product technical goodness or aesthetic appeal. Yet it is essential to demonstrate that it is at least possible to separate these dimensions, otherwise the discriminant validity of the measure would be in doubt. In other words, judges might be rating a product as 'creative' merely because they like it or believe that it is technically well-done.

Supporting Data

In the program of research carried out by Amabile and her colleagues over the last 30 years, numerous studies have demonstrated that the subjective assessment technique described above does, in fact, yield reliable measurements appropriate for social psychological studies of creativity. In studies employing a paper collage task, participants are presented with a piece of cardboard, glue, and a variety of colored pieces of paper of different shapes and sizes. They are instructed to make a design that 'makes them feel silly,' and they are given approximately 15 minutes to engage in the task. In the majority of instances, professional artists and/or graduate students in the studio arts have served as the 'expert' judges. In those investigations enlisting elementary or preschool students as participants, classroom art teachers familiar with the work of children have also been recruited. For collage ratings, ten or so judges have typically been employed. Without exception, raters have yielded highly reliable assessments of collage creativity.

Equally important as interrater reliability is the requirement that judges' assessments of certain additional product dimensions do not correlate highly with their ratings of creativity. Here too the results have been very encouraging. In keeping with most theorists' conceptions of creativity, ratings of novelty and originality have typically been highly related to ratings of creativity, while ratings of various aspects of collage technical goodness have not usually been significantly correlated with creativity assessments.

In addition to the collage measure, Amabile and her colleagues have also employed a wide variety of other creativity tasks in their investigations. In an attempt to assess the impact of social constraints on verbal creativity, they have, for example, asked adults to complete five-line American haiku poems. In an effort to reduce product variability and make the judging task somewhat more manageable, study participants are typically provided with the first line of the poem they are to write. In one study, this technique was successfully adapted for use with young children. Sitting in front of a computer screen, elementary school students were prompted in a question and answer interactive format to enter one-, two-, or three-word lines. Other measures of verbal creativity that have also proven useful involve completing sentences; writing essays, descriptive paragraphs, and free-form poems; coming up with captions for cartoons; and telling a story to accompany an open-ended picture book without words. This story-telling task has been used successfully with children as young as first grade. Study participants look through the book with the experimenter and then are asked to tell a story by saying 'one thing' about each page.

Each of these verbal tasks has also yielded highly reliable creativity assessments. Whether they are poets rating haikus, elementary school teachers rating children's stories or graduate students rating cartoon captions, judges show consistently high interrater agreement.

In addition to measuring artistic and verbal performance, Amabile and colleagues have also used some creative problem-solving tasks. One assessment procedure taps spatial-mathematical creativity in children and calls for the construction of a geometric design on a computer screen. Another activity requires that young subjects fill in the outline of a geometric shape with colored pieces of felt. Problem-solving tasks involving adult subjects include the construction of computer programs, building structures from ordinary materials, generating survival ideas or ideas for high-tech products and coming up with business solutions. Although none of these techniques has been tested to the same extent as the collage-making or many of the verbal creativity tasks, it is encouraging that judges have rated products produced by children and adults with high levels of reliability.

Recent work by Hennessey and colleagues investigated whether the CAT would also produce valid and reliable creativity ratings in non-Western cultural settings. Specifically, one study recruited school teachers from the United States, Saudi Arabia, China, and South Korea to assess collages and stories created by children living in their local area. Results confirmed that across all four cultural contexts, judges' ratings of product creativity showed high levels of interjudge agreement. This suggests that the CAT is especially useful for cross-cultural investigations. Rather than impose a paper-and-pencil measure and scoring criteria originally developed for use in the West, the CAT allows for the subjective assessment of products by judges who come from the same cultural background as the study participants who produced the products.

Clearly, the CAT has wide-range application. It has been successfully employed with both child and adult subjects and allows for the assessment of creativity in a number of different domains. Over the years, subject populations have been expanded beyond the original pool of undergraduates and

elementary school children, demonstrating that the creativity of professional artists, professional art students, computer programming students, student poets, and employees of a high-tech company can also be reliably assessed. Most recently, the CAT has also been demonstrated to yield reliable assessments of product creativity across a wide range of cultural contexts. For these reasons, an ever-growing number of researchers have come to rely on this assessment technique.

Taking a Closer Look

The CAT was originally developed to yield reliable measures of the creativity of products produced in experimental studies of social-psychological influences on creativity. More recently, this methodology has also been applied to field studies in organizational settings. Whether they are asked to make a collage, tell a story, write a haiku poem, or come up with new ideas for products or solutions to problems, participants in these investigations are primarily engaged in behaviors resulting in what has been termed 'little c,' 'everyday,' creativity. The CAT has consistently been shown to yield reliable measures of product creativity in these contexts, but what is it exactly that judges are doing when they set out to make these ratings? Are they assessing only the completed product or are they also making assumptions about the process that went into producing that product? Can judges be expected to reliably assess features of the creative process? In 1994, Hennessey conducted a series of four studies with these questions in mind.

In the first of these investigations, undergraduate students rated either the creativity, technical goodness and likeableness of geometric line designs that had been created on a computer or they rated computerized replays of the procedure that went into producing each of these products. Reliability was high and raters who had been asked to make assessments of process had no more difficulty than did raters assessing finished products. A strong and positive relation was found between ratings of product creativity and ratings of the creativity of the processes that went into completing those finished products. And similar strong and positive correlations were found between ratings of the technical goodness of finished products and ratings of the technical goodness of the processes that lead to the completion of those products. In Study II, a separate group of undergraduate students made assessments of both process and finished products. Reliability was again acceptable. Judges found the rating of process no more difficult than the rating of finished products, and their ratings of process and product were positively correlated. A third study then explored whether these same results would obtain when 'real-world' drawings produced by Pablo Picasso were assessed. Undergraduates in this investigation rated videotaped segments of the processes that went into completing four Picasso drawings and stills of those drawings taken from the movie 'The Mystery of Picasso.' Importantly, these videotaped segments and stills had all been pretested on another sample of undergraduates, and not a single study participant had guessed that the drawings had been done by Picasso, or any other 'big-C' artistic master for that matter. These products were not typical of Picasso's work and were utilized simply as a matter of convenience, because a professionally-produced video of the process that

went into creating the drawings was readily available. Reliability among judges was again acceptable and correlations between ratings of process and product were of approximately the same magnitude as those obtained in the two previous investigations.

But what are judges actually doing when they make their ratings? When asked to assess product creativity, are they considering only the final product? Or do they also take into account other factors – factors such as information about the circumstances under which a product was produced or the characteristics of the creator? In investigations employing the CAT, judges are typically given very little information about the persons who have made the products they are to rate. Most often, they are instructed in the assessment process and are told simply that the materials they will be viewing were produced by university undergraduates, or preschoolers, or some other group. Implicit in this procedure is the assumption that creativity is a unitary construct independent of factors such as background or experience of the creator.

The last of Hennessey's four investigations was intended as a preliminary exploration of the impact of artist age information on judges' creativity assessments. One group of undergraduates was asked to judge collages made by children and adults after receiving accurate information about the age of the artists. A second group was asked to rate the same collages after receiving false, reversed information as to the age of the artists. Finally, a third group of undergraduates was asked to judge the collages without being given any information as to the age of the artists. Reliabilities were highly acceptable for all three of the judgment conditions, and age information was found to have a significant effect. The highest creativity ratings were given to adults' collages that had been falsely labeled as children's products. The lowest creativity ratings were given by judges who had received no age information to collages that had been produced by children. Overall, it was found that those raters receiving age information about the artists, whether accurate or reversed, gave products higher ratings of creativity than did raters for whom no age information was available. Within age information groups, no significant differences emerged between judges' creativity ratings of children's and adults' collages.

Six of the 33 judges polled reported that they had considered artists' ages when making their product assessments. Two other respondents mentioned 'fighting' against the tendency to take artist age into consideration. Contrary to expectation, it was the mere availability of age information and not the specific adult or child label that affected raters' judgments. Whether raters were given an accurate or a reversed age label, they judged children's collages to be higher in creativity than did raters given no age information. This finding suggests that creativity theorists and other researchers wishing to employ the CAT must be certain to note whether age information has been made available, either purposefully or unintentionally, to judges. Similarly, careful assessments should be conducted to determine whether raters have made any age inferences on their own.

Does knowing a subject's identity inject bias into judges' creativity ratings? This question is particularly pertinent to field studies of creativity within the realm of organizational behavior, as they frequently elicit supervisory ratings of subordinates'

creative behavior. This procedure necessitates that supervisors know the identity of the individuals who have produced the products or generated the ideas they are rating. While these studies typically control for workers' gender, age, organizational tenure, and other demographic variables that could impact creativity ratings, research has yet to determine the extent to which supervisors' attitudes, affective states or biases – such as feelings of liking and favoritism – might impact their ratings in significant ways. This issue is of particular concern because most organizational studies rely on the ratings of only a single supervisor, violating a central tenet of the CAT. However, a recent study by Baer and Oldham did find that independent ratings by two supervisors correlated highly. Of course, it is possible that both supervisors were subject to the same biasing forces. Thus, ratings of an individual's work by people who know that individual must always be regarded with caution.

Another related issue is whether individuals can make reliable ratings of the creativity of their own work. Researchers have typically found moderate correlations between creativity self-assessments and mean ratings made by others, although self-ratings often show a positivity bias. For example, in a recent study by Moneta and colleagues, workers' monthly self-assessments of their creative contributions to a project correlated moderately and significantly with independent ratings made by coworkers and supervisors. However, the mean self-ratings were higher than either the mean coworker ratings or mean supervisory ratings. Other researchers have found moderate correlations between self-ratings and peer-ratings. Indeed, a recent meta-analysis conducted by Heidemeier and Moser yielded an overall correlation of 0.22 between self and supervisory performance ratings. In sum, the literature suggests that self-ratings of creativity do relate to ratings made by external observers, but may be biased toward positivity.

A variety of papers have carefully explored these and other issues concerning the question of who should be considered an appropriate judge. In one study, parents and teachers were found to be equally accurate at recognizing the creativity of children's ideas. But other investigators found that young children's judgments about art were considerably different from those offered by older children. Runco and colleagues asked college students to each produce three three-dimensional artworks that were then rated by the subjects themselves, a group of their peers, and three professional artists. Analyses revealed that the student subjects saw significant differences in the creativity of their own three art projects. Similar differences also were reflected in the peer ratings of the artwork. The assessments made by the professional artists, however, failed to reflect significant differences in creativity between products. Thus, vast differences in level of expertise between study participants and judges may influence creativity judgments.

Dollinger and Shafran reopened the question of whether nonexpert judges might reliably rate the creativity of drawings made by a sample of nonprofessional artists. As mentioned previously, the CAT requires that researchers refrain from training judges so as not to impose their own views and risk shaping judges' ratings. However, in an interesting modification of the CAT, Dollinger and Shafran calibrated nonexpert judges' artistic creativity ratings by exposing them to 16 prototype drawings and corresponding ratings made by expert

judges in a prior experiment. Subsequent to the calibration, the mean correlation between expert and nonexpert ratings for a second set of products was 0.91.

Taken together, these results suggest that some clarification or modifications be made to the CAT specification about what qualifies as an appropriate level of judge expertise. When rating products produced by either nonprofessional or professional individuals, appropriate judges should be defined as persons whose expertise matches or exceeds the expertise of those individuals who created the products. In the case of products produced by nonprofessionals, if researchers desire nonexpert judges' ratings to correspond to ratings made by expert judges, researchers may use a calibration technique. Finally, if creativity assessment procedures require raters to have familiarity with the entire body of a given person's work – as is often the case in field research – the most appropriate judges will be those with the greatest knowledge of the subject's performance and output. Importantly, as cautioned earlier, future research should consider the extent to which knowledge about a creator's identity might bias the validity of such ratings.

Some Recent Developments

Over the years, the CAT has come to serve as an invaluable tool for a number of creativity researchers. This methodology has been extended to a variety of tasks in a variety of domains, and the diversity of subject populations and rater populations being studied is also constantly growing. Researchers have shifted from employing the CAT exclusively in tightly controlled experimental settings, to also using the CAT in quasiexperimental or field studies in which participants create products under a variety of different conditions and situations. Perhaps the most prolific expansion of the CAT in the recent decade has occurred in the organizational domain. In field studies designed to investigate the creative performance of professionals, supervisors and/or coworkers are frequently called upon to serve as raters. As noted earlier, the majority of organizational creativity studies rely on the ratings of a single supervisor per study participant. This dependence on supervisor ratings draws on a decades-long tradition in the organizational literature of using such assessments to obtain quantitative measures of an employee's performance. Although the traditional CAT involves multiple judges rating the creativity of products using a single-item scale ('creativity'), the organizational domain has adapted the CAT to involve a single supervisor who rates several subjects on a multiitem scale (e.g., 'Searches out new technologies, processes, techniques, and/or product ideas'; 'Generates creative ideas').

Investigations carried out in the organizational domain pose unique challenges that make strict adherence to the CAT protocol difficult, if not impossible. Most prominently, while it would be preferable to obtain independent creativity ratings from multiple judges, it is often difficult to find more than one person who has access to the same range of information about the work done by a given employee. Moreover, because employees often work in team contexts, the identification of a single individual's contribution to a creative product developed by a team requires knowledge about the specific set of tasks to which the individual was assigned. Due to intense

pressures in organizations, higher-level managers often do not have the time to interact with subordinates and instead rely on immediate supervisors to provide performance evaluations and feedback. Indeed, Hoegl and Gemuenden suggested that ratings made by higher-level managers reflect external market pressures more than they do the actual performance and functioning of team members. Thus, higher-level managers are seen as unsuitable judges of the creativity of most employees' work.

To circumvent these difficulties, some organizational research has employed peer ratings of creativity – requiring every member of a team to independently rate the performance of every other member. This method appears particularly promising, as it allows researchers to assess interjudge reliability. Moreover, research suggests that peer ratings are highly correlated with supervisory ratings of a target's performance, which, in turn, correlate significantly with some objective measures of creativity such as invention disclosures. The research evidence clearly suggests that it is preferable to use multiple raters (i.e., supervisors and coworkers, if available) to improve the reliability of creativity assessments in organizational studies. Nonetheless, perhaps for the sake of expediency, most organizational creativity researchers have tended to rely on ratings made by a single supervisor.

One additional arena of organizational creativity research that now frequently employs the CAT is the research on group creativity. Since the 1999 publication of this encyclopedia, the investigation of group creativity has blossomed into a distinct, multifaceted, and highly prolific field of inquiry. Early brainstorming studies in the laboratory typically employed the CAT, requiring three or more expert raters to judge the originality of each idea produced by a group. The developing body of group creativity field research – like field research on individual-level creativity – has measured creativity in a variety of ways. Some field studies have employed a single rater to assess a specific product. At other times, group creativity research has employed multiple raters assessing either a single product or the holistic creativity of a group. This CAT protocol allows for the calculation of reliability estimates, and is thus preferable to employing single judges.

Conclusions

Clearly, the CAT has been a great boon to many creativity researchers. It has broad application, is founded on a clear operational definition, and can be adapted to suit a wide variety of research situations. Moreover, with its similarity to real-world creativity judgments, the CAT enjoys a high degree of ecological validity. Despite these advantages, however, the CAT should not be considered an ultimate and universally useful means of creativity assessment. Indeed, this assessment methodology has some specific limitations. Most notably, if time concerns are paramount, this approach is decidedly impractical. Choosing an appropriate task as well as an appropriate body of judges can be extremely time-consuming, as can the assessment of products and the necessary statistical data analyses. However, a number of creativity researchers continue to believe that the benefits of the CAT outweigh its costs; and recently, Kaufman and colleagues successfully experimented

with a modified CAT technique that reduced time demands yet still yielded reliable assessments.

Perhaps the greatest strength of the CAT rests in the flexibility it affords to creativity researchers. First, the CAT can be used to obtain reliable assessments of the relative creativity (technical goodness, aesthetic appeal, etc.) of products made by a variety of individuals. Second, the CAT can be expanded to new subject populations, new performance domains, and new tasks that are quite different from those originally envisioned. In mimicking the way in which creativity is judged every day in the arts, the sciences, and the professions, the CAT helps bring creativity from the realm of the mysterious and the mystical, where it remained for centuries, into the realm of the understood and the accessible.

See also: Creative Products; Definitions of Creativity; Divergent Thinking; Everyday Creativity; Historical Conceptions of Creativity; Novelty; Pablo Picasso 1881–1973; Research: Quantitative; Social Psychology; Testing/Measurement/Assessment.

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- <http://www.apa.org/about/division/div10.html> – Society for the Psychology of Aesthetics, Creativity and the Arts.

Contrarianism and Creativity

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Glossary

Contrarianism Intentionally doing what other people are not doing. Adapted from economics, now a popular tactic for insuring originality in many other creative endeavors.

Creativity Original and useful or effective behavior, solutions, or insights. The usefulness criterion implies that contrarianism is not sufficient for creativity; contrarianism only guarantees originality.

Dark side of creativity Original and operational solutions and inventions used in immoral ways. One result of contrarianism that is not directed to creativity but is instead directed toward unconventionality.

Misplaced investments Occurs when a contrarian tactic is used, but used to the extent that the person is not investing

enough time and energy into the topic or problem itself. Time invested into being different is often time away from good focused work, and focused work is frequently necessary for creative insight.

Oppositional thinking Proclivity towards unconventional behavior. It leads persons to do what others are not, but it is often not a conscious decision and is therefore not strategic nor related to intentional creativity.

Postconventional contrarianism The recognition of rules and conventions, but making decisions for one's self. Exercising discretion before acting in a contrarian fashion. It may also be viewed as discretionary originality.

Introduction

Mickey Mouse was created by Walt Disney in the late 1920s. Mickey was a result of some collaboration; Disney worked with his brother Roy and Ub Iwerks. Disney could no longer use his 'star performer,' Oswald the Lucky Rabbit, because his old distributor held the rights. Disney needed a new star, and Mickey was conceived.

Why a mouse? As a matter of fact Walt apparently wanted a cat. He discussed this with Roy and Ub, and they decided on a mouse. That decision was implicitly contrarian. Disney and his collaborators wanted to do what no one else was doing. The character Krazy Kat was already widely known and a second feline would be unoriginal. For that reason Walt and his collaborators decided on a mouse – to be different, unique.

Interestingly, the original suggestion was to call Mickey 'Mortimer,' but Walt's wife Lily decided that Mickey was more appropriate. The discussion between Walt and Lily, summarized in *Walt Disney: An American Original*, can be described in terms of certain group dynamics and certain strategies, Walt being very contrarian, and Lily making sure that the new mouse would have a name which would sound right to the general public. 'Mickey Mouse' has a nice ring to it; and like other creative names, labels, and titles, it is fitting in some aesthetic sense. This is true of all creative insights and ideas, not just names, labels, and titles. Creative work is original, but it is more than just original. It is original and fitting.

Rationale for Contrarianism

The rationale for contrarianism is as follows: Originality is a critical aspect of creativity, and a contrarian tactic has a high probability of leading to an original idea or behavior. It is a

very practical tactic because people can think about what others are doing and then do something different and original. If you just ask them to 'be original,' they may have some difficulty. There is no criterion with which they can actually judge their originality. But if you tell them to 'do what others are not doing,' they have something concrete to think about and to use in their judgments.

It is easy to be taken in by this strategy, to be convinced of its value. There are several reasons for this.

First, as just noted, it is operational and practical. It gives individuals something they can use when judging their ideas or behavior.

Second, novel behaviors and actions are salient. For this reason the contrarian results of the tactic are easy to see. They often capture attention and are rewarding.

Third, it is an easy tactic to explain to others. Teachers, for example, can easily describe this tactic to their charges. A number of empirical projects have demonstrated how easily original thinking can be enhanced with some simple tactics.

Many biographies, autobiographies, and case studies mention contrarianism and tie it to creativity. The next section of this article reviews example cases. The pros and cons of the contrarian tactics are then explicated.

Persons Who Have Used Contrarian Strategies

Many famous creative persons have used a contrarianism tactic, in addition to Walt Disney.

Gandhi was a contrarian, especially in his methods of passive resistance. These were fitting, given his beliefs and objectives, and original. He found a way to both resist (which is in itself contrarian, at least *vis-à-vis* the British) and remain a passivist.

James Watson, who shared the Nobel Prize for his work on the structure of DNA, was contrarian in this sense. He collaborated with Francis Crick, but the competition with Linus Pauling was fierce. Sometimes competition requires contrarianism in that you do not want others to do what you are doing – or at least not until you have finished or established yourself.

In the medical research field Heimlich (who developed the Heimlich maneuver) was long known as a maverick and non-conformist. Most recently he proposed curing patients with AIDS by giving them malaria. The *Los Angeles Times* claimed that “this is not the first time the 74-year-old Heimlich’s headstrong approach to medicine has shocked, even outraged the Establishment.” Heimlich was quoted as saying, “I don’t do ordinary things. I don’t follow all the rules if there’s a better, faster way to do it” (Oct. 30, 1994: A30).

The *Los Angeles Times* also published an article, “Renegades Reinvent the Bicycle.” Apparently the mountain bike – a modification of what *Britannica* called “the most efficient means yet devised to convert human energy into propulsion” – “came out of nowhere, a product of counterculture – invented by hippies, no less, a ragtag of pot-smokers and Haight–Ashbury drifters who barely got through high school.” Note the term *counterculture* – a group of contrarians.

A final example from the *Los Angeles Times* can be given. I am referring to Rock ‘n’ Roll. In a 1998 Times book review rock is called “a disagreement with established power – a refutation of authority’s influence” (4/15/98, p. E6).

Nor is rock ‘n’ roll the only rebellious kind of music. Duke Ellington was, for instance, quite the contrarian. Arnold Ludwig, MD, author of *The Price of Greatness*, explained how this response style can play an important role in creativity . . . illustrated, for example, in the compositions of Duke Ellington. Knowingly or not, Ellington exploited traditional musical rules as inspiration for his jazz. If he learned that he was not supposed to use parallel fifths, he immediately would find a way to do so; if told that major sevenths must always rise, he would write a tune in which the line descended from the major seventh; and if the tritone was forbidden, he would find the earliest opportunity to use it and, to emphasize the point, would let it stand alone and exposed (pp. 7–8).

The comment, “knowingly or not” is critical because by definition tactics and strategies are intentional. Unintentional contrarianism may best be viewed as *oppositional thinking*, which Ludwig defined as “the almost automatic tendency to adopt a contrary or opposite response” (pp. 7–8).

Ludwig gave Freud as a second example. Certainly Freud’s work was original, and yet it fit with his observations and with certain lines of medical theory. Freud was oppositional, and perhaps contrarian, in his efforts to do original work and in his nonconformity.

In the arts, Picasso described cubism as follows: “We were trying to move in a direction opposite to Impressionism.” This is pure contrarianism, especially in the direction – namely, opposite to Impressionism. It is not just a reaction to others, and not just different, but *opposite*.

Stephanie Dudek argued that the Dadaists and Surrealists were “particularly determined to burn all bridges behind them.” In this light, contrarianism breaks with traditions. That implies that *avant-garde* is inherently contrarian. As Dudek put it, *avant-garde* is “by definition art that is ahead of its time,

that is shocking, disturbing, and therefore viewed as socially objectionable. Its specific aim is to undermine the existing order and to replace it by another. It attempts to do this by contradiction, challenge, confrontation, and self-assertion.”

Turning from the visual arts, consider Bruce Lee. He developed an original system of martial arts – Jeet Kune Do – but had to fight the establish schools because they did not want to teach any such techniques outside of Asia.

Howard Gruber described how the famed developmental psychologist Jean Piaget used several specific strategies used in his work.

First, he suggested that he always thought with a pencil in his hand. This is a simple but useful tactic, given how fleeting creative insights can be. Second, Piaget read outside his own field. Third, he did not read inside his own field. And last, he always had target or “whipping boy.”

B. F. Skinner also suggested that scientists read outside their own field. This is a kind of contrarianism. Focusing on what goes on outside one’s own field, and thus avoiding one’s own field, is even more contrarian.

Dr. Seuss, prolific author of children’s literature, broke rules on every page of every book. He made up his own words, used many an ungrammatical sentence, and defied the laws of physics in the actions of his characters. Gertrude Stein and E. E. Cummings also come to mind; they too broke certain literary traditions.

Although instructive, these cases – Disney, Gandhi, Heimlich, Ellington, Freud, Picasso, Piaget, Skinner – are famous creators. Generalizations from them are therefore questionable.

Contrarianism in the Service of Creativity

Two distinctions will help to insure that contrarianism is in fact associated with creativity. First is the distinction between contrarianism and oppositional thinking. The former is intentional and the latter an unintentional tendency toward nonconformity and unconventionality. Similarly critical is the distinction between contrarianism that is intentionally used for the sake of creativity, and that which is used merely to insure originality and salience.

Contrarianism does not guarantee creativity; it can have other results or be directed to other objectives, including originality. But originality does not insure creativity; it is necessary but not sufficient. It follows that contrarianism for the sake of originality may lead only to deviance and not to creativity.

Salience is a possibility because contrarianism does lead to originality – the contrarian is different and unique – but this can just attract attention. Original behaviors and actions are salient. They grab our attention. Creativity, on the other hand, probably is much more likely when the intention is creativity. This is *contrarianism in the service of creativity*. When that is the case, there will be some fit, some appropriateness, as well as originality. Recall here that creativity requires both originality and appropriateness. Contrarianism only contributes to the former and can inhibit the latter.

Even contrarianism in the service of creativity, there are potential problems. First is what has been called *misplaced investments*. This occurs when the creator uses a contrarian

tactic, but does so to the extent that he or she is not investing enough time and energy into the topic or problem itself. Time invested into being different is often time away from good focused work.

A second potential problem is that contrarianism can lead the individual to break rules that should not be broken. It may be that the creator is reinforced for contrarianism because it leads to creative insights, but then fails to exercise discretion and applies the same tactic in areas where some conventionality should be respected. In fact, Feldman, Gardner, and Csikszentmihalyi in 1999 and Gruber in 1993 proposed that moral and humanitarian values in work and creative efforts should be clearly encouraged. If contrarianism leads the individual to break the important rules that keep society running smoothly, we have yet another example of what Robert McLaren called *the Dark Side of Creativity*. Examples of this were given by Russell Eisenman and Richard Brower in the Special Issue of the *Creativity Research Journal* which was devoted to Creativity and Deviance. Brower provides long lists of eminent creators who have spent time in jail.

Creativity as Postconventional Contrarianism

One useful way to think of contrarianism is as postconventional creativity. This term is used in developmental theories. It is a third stage and follows the preconventional and conventional stages. A child in the first of these stages is unaware of rules, norms, and conventions, and in fact does not recognize the value of rules. His or her games are ever-changing; there are no stable rules to keep them moving toward an objective. Moral judgments at this age are based on rewards and punishers rather than a sense of right and wrong. The child is, however, often quite creative in art and expression. Ask a group of preschoolers to draw pretty trees and you will get mostly trees without green leaves. They pick their colors based on preference rather than convention.

Not so individuals in the conventional stage. They are well aware of rules – and in fact hold to very literal interpretations of them. They see the value of conventions for fitting it, but

sometimes put a bit too much effort into doing just that. The result is a tendency away from anything unconventional and original. Conventional individuals respond to peer pressure and hate bending rules. This explains the fourth-grade slump, when many children become noticeably less original in their ideation. Conventionality also leads them to a literal use of language, and it certainly is apparent in their playing games (by the rules) and their art. Children in this stage are likely to draw trees that will very likely have green leaves.

The third stage is postconventional. Here the individual is aware of rules, norms, and conventions, and typically abides by all. He or she does, however, make decisions for him- or herself. Conventions are taken into account, but so is the immediate context. If asked to draw “what trees look like,” leaves may very well be green, but if asked to draw what trees should or could look like, the leaves may be rainbow colors or whatever color is the individual’s favorite.

This same capacity to recognize conventions but think for one’s self is exactly what was meant earlier by exercising discretion. With that kind of discretion, contrarianism will be used appropriately, for creativity.

See also: Developmental Trends in Creative Abilities and Potentials; Pablo Picasso 1881–1973.

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Creative Environments, Conditions, and Settings

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Glossary

Audience Any person(s) other than the original creator(s) who come(s) in contact with a novel act or product in any field. Not restricted to viewers of performances.

Autonomously creative people People such as artists, designers, garage inventors, writers, and some academics who carry out much of their relatively solitary and unsupervised creative activity outside of organizations. As made clear in this article, however, such people are by no means entirely autonomous in their creative work.

Coworking spaces Settings which offer a combination of individual and communal work spaces to autonomously creative people who would otherwise probably work by themselves and often at home. The settings are designed to facilitate socializing, potentially synergistic exchanges of information, and opportunities for possible collaborations among people working in different domains. Contemporary amenities such as coffee and internet access are typically provided to create a modern cafe-like environment.

Creative cities Cities such as Paris, Vienna, and New York City which have been the site of historically noteworthy creative efflorescences in particular creative fields during certain periods of time.

Creative environment The physical, social, and cultural environment in which creative activity occurs. Creative environments may involve nested environments,

for example, an office space nested within a home, nested within a neighborhood, nested within a city, nested within a particular time in history.

Creative seeds The initial 'seeds' around which creative interests and activities first develop. Seeds may consist of problems or projects presented or discovered. Seeds may also consist of new ideas, perspectives, images, sounds, objects, materials, processes, or tools which elicit the curiosity and attention of creatively inclined people and which eventually evoke creative activity. Seeds are sometimes experienced as emerging from the self in the form of powerful images, mysterious phrases, haunting feelings, or dream fragments from which creative activity evolves.

Creatively active person A person who is currently engaged in a creative activity.

Creatively inclined person A person who tends to enjoy certain types of creative activity and who has a history of voluntarily, and often enthusiastically, undertaking those activities.

Designated and protected workspace A special type of workspace that is 'designated' in the sense that it is intended to be used primarily or exclusively as the person's central place of creative work and is 'protected' in the sense that it is not to be intruded upon, re-arranged, or 'cleaned up' without permission. These spaces may take many forms, including that of offices, studios, garages, basements, or even old barns.

Introduction

Creative environments help people function more creatively than they would in less creative environments. In view of the fact that other articles in this encyclopedia describe environmental factors which influence the creative functioning of people working within organizations, the present article will focus on environmental factors which tend to facilitate the efforts of autonomously creative people such as writers, artists, designers, garage inventors, and some academics, who carry out much of their creative work without the support, supervision, or resources which organizations typically provide.

This article will focus on five aspects of the creative working environments which such people often seek out or construct for themselves: (1) the physical spaces in which they often do much of their work (e.g., studios, offices, garages, workshops, and libraries); (2) creatively supportive spouses, partners, and friends; (3) informal settings such as cafes, bars, and creatively-active neighborhoods which facilitate interactions with other people involved in similar creative activities; (4) settings that have been designed specifically to foster creative work such as

artists' collectives and colonies, writers' retreats, and centers for advanced studies.

Need for a Conceptual Framework

The systematic study of environments which help support the work of autonomously creative people is much less developed than the study of environments which support the creative activities of people working within an organization. For example, whereas conceptual frameworks and related questionnaires have been developed and used to study work-settings and climates associated with creative performance within organizations, no such frameworks and almost no psychometric instruments exist for studying the multi-layered environments within which autonomously creative people function. In preparing to write this article, therefore, it was necessary to construct a conceptual framework that might be useful in organizing and making sense of what might be known about the kinds of environments that autonomously creative people tend to construct or seek out for themselves and about the actions they take in doing so. Once constructed, this framework was then used to help interpret descriptions of

those environments and of the actions taken to construct or seek them out.

A Conceptual Framework

The conceptual framework developed here rests on two working assumptions: (1) creative activities and projects present a variety of challenges to people who are attempting to initiate and carry them out; and (2) many of the qualities which tend to distinguish creative from less creative environments involve functional features of environments which help creatively-active people meet those challenges. For example, because many creative activities involve phases during which multiple strands of thought are being dealt with more or less simultaneously, those activities present creative people with the challenge of simultaneously handling several strands of thought. As a consequence, environments which make it easier for creatively active people to handle multiple strands of thought when the need arises, should be expected to support, on average, somewhat higher levels of creativity than environments which serve this function less effectively.

The specific framework described below and used throughout this chapter was developed by: (1) compiling a list of widely cited and presumably relatively common features of creative activities and episodes; (2) drawing inferences about the challenges those features would tend to present to people engaged in creative activities; and (3) drawing predictive inferences about the functional characteristics of environments that would tend to help people meet those challenges.

It is important to understand at the outset that the ways in which these challenges affect creative people and the creative working environments they construct in efforts to deal with those challenges almost certainly reflect the personality and cognitive characteristics, working styles, and personal preferences of the individuals involved as well as the nature of their typical creative activities and projects. Therefore, though it may be possible to sketch the general contours of 'typical' creative environments, the most creative environment for any particular person at any particular time is very probably a matter of person-project-environment fit.

Predicting the Functional Characteristics of Creative Environments from an Understanding of Creative Processes and Episodes

Creative Episodes: Common Elements, Features, and Associated Challenges

Creative episodes of the type being discussed here typically begin when creatively inclined people, (i.e., people who generally enjoy engaging in certain types of creative activities and who have a history of doing so) come in contact with pre-defined projects or, more commonly, when they encounter or generate creative seeds from which they construct motivationally appealing projects.

Creatively inclined people

Because creativity requires the presence and actions of a creatively inclined person, a creative environment must

contain at least one such person. Furthermore, because creatively active people often stimulate and amplify one another's creativity in ways that will be described below, adding creatively inclined people to an environment will tend to increase the level of creative activity within it. The challenge for potentially creative environments, therefore, is to attract and retain creatively inclined people.

Creative seeds and projects

Autonomously creative people are sometimes presented with more or less clearly defined projects in the form of invitations, competitions, or commissions which they are free to accept or ignore. In other cases, autonomously creative people decide to undertake more or less clearly defined projects which are available in the social or artistic-intellectual milieu as tasks which they are free to engage or ignore. Writing the Great American Novel, writing an essay explaining in convincing detail how consciousness arises from activities of the brain, or constructing an engine that will propel an automobile for 100 miles on a gallon of gas, are examples of projects that reside in the culture, and can be undertaken by anyone.

More commonly, however, creatively autonomous people construct their own projects from what may be thought of as creative 'seeds.' Seeds may come in the form of new ideas, images, sounds, objects, materials, processes, tools, and ways of thinking which are encountered in the outside world, which catch the attention of creatively inclined people and from which they construct new projects relevant to their long-standing creative interests. For example, a snippet of conversation overheard on a busy sidewalk might become the seed for a new song, a detective novel, or nothing at all, depending upon whether it was overheard by a singer-songwriter, a writer of detective novels, or by someone who is not creatively inclined. Creative people also sometimes experience seeds as emerging from within themselves in the form of dream fragments, powerful feelings, visual images, or ideas for possible projects that pop unexpectedly into consciousness. In other instances, creative seeds emerge from creative people's explorations and playful manipulations of the materials with which they typically work.

The challenge for creatively inclined people, therefore, is to place themselves in situations where they are apt to encounter potential projects or seeds, or in which 'internal' seeds are apt to arise, or in which they are apt to engage periodically in goal-free explorations and playful manipulations of the materials in which they work.

The corresponding challenge for environments is to provide such seeds and projects and to provide conditions conducive to their generation. Environments which serve these functions well should be expected to support, on average, higher levels of creativity than environments which serve these functions less effectively.

Motivation

People are motivated to initiate and carry out creative activities by a wide range of anticipated and experienced pleasures and satisfactions, some of which flow directly from the activities themselves, and others of which are contingent upon actual or anticipated reactions from the outside world. The first category would include, for example, the pleasures people often derive

from using their own imaginations, from manipulating their projects' physical materials, or from creating or discovering new things.

Though sometimes de-emphasized by scholars more focused on the first category of pleasures and satisfactions, many of the satisfactions, pleasures, and rewards which are contingent upon reactions from the outside world play very important motivational roles in the working lives of creative adults. Many professionally creative people, for example, are substantially motivated by the hope that their work will be recognized and valued by their professional peers. Some are strongly motivated by desires to produce work that informs, gives pleasure to, enriches, or in some way benefits other people. Most professionally creative adults who are financially responsible for themselves and perhaps others are also motivated by the hope that their creative work will contribute to their financial well-being.

There are several challenges to creatively inclined people related to this issue. It is important that they undertake creative activities from which they are apt to derive process-based pleasures and satisfactions. It is also usually important that they undertake projects which have reasonably good chances of evoking the kind of socially contingent recognitions, rewards, and responses they desire.

The corresponding challenges to creative environments are to (1) give people the freedom to choose activities from which they are apt to derive process-related as well as socially-contingent pleasures and satisfactions, (2) contain a wide range of 'audiences' that value a variety of creative products and are capable of and inclined to appropriately reward those who produce them. Environments which serve these functions well would be expected to support higher levels of creative activity than environments that do not.

Information

Psychologists generally believe that creativity almost always involves combining, building upon, and transforming pieces of information, constellations of knowledge, ideas, images, sounds, theories, perspectives, and ways of thinking that are encountered in the external world prior to or during any particular creative episode or which are generated in the course of the episode.

The challenge to creative people is to possess such information at the outset or know how to acquire it quickly during the episode. The corresponding challenge for creative environments is to contain such information and make it easily available to creative people or to facilitate the acquisition of such information from other environments.

Time

Creative people generally want to spend as much time as necessary on their projects. Creative people also often wish to exercise considerable control over how the total time available to them is configured. For example, some creative people can work effectively in many short blocks of time whereas others need long periods of time. Some autonomously creative people have very strong preferences regarding the time of day and, in some cases, even regarding the time of the week or year in which to work. In addition, people often want to be able to plunge quickly into their creative work in response to suddenly emerging ideas or to a strong sense that conditions are 'right.'

They also frequently wish to keep working for as long as the process is going well.

The challenge to creative people is to find or 'make' as much time as possible for their creative work and to find ways to control the configurations and availability of their work time as fully as possible.

The corresponding challenge to creative environments is to help people find or make sufficient work time and to make it possible for them to configure and access that time as needed.

Space

Most creative activities require space. In some cases this may involve little more than a place to sit, though in other cases it may involve larger and more complex spaces in which to store and use materials and equipment. Furthermore, as noted below, the spaces also may need to satisfy other special requirements.

The challenge to creative people is to locate or create such space. The corresponding challenge to creative environments is to provide such space or make it possible for people to construct or locate space that meets their needs.

Reliance upon easily disrupted concentration

I find it is very important to work intensively for long hours when I am beginning to see solutions to a problem. At such times atavistic competencies seem to come welling up. You are handling so many variables at a barely conscious level that you can't afford to be interrupted. If you are, it may take a year to cover the same ground you could cover otherwise in sixty hours.

Edwin Land, inventor of the Polaroid camera,
quoted in Bello, 1959, p. 158

As illustrated by Edwin Land's comment above, and as echoed by countless others, creative people often need protracted and uninterrupted periods of time during which they can become totally absorbed in their work and be able to handle the multiple elements and strands of thought frequently involved in creative thinking.

The challenge to creative people is to create or locate time and space in which such uninterrupted absorption in their work is possible. The corresponding challenge to creative environments is to provide the space and time necessary for such periods of uninterrupted concentration.

Reliance upon experimentation, exploration, and partially guided trial and error

... but sometimes the poem had to be taken in hand and completed by the brain, which was apt to be a matter of trouble and anxiety, involving trial and disappointment, and sometimes ending in failure.

A. E. Housman, in Ghiselin, 1985, p. 91

A. E. Housman's observation regarding his own writing process is typical of those made by creative people in almost all fields who frequently find themselves relying upon experimentation and partially guided trial-and-error in the course of their creative activities. In remarking upon the fact that such efforts often elicit anxiety and a sense of trouble and possible disappointment, Housman also describes feelings that are widely experienced and frequently expressed by creatively active people who realize, correctly, that resorting to trial and

error may mean that they are facing problems in their work which may require unpredictably long periods of time to solve or which they may not be able to solve at all. The challenge to creative people is to avoid, minimize, or manage such feelings and fears sufficiently that they do not disrupt or halt their creative work. The corresponding challenge for creative environments is to help people avoid, minimize, or cope with such feelings of anxiety and distress.

Reliance upon nonconscious cognitive processes

Creative people sometimes experience their work as being dependent upon the functioning of cognitive processes which are largely beyond their conscious awareness or control and which may or may not produce useful ideas. In some instances the products of these seemingly nonconscious processes pop up quite unexpectedly while people are engaged in relatively mindless everyday actions such as walking or taking showers, especially after having recently engaged in fairly intense periods of work on the project. In other cases, however, people attempt to engage these rather elusive processes by intentionally establishing what they consider to be particularly helpful internal and external conditions. Though such conditions sometimes include idiosyncratic sensory cues, they are often characterized by lack of distractions, a sense of peace and quiet, and sometimes the presence of an aesthetically pleasing visual scene. Such times and spaces, it should be noted, may be similar in some important respects to those needed for periods of creative absorption and concentration.

Reliance upon these marginally controllable and unpredictably helpful processes can also stir feelings of anxiety and doubt similar to those elicited by reliance upon experimentation and guided trial and error.

The challenges to creative people include making or gaining access to times and spaces which seem to facilitate conscious contact with the products of these processes, arranging propitious external and internal conditions, and avoiding or managing the anxieties sometimes associated with reliance upon these processes. The corresponding challenges to creative environments are to help make such times and places available and to help people avoid or manage the feelings of anxiety and self-doubt sometimes associated with dependence upon these processes.

Physical materials and tools

Most forms of creative activity require the use of certain physical materials, tools, and instruments. The challenge to creative people is to gain access to such materials and tools. The corresponding challenge to creative environments is to provide access to such materials and tools.

Assistants

Creative activities initially undertaken as one-person projects sometimes require more knowledge, skills, energy, and time than one person can provide. The resulting challenge to people centrally involved in such projects is to identify their need for assistants and to locate and recruit them. The corresponding challenge to creative environments is to help people identify their need for assistance, to contain and provide easy access to potential assistants, and to facilitate their identification and recruitment.

Tentative completion

Creative projects must eventually be brought to at least tentative completions despite their imperfections and undeveloped possibilities. The challenge to creative people is to at least tentatively complete their projects despite unavoidable uncertainties as to whether these imperfect products are good enough. The corresponding challenge to creative environments is to help people make good decisions about when to consider a project 'finished.'

Projection into and reception by the outside world

If creative products are to provide those who create them with the socially contingent benefits they need and desire and if the products also are to benefit people for whom they were created, they must be projected into the outside world and made visible to audiences (broadly construed) that are capable of recognizing, rewarding, and responding to them in motivationally satisfying ways. The challenge to creative people is to help project their finished products into the outside world where relevant audiences will become aware of them. The challenges to creative environments are to contain a wide range of audiences which are interested in a variety of creative products and which are also capable of rewarding those who created them, and to help creative people project their work to relevant audiences.

Pervasive uncertainties

Creative projects of the sort discussed here are fraught with uncertainties from start to finish that can threaten their successful completion. Because creativity, by definition, involves doing something that has never been done before, creative projects often lie somewhat beyond people's initial zones of competence. Successful completion of such projects therefore often depends upon whether, while engaged in the activity itself, people are or are not able to strengthen their initial skills and are able to acquire new skills, strategies, and information needed to complete their projects. As noted above, frequent reliance upon unpredictably successful periods of exploration, experimentation, and guided trial and error and upon marginally-controllable and unpredictably effective nonconscious processes are additional sources of uncertainty. Further layers of uncertainty are added by the fact that it is often very difficult to know whether a tentatively completed product is ready to be projected into the world, whether it will be possible to project a finished product into the world and whether, once there, it will be noticed by audiences who will provide the desired responses. Unless avoided or managed effectively, the anxieties, misgivings, and self-doubts produced by these uncertainties can prevent people from even initiating projects which they fear will include excessive levels of uncertainty. Unless avoided or managed, these feelings can also lead to disrupted and constricted thinking during the creative activities themselves, to the premature completion of projects, to endless perseverance, or to the total abandonment of projects which might have been completed successfully had such reactions been avoided or managed.

The challenge to creative people, therefore, is to avoid, subdue, or somehow manage all of these potential anxieties, misgivings, and self-doubts. The corresponding challenge to creative environments is to help people avoid or manage these process-threatening thoughts and feelings which are grounded in the unavoidable uncertainties associated with creative activity.

Constructed and Sought-Out Environments

This stage of the analysis involved three steps: (1) identifying recurring patterns in the actions which autonomously creative people have taken to construct or seek out environments to support their work; (2) identifying salient characteristics of those environments; and (3) pointing out possible connections between those characteristics and the challenges which creative activities often present. Creatively active people and potentially supportive environments which were predicted in the section, 'a conceptual framework.'

The first two steps relied most heavily upon qualitative descriptions written by autonomously creative people of the environments they have constructed or sought out for themselves and of particularly creative environments in which they have found themselves fortuitously situated. Descriptions of such actions and environments which have been produced by journalists, biographers, sociologists, and historians were also examined. These two steps were also informed by historiometric studies which have examined macro-level factors which appear to have influenced levels of historically noteworthy creativity and by a few studies in which creative people have been asked to identify environmental factors which they believe influence their creativity.

Actions Taken by Autonomously Creative People to Construct or Seek Out Supportive Environments

The following five broad themes recurred with notable frequency in the descriptions of actions taken by autonomously creative people to construct or seek out creatively supportive environments for their work:

1. A tendency to construct or seek access to designated and protected work spaces.
2. A tendency to establish relationships with spouses, partners, and friends who support their work.
3. A tendency to establish supportive connections with other people engaged in creative activities similar to their own.
4. A desire to work in settings such as artists' colonies, writers' retreats, and centers for advanced studies.
5. A tendency to be drawn toward cities or regions in which unusually high levels of creativity are occurring.

Though it is currently impossible to estimate accurately the frequency with which these tendencies are exhibited, it is probably safe to say that almost all autonomously creative people exhibit at least one and probably two or more of these behaviors and aspirations.

Designated, protected, and easily accessed work spaces

People certainly do some of their important creative thinking and work beyond the confines of their standard work settings. Good ideas, for example, are frequently reported to appear while walking, taking showers, or immediately upon waking from sleep. However, people do much or most of their creative work in settings which they consider to be their primary places of work. It appears that a large percentage of people involved in relatively solitary and autonomous creative work construct or seek out primary places of work for themselves which may accurately be described as 'designated and protected' work spaces. These spaces

take many forms, including that of offices, studios, garages, basements, or even old barns. These spaces are 'designated' in the sense that they are intended to be used primarily or exclusively as the person's central place of creative work. They are 'protected' in the sense that those who use them often make clear to other people that the spaces are not to be intruded upon, re-arranged, or 'cleaned up' without permission. The 'protected' quality of these spaces certainly calls to mind Virginia Woolf's famous suggestion to aspiring young women writers that they manage to obtain rooms of their own 'with a lock on the door.' Many people also try to make these workspaces quickly accessible by establishing them within or very near the structures in which they live, though others find it easier to maintain the designated and protected quality of these spaces if they are clearly separated from where they live. Ideally these spaces also can be equipped and arranged to suit the user's particular needs and work style. Such work spaces serve many functions in the process of supporting their users' creative activities.

Help sustain concentrated and meditative thought

For many people, the most valuable aspect of such spaces is the fact that they provide the physical and psychological space needed to engage in the uninterrupted and undistracted periods of absorbed, concentrated, and sometimes meditative thought which are so often crucial to their creative work. The fact that such spaces give people opportunities to become totally immersed in their own creative work and in their own created worlds is noted repeatedly and emphatically by people who work in such spaces.

By permitting people to leave work-in-progress (e.g., unfinished canvases, pages ending in mid-sentence, partially completed gadgets, etc.) safely undisturbed between periods of work, these workspaces expand actual work time somewhat by reducing set-up time. This feature also helps people quickly re-enter their previous frames of mind and easily pick up threads of thought which were laid to rest at the end of the last period of work.

For reasons of necessity and preference, some workspaces are less than fully designated or fully protected. For example, people who enjoy occasional interruptions and perhaps find them beneficial tend to construct somewhat more permeable spaces. Those who must remain within sight or sound of other people for whom they are caring either tend to construct much more permeable workspaces or, more often than not it would seem, defer their creative work to times when they are relieved of those responsibilities and can enter more protected workplaces. More generally, those constrained by practical impediments, often find ingenious ways to construct or seek workplaces that serve some of the functions of designated and protected workplaces.

Safe space for small 'failures'

Such settings also function as psychologically 'safe' spaces in which it is possible to engage in the frequently unsuccessful experiments, explorations, and partially guided trials-and-errors so often characteristic of creative work without fear of having others witness these many small 'failures.'

Motivational support and encouragement

Such work spaces can provide modest motivational support and encouragement in at least three ways. Because they can be

arranged to meet the creative worker's individual tastes, they presumably slightly enhance the pleasure experienced while working within them. In addition, if such spaces are used almost exclusively for creative work, the simple process of entering them will tend to trigger and encourage, by means of automatic and largely unconscious processes, the kind of focused creative work behavior that has come to be associated with that space. Furthermore, if these spaces have been the site of previously successful work, they may somewhat enhance motivation by eliciting memories of those successes.

Freedom

The private and unsupervised nature of these spaces also gives those who work within them considerable freedom to work on their projects in whatever ways they choose. The exercise of such freedom tends to increase the probability of creative success in two ways: by maximizing person-project and person-method 'fit' and, according to self-determination theory, enhancing the motivation to engage in the chosen activity.

Accessible materials and tools

Such workspaces facilitate creative work by making the necessary materials and tools easily accessible. The challenges associated with obtaining such materials and tools in the first place, however, must be met through interactions with the outside world.

Information

Such workspaces can also help satisfy some of the information-related needs of creative projects by containing resources such as personal reference libraries and collections of art books and musical recordings. Though workplace connections to the internet provide access to vast bodies of easily accessed information, not all of the information people need in the midst of their creative activities exists in digitally accessible form. As noted below, therefore, autonomously creative people must often turn to the world beyond their immediate workspaces to gather information they need.

Exceptions: People who dislike working in social isolation or are unable to do so

Designated and protected work settings obviously do not meet the needs of people whose circumstances prevent their constructing or locating such environments. Nor do such workplaces meet the needs of people who find it psychologically uncomfortable to work in such socially isolated settings and who therefore move their work to settings where they will, at the very least, be within sound and sight of other people. Writers, for example, have often used cafes or restaurants as places to work near other people and within reach of desired beverages which may or may not enhance the creative workings of their brains. In the 1990s, for instance, J. K. Rowling wrote parts of her first Harry Potter novels in a neighborhood cafe with her infant daughter in a nearby stroller and an espresso close at hand. Over the years writers who have found rooms of their own nonexistent or too isolating have sometimes turned to great public writing rooms such as the British Library's Reading Room to do their work. There, for example, Charles Darwin and Karl Marx thought and wrote in a setting supportive of concentrated thinking yet in the

presence of other people and in close proximity to vast resources of information.

Supportive spouses, partners, and friends

Supportive spouses, partners, and friends are frequently very important elements in a creatively active person's environment. For example, autonomously creative people often acknowledge the important role played by people with whom they live in helping establish and protect their work place. Spouses and partners are also often thanked for tolerating work patterns that sometimes deviate substantially from the social norm, by occasionally freeing up work time by relieving the creatively active person of some household obligations, and by tolerating problematic behaviors and mental states sometimes associated with intense involvement in creative activity. Spouses, partners and friends are also frequently identified as influential sources of personal encouragement and as people who affirm the fundamental value and importance of the kind of creative work being done. In some cases spouses and partners also serve as sounding-boards, first audiences, helpful critics, and friendly editors. It is presumably not by chance that creative people often establish and maintain relationships with people who support their work in these ways.

Settings for informal contact with peers engaged in similar creative activities

Cafes and bars

Autonomously creative people in Europe and the United States have often used cafes, bars, and restaurants as places to meet and mingle with one another during or at the end of their workdays. The cafe life of Vienna and Paris, for example, has often been cited as an important factor in sustaining the creative ferment of these two cities during certain periods in their history. Historians and sociologists of art and literature have also cited the roles played by particular bars in the emergence and development of bebop jazz in Harlem in the 1940s, the New York School of artists and poets in the 1940s and 1950s, and the development of the beat poets in San Francisco's North Beach in the 1950s. (Interestingly, certain restaurants have also been cited as playing important roles in the productive back-channel exchange of information that helped fuel Silicon Valley's creativity.) In such settings creative people are able to satisfy some of their needs for social contact that may have been unmet during hours of relatively solitary work. Here, too, they are able to participate in conversations and creative interactions with other creatively active and intellectually lively people who expose them to new and, perhaps, the very newest, ideas, perspectives, and methods in their field of work. Valuable information about possible venues and outlets for their work and about intermediaries who might help project their work in the larger world is also sometimes shared and gathered in these conversations. Within such gathering places, autonomously creative people often experience strong general affirmations regarding the importance and ultimate value of the kind of work in which they are engaged, as well as more personally directed expressions of encouragement, find extremely important encouragement and motivation implicitly and explicitly provided by other creatively active and therefore highly credible people.

Informal associations

Creatively autonomous people also sometimes seek creative support and stimulation by establishing friendships with other creatively active people or by joining informal groups to share ideas, work and constructive critiques in supportive environments. The Noble laureate, Toni Morrison, for example, reportedly received crucially important support at the outset of her writing career from a small group of writers who gathered monthly to share and discuss one another's most recent work.

Writers' rooms and coworking spaces

Recent years have seen the emergence of writers' rooms which provide private (semi-protected) writing spaces for concentrated work as well as modern amenities such as coffee and internet access. These writers' rooms often include communal spaces which can be used to socialize and, if desired, exchange ideas about work in progress. Along very similar lines, 'coworking spaces' have been established to serve the needs of people involved in a variety of autonomous creative activities and who would otherwise work at home. These coworking spaces typically offer private and semi-protected work spaces, the usual amenities, and communal spaces very specifically designed to facilitate socializing, potentially synergistic exchanges of information, and possible collaborations between creatively-active people working in different domains.

Creatively active neighborhoods and enclaves

For centuries, and continuing to this day, artists of various sorts have migrated to neighborhoods and enclaves which have become heavily populated by other artists and creatively active people. In so doing they place themselves and their workspaces near other artists with whom they can experience camaraderie, ideas, information, mutual encouragement, a shared sense of the value of artistic work, and what is sometimes referred to as good 'creative energy.'

*Settings specifically designed to foster creative work**Collectives and cooperatives*

Various types of artists have also attempted to facilitate their own work by constructing and migrating to settings such as artists' collectives and creatively oriented cooperatives. In such intentionally constructed settings they are able to share space, materials, equipment, ideas, perspectives, and information about possible outlets and venues for their work and the same kind of 'creative energy' noted above.

Colonies and retreats

The qualities of some of the most prestigious artists', writers', and musicians' colonies in the United States, such as Yaddo in New York and MacDowell in New Hampshire, also reveal much about the kind of working environments which many, though certainly not all, people involved in autonomous artistic activities desire. In such retreats, artists enjoy 24-h access to designated and protected workspaces in the form of appropriately equipped studios. Lunches are often delivered to the individual cabins or studios in ways designed not to interrupt work. Communal dinners are provided in the evening during and after which residents can socialize, exchange ideas, share work in progress, and generally energize one

another. Relieved of almost all nonwork-related responsibilities and distractions and provided with designated, protected, and well-equipped work spaces, residents are presumably able to focus essentially all of their energy and attention upon their creative work. Though such colonies do not fit the needs of all autonomously creative people, due in large part to the separation from family that they require, and though access to them is sharply limited, the appeal they hold for many autonomously creative people is instructive.

Centers and institutes for creative scholarship

Centers for creative thought and scholarship such as the Institute for Advanced Studies in Princeton, New Jersey and the Center for Advanced Study in the Behavioral Sciences in Palo Alto, California have been designed to offer scholars many of the same features provided by artists' colonies. In such settings scholars are offered: intellectual freedom; designated and protected workspaces in the form of private offices and institutional protection from intrusions by the outside world; access to information in the form of great libraries, internet connections, and other creative scholars and thinkers in residence with whom numerous opportunities for formal and informal interactions are constructed; and, perhaps most importantly, time to think freely and deeply, absent most of the responsibilities associated with contemporary academic life. Though access to such centers is also sharply limited, and though not all potentially eligible scholars could or would want to avail themselves of the full constellation of features offered by these centers, it is once again the case that the benefits offered by residencies at these centers reveals much about the working environments desired by many creative academics.

Creative cities

There is considerable evidence that certain cities and regions of the world have become, for a time, the centers of spectacularly high levels of creativity. Scholars, for example, have frequently cited Athens of the fifth century BC, Florence in the fifteenth century, London between about 1570 and 1620, fin de siècle Paris, Vienna and Paris between the two world wars, and New York City since the end of World War II as centers of certain types of creativity for notable periods of time.

Scholars generally agree that there is no single factor that distinguishes these unusually creative cities from less creative ones, and no single factor that has triggered a common sequence of events leading to their creative efflorescences. However, in attempting to identify some of the factors which have played important roles in the creative periods of these cities, historians have identified several which appear to be highly relevant to some of the needs and challenges associated with creative activity itself.

Informationally rich crossroads

For a variety of historical and economic reasons, these unusually creative cities have tended to be crossroads through which people from multiple cultures passed or to which they came to live and work, bringing with them a steady flow of creative seeds and creativity-relevant information in the form of new ideas, values, knowledge, images, sounds, tastes, tools, ways of thinking, and ways of doing things.

Relatively large, culturally diverse, and histories of interest in high culture

Several of these cities also tended to have been relatively populous, culturally diverse, and to have had histories of interest in and support of high culture. As a result, these cities tended to contain: unusually large numbers of patrons, benefactors, sponsors, and investors who were able to provide creatively-active people with crucial financial support and social recognition; relatively large numbers of people who could be called upon as collaborators and assistants if needed; unusually numerous, diverse and sophisticated 'audiences' (broadly construed) eager for a wide range of new creative products and performances; unusually numerous and varied outlets and venues (e.g., galleries, theaters, literary publications, performance spaces, etc.) by which new creative work could be displayed to potentially relevant audiences and patrons; and numerous and unusually sophisticated 'intermediaries' who were interested in identifying producers of new and creative work and connecting their work with people interested in displaying and disseminating it. The presence of such patrons, potential assistants, audiences, venues, and intermediaries in these cities certainly contributed to these cities' capacities to encourage and support unusually high levels of creative activity.

Attractors of creatively talented and ambitious people

Because of their creativity-fostering qualities, these cities tended to become magnets which attracted creatively talented and ambitious people from across continents and oceans, thus swelling the numbers of creative people living and working in relatively close proximity to one another. Such increased numbers and densities tended to increase the likelihood that creative neighborhoods and enclaves would emerge, that planned and unplanned interactions among creatively active people would occur, and that ideas, enthusiasm, materials, workspaces, cafes, intermediaries, venues and increasingly sophisticated early audience might be shared in mutually beneficial ways. As a result of these processes, of course, such cities tended to foster ever higher levels of creativity and become even more attractive to creatively ambitious people who might gravitate toward them. The fact that recent US census data indicates that specific types of artists (e.g., fine artists, designers, writers) are disproportionately located in certain US cities clearly suggests that processes of selective migration have been and probably continue to be at work shaping this country's creative geography. It seems reasonable to suppose that similar processes are at work in countries around the world.

Creative cities not for all

Most people involved in autonomous creative activities do not, do not want to, and do not need to live in creative cities in order to do their creative work. In the first place, many people simply do not like cities as places to live or are prohibited by practical considerations from doing so. In addition, many creative people do not wish to lose their sense of place, comfort, and belonging by moving to a city. Others do not want to be distracted from their work by the many seductive possibilities that cities offer, to become overly influenced by the highly visible and much-talked-about creative work of other people, or to experience themselves as little fish in big

ponds. Autonomously creative people have also begun to report that new modes of communication and new ways to display of their work made possible by the latest technologies are diminishing some of the creative advantages previously afforded by physical proximity to creative colleagues, potential patrons, audiences, intermediaries, and potential assistants. It should also be noted that many creative people who are attracted by some benefits of unusually creative cities but deterred by others, resolve their dilemmas by locating themselves within easy reach of, but not actually within, such cities.

Caveats

Variability Among Good Creative Environments

Creative people differ from one another in many important respects. They have different personalities, motivational profiles, and work styles, for example. Furthermore, the conditions, settings, and environments conducive to one type of creativity (e.g., writing a novel) may not be most conducive to other types of creativity such as producing a series of multimedia canvases or expanding knowledge of a particular mathematical domain. As a consequence, the exact environmental conditions most helpful to any particular creative person working on any particular project may not be the most helpful to other people working on other projects. Therefore, the ideal macro-environment is presumably one within which people have the freedom and power to construct or migrate to whatever particular environments best suit their individual and perhaps project-specific needs. It is certainly not being suggested here that the multitudinous and varied environments constructed or sought out by free creative agents would share all of the features or serve all of the functions discussed in this article. What is being cautiously suggested here is that many, and perhaps most, of the environments which autonomously creative people would construct or seek out for themselves under such free conditions would exhibit several of the features and serve several of the process-entailed functions identified here. The degree to which this proposition is true, of course, remains to be seen.

Creative Environments Helpful but Not Necessary

What does not remain to be seen, however, and what is extremely important to understand, is the fact that very good environments are neither necessary nor sufficient for creativity to occur. As history shows, acts of creativity can and do emerge from very difficult or even hostile conditions, and as history also shows, creative efforts undertaken in highly supportive environments often fail. Though supportive environments are neither necessary nor sufficient for creativity to occur, it seems reasonable to suppose that they tend to increase the likelihood that creative activities will be undertaken and completed successfully. Establishing or seeking out creatively supportive environments may therefore be analogous to eating well, exercising, and not smoking: while these practices do not guarantee desired outcomes, they generally improve the odds. Given the inherent unpredictability and riskiness involved in creativity, that seems all that could be hoped for.

See also: Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Climate for Creativity; The Creative Sector and Class of Society; Writing and Creativity.

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Relevant Websites

- http://rodcorp.typepad.com/rodcorp/how_we_work/ – Site containing descriptions of how/when/where various types of people work – including many autonomously creative people.
- <http://on-my-desk.blogspot.com/> – Artists, illustrators, designers and other autonomously creative people describe their workspaces.
- <http://www.guardian.co.uk/books/series/writersrooms> – A collection of writers' descriptions of where they write from *The Guardian*.
- <http://accio-quote.org/> – Site about J. K. Rowling, including information about how/where the Harry Potter books were written.
- <http://www.womenfolk.com/creativity/> – Guide for women doing their creative work at home.
- <http://www.nytimes.com/1998/05/15/arts/my-manhattan-where-writers-find-peace-well-sort-of.html?scp=1&sq=&st=nyt> – Article about the Writers Room in New York City from the New York Times electronic archives.
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- <http://www.vermontstudiocenter.org> – Site for Vermont Studio Center.
- <http://www.artistcommunities.org/> – Site for Alliance of Artists Communities. Contains useful resource library.
- <http://yaddo.org/> – Site for Yaddo artists' community.
- <http://www.macdowellcolony.org/> – Site for MacDowell Colony.
- <http://www.nytimes.com/1999/09/25/books/togetherness-solitude-fertile-chemistry-art-colonists-learn-creativity-can-be.html?scp=1&sq=&st=nyt> – Article about the MacDowell Colony from the New York Times electronic archives.
- <http://www.casbs.org/> – Site for Center for Advanced Study in the Behavioral Sciences.
- <http://www.ias.edu/> – Site of Institute for Advanced Study at Princeton.
- <http://www.npg.si.edu/exh/rebels/painters.htm> – Article about abstract expressionists in New York City.

Creative Products

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Glossary

Consensual assessment technique (CAT) Teresa

M. Amabile's method for assessing creativity globally based on the independent subjective judgments of products by expert observers who are familiar with the domain in which the product was made.

Creative Behavior Inventory (CBI) A checklist of creative activities and accomplishments originally developed by Dennis Hocevar, with six subscales: creativity in the fine arts, crafts, literature, music, performing arts, and math/science.

Creative product analysis The process of carefully considering products or product concepts in an objective and unhurried way to examine the underlying characteristics of the product. When the characteristics are understood, they may be used to make rational decisions about the product, and/or manipulated to strengthen and develop the product concept.

Creative Product Semantic Scale (CPSS) The specialized assessment instrument used to gather information from raters about a product or product concept, based on the Creative Product Analysis Model (CPAM) of Susan P. Besemer.

Divergent thinking The type of thinking when many options are generated without prejudgment.

Domain A specific discipline, such as art, business, education, or science.

Novelty The newness of a product; the extent to which it is original or statistically infrequent. This is one of the dimensions or factors of the CPAM, and is the rubric for two facets, Surprise and Original.

Reliability The degree to which an assessment may be depended upon to consistently produce similar results when used by different people in different settings, or by the same people when used at different times.

Resolution When speaking of products, the degree to which the product is valuable, useful, and fits or meets the needs of a problematic situation. This is one of the three dimensions or factors of the CPAM, and is the rubric for four facets, Logical, Useful, Valuable, and Understandable.

Style When speaking of products, style (originally termed 'Elaboration and Synthesis') is the degree to which the product combines unlike elements into a refined, developed, coherent whole, statement, or unit. This is one of the three dimensions or factors of the CPAM and is the rubric for three facets, Organic, Well-Crafted, and Elegant.

Validity A test is said to be valid if it truly and accurately measures what it sets out to measure.

Introduction

The root of the English word create lies in the Latin *creare*, which means to make or to produce. Creation thus implies production, so the term creative product almost seems redundant. We use the term 'product' in a liberal sense to mean expressed ideas as well as observable outcomes (such as a poem, dance, article, cake, or website). The product, broadly defined, is nearly synonymous with creativity.

However, in the history of the study of creativity, the product almost seems to be an afterthought. Noted creativity author Arthur Cropley, recently stated that "thinking about creativity has been hijacked by three of the four Ps: person, process and press, and . . . product has been neglected." Most of the theory and research in creativity has focused on the creative person and, to a lesser extent, the creative process. Such a focus has often eclipsed the study of the very thing that allows us to determine whether a person or process is creative: the product.

Although creativity in products is still underexplored, in the last ten years the total number of studies about products has roughly doubled. A search of the literature from 1965 to

1998 yielded 63 citations; from 1999 to 2009 an additional 67 articles were published. While this search was not exhaustive, the result suggests an increased interest among researchers in studying creative products. Similarly, websites such as *Instructables.com*, *Make* magazine and *Make TV* are indicators of an increased interest among the general public in creating products for fun. This can also be seen in the widespread popularity of crafting and cooking shows.

Evaluation Is Inevitable

It is an inevitable fact that creative products are evaluated, either explicitly or implicitly. Current brain research shows that evaluation is constantly taking place whether or not we are aware of it, or intend to make a judgment. Evaluation is important in education, because students' works of art, writing, and science are evaluated as evidence of learning and aptitude. In business, new product ideas are screened to pick those with the most promise for development and appeal in the market. Works in fine arts and performing arts are subjected to art criticism, music criticism, and published reviews.

The concept of evaluation has been extended to evaluation of ideas (which may be considered proto-products), with the recognition that idea evaluation plays a more important role in the recognition of creative achievement than has traditionally been realized. For example, Cassie Blair and Michael Mumford examined the criteria that people used in appraising ideas. They found that respondents preferred ideas that were easy to understand, provided benefits to many people, and were consistent with social norms; the most original and risky ideas were disregarded. We will return later to the notion that it is possible to have too much originality.

Criteria of Creativity in Products

The common wisdom is that two major components combine to mark creativity in products. The first of these two elements is novelty, originality, or a demonstration of newness in the product. There can be no definition of creativity which does not include novelty, although novelty needs to be considered relative to a given population of products (e.g., products of children should be judged relative to those of other children). It seems impossible to imagine a truly creative product which has no elements of newness.

The second major component which is commonly thought to be important to creativity is the product's value, appropriateness, usefulness, or the extent to which it solves a problem. Without this second criterion as a necessary component of creativity in products, bizarre outcomes such as the senseless muttering of psychotics (which are often highly novel) would be considered creative. There must always be a balance of this second criterion with novelty to elicit praise as creative; too much novelty will cause a product to be rejected as weird or peculiar, even in the arts. An example of this balance is provided by the website *DVICE*, which is devoted to the "wildest and most interesting" new products; however, they make it clear that they also provide a reality check on the extreme novelty of the chosen products.

In addition to these two widely recognized criteria, it has been argued that there is at least one more component. When products are marginally new, or the value that they add is only incremental to the existing standards of a field, they are not usually termed creative unless something in the way that they are made, presented, finished, or implemented adds to the overall product concept. There is something emotional in this third dimension that moves the user, viewer or listener in some way. It evokes a reaction, an attraction, a repulsion, or at least attention of this viewer, the outsider who is evaluating the work. This third component, sometimes called the product's style, elegance, or aesthetic quality, is often missing in the usual definition of creativity in products. The failure to account for the third dimension has caused problems in some empirical studies investigating creativity, where creativity is defined only as novelty, or only as appropriate/useful novelty.

Brief History

The formal psychological study of creativity began in earnest in 1950 when J. P. Guilford stated the need for a rigorous consideration of the subject in the journal *American Psychologist*, and

called for scholarly investigation into the concept. His focus was the creative person, although he briefly addressed creative behavior as the production of ideas. Guilford's structure of Intellect model, in which he described convergent and divergent thinking, greatly influenced creativity studies over the next two decades. Researchers of the 1950s and 1960s frequently did not differentiate between the criteria for judging creativity in personality with criteria for judging creativity in products. However, in his book *On Becoming a Person*, the eminent psychologist Carl Rogers said:

In the first place, ... there must be something observable, some product of creation. Though my fantasies may be extremely novel, they cannot usefully be defined as creative unless they eventuate in some observable product – unless they are symbolized in words, or written in a poem, or translated into a work of art, or fashioned into an invention. (p. 349)

In 1961, Mel Rhodes famously described four strands intertwined in the definition of creativity: the 'Four Ps' of creativity were the person, the process, the environment, or 'press,' and the product. In his *Phi Delta Kappan* article analyzing the concept of creativity, Rhodes stated flatly that objective investigation into the nature of the creative process could proceed in only one direction: from product to person and then to process and to press. However, until the 1990s, little research in creative studies started with the product.

Well-known creativity author Donald W. MacKinnon identified five criteria for creativity in products: the product's originality, adaptiveness (its ability to solve a problem), its elegance and other aesthetic qualities, its transcendence (the ability to transform or transcend reality), and 'realization' (the product's development and elaboration, evaluation and communication to others). He pointed the way to product-related scholarship by his own research on architects identified as especially creative by their peers. Later, MacKinnon guessed that the explicit determination of the qualities which identify creative products had been largely neglected because we implicitly know – or think we know – a creative product when we see it.

In 1980, Larry Briskman argued forcefully for a product-oriented approach to scientific and artistic creativity. He firmly stated that it was impossible to identify creative people or creative processes independently of the creative product and our evaluation of it. He said that creative people and creative processes can only be identified via prior identification of their scientific or artistic products. Briskman contended that we cannot even *describe*, let alone understand or explain, the creative process without reference to the products which are its outcome.

Teresa M. Amabile has employed a product-oriented operational definition of creativity in numerous studies, and her approach has been adopted and adapted by scores of subsequent scholars. She and her colleagues developed the consensual assessment technique (CAT); that is, a product or response is creative to the extent that appropriate observers independently agree that it is creative. In these studies, product evaluations are usually made by expert judges; the goal of such evaluations is most often to observe changes in the level of creativity caused by variations in the treatments of the participant groups.

The most comprehensive work on identifying characteristics of creative products has been carried out by Susan Besemer and her colleagues. In the 1980s, she and Donald Treffinger published a taxonomy called the Creative Product Analysis Matrix (CPAM), with three theoretical dimensions, or three distinct categories for the criteria of creativity. These categories are Novelty, the elements of newness in the product; Resolution, how well the product fills the need or works to resolve the problem for which the product was created; and Style (originally called 'Elaboration & Synthesis'), which considers how the solution is implemented or worked out. Although none of the criteria were original, as they had all been previously published, the construction of a three-dimensional model for identifying creative products was a new approach to the field.

These theoretical approaches lead us to a product-focused definition of creativity. More importantly, they lead to a broader discussion of the measurement issues involved in a product-focused definition.

Measurement

It has been said many times that creativity is in the eye of the beholder; a work's creativity is thus inescapably subjective. The creativity of products can be measured in many ways, and its measurement provides the evidence for creative persons, processes, and environments.

Early measures of creativity, influenced by psychologists, focused largely on creativity as an ability or trait, often assessed by test performance. Early tests focused on fluency, or the number of ideas produced by an individual; this early work was integrated with Guilford's concept of divergent thinking in the 1950s. Note that fluency involves the production of ideas (proto-products); measures of fluency often simply count the number of ideas produced. Sometimes on fluency tests, the ideas are judged for originality, but rarely for any of the other criteria which might be applied to creative products.

A number of researchers have used measures of creativity which indirectly relate to products, some have measured creativity with global judgments of products, and some have devised domain-specific measures. However, few studies have attempted to develop general criteria which can be applied to creative products across many disciplines.

Measures Relating Indirectly to Products

Many measures used by creativity researchers and the general public over the years are somewhat indirect measures of creative productivity: peer and teacher nominations and awards, measures of eminence, and self-reported creative activities and achievements.

Peer and teacher nomination and awards

Peer nomination is a common measure of creativity. With this technique, experts in a particular domain are asked to identify especially creative members of their fields. Presumably, knowledgeable peers of a scientist, architect, poet, or artist who nominate a target person as creative, must to some extent be considering the quality and/or quantity of that person's work. Similarly, teacher nomination is often used to

measure creativity of children. If a teacher can indeed make judgments of a child's creativity independently of judgments of intelligence or likeability, the teacher must be considering (at least to some extent) the child's work in arriving at the judgment.

In recent years awards for creativity in varied fields have proliferated. There are creativity awards for their members in trade associations from audio engineers to manufacturers of corrugated box equipment, and designers of food packaging. The field of advertising alone celebrates creativity with the *One Show* in the United States, giving advertising creativity awards in several categories, awards in Europe (*Epica*), and the *London International Awards* which makes selections from many countries; all of these awards have developed websites. Identifying the criteria used for these awards can be difficult because of the 'we know it when we see it' point of view of many advertising practitioners. Creativity is generally seen as a one-dimensional construct, with effectiveness the counterbalancing factor.

Awards for children's creativity include the *Heinz Ketchup Creativity Award* where children compete for the opportunity to display their works of art on a bottle of ketchup. In contrast to many contests and awards, Heinz has articulated weighted criteria: 50% on creativity, 25% on originality, and 25% on the clarity of the artwork. The website of the *Red Dot Design Award* for adults also specifies criteria including innovation (novelty), functionality, and the formal quality; the jury is composed of design experts. The Invent Now website contains details of the *Collegiate Inventors Competition*; entries are judged on their originality and inventiveness, and the entry must be complete, workable, and well-articulated.

We should point out that these popular attempts to evaluate products use their own idiosyncratic criteria, typically unrelated to research in the field of creativity. They do not often indicate whether measurement issues such as objectivity, reliability, or validity are addressed.

Measures of eminence

Another indirect approach to measuring creative production is to study eminent people. MacKinnon was one of the pioneers of such an approach, using peer nomination to identify 40 of the most creative architects in the United States. Eminence has been measured in other ways. For example, the eminence of artists has been measured by looking at the prices for their work. Traditionally, prices of works by a particular artist tend to fluctuate wildly for several generations after the artist's death, then settle down to some 'proper' place. In this millennium, things changed considerably. Sarah Thornton in *Seven Days in the Art World* observed that contemporary art had reached astounding heights both in the instant evaluation of the auction setting and in art galleries. Until recently, the art of living artists did not sell for astronomical prices, but in the burgeoning economy of the early twenty-first century, the productions of contemporary artists were going at auctions for hundreds of thousands of dollars. Once sold, art works were often quickly re-sold, within a few years again being available at auction, rather than remaining for decades in collections. This fact contributed to the quickly rising value of a particular work, and by extension, other works by the same artist. The phenomenon may not last, but now the traditional technical

and aesthetic values of art criticism for works sold at auction are obscured by commercial selling points.

Starting in the 1970s, Dean Keith Simonton has conducted an impressive research program examining eminent people in several fields such as music and science, usually by analyzing published historical and biographical data. For example, he measured the amount of space devoted to philosophers and composers in different reference works, and in another study, the amount of time devoted to works of various composers by the Boston Symphony Orchestra. In some cases, Simonton directly studied the products of eminent people; for example, he analyzed the melodic originality of composers by measuring the note-to-note transitional improbability (surprisingness) in their works.

Other researchers have also used measures of eminence, generally focused on people with outstanding occupational achievements. The sources for study have included obituaries of scientists from multiple fields, tabulations of the output of classical composers, published illustrations of Japanese print-makers, biographies of modern writers, and many more.

Self-reported creative activities and achievements

Several researchers have used lists of achievements in science, art, literature, and music to assess creativity. Building on earlier work from the 1960s using such criteria, Dennis Hocevar developed a checklist of creative activities and accomplishments. A 90-item Creative Behavior Inventory resulted with six subscales: creativity in the fine arts, crafts, literature, music, performing arts, and math/science. Short forms of the CBI have since been developed. Typically, respondents indicate whether they have won awards in science fairs, have exhibited or performed works of art, have had poems, stories or articles published, have had roles or leads in plays, etc. The total creativity score is based on the number of activities checked or listed, or the reported frequency of each activity. Clearly, creative productivity is being measured, although there is often no indication of the extent to which respondents are being truthful in their self-reports. The CBI has been used in many subsequent studies; for example, Stephen Dollinger found that the CBI was moderately correlated (0.34) with judges' ratings of drawings using consensual assessment. The CBI has inspired the development of other self-report measures, such as the Creative Achievement Questionnaire created in 2005 by Shelley Carson and her colleagues.

Global Judgments of Products

Like the popular press and the contests and awards mentioned above, some researchers have felt that it is not necessary to define creativity in general, nor to define it in products. Often in the creative studies literature, rating creative products is a step intended ultimately to assist in the identification of creative persons, so the definition (or the criterion) is not as important as the identification itself. In the real world, global judgments of the creativity of one or more products are often made, either by a single judge (such as a movie critic) or by a panel of judges. This judgment may involve selecting children for programs for the gifted and talented, or to receive special awards. In some cases, such judgments are made by the assessment of a portfolio of work, but sometimes one single product is judged. For example, high school students who enter the

annual Westinghouse Science Talent Search are evaluated primarily on the basis of an original research paper.

A similar global evaluation is still often used in business to select new product ideas to develop for production. However, the growing influence of the *Product Development Management Association*, which certifies practitioners to assist companies to improve product portfolios, has led more organizations to apply business metrics, technical metrics and sometimes aesthetic metrics to concepts during the new product development process. Businesses are becoming more deliberate about rating their new product concepts, and more explicit in expressing criteria.

Global evaluations are also frequently used in the art field, by art critics or by those making judgments simply on the basis of cost. Some authors, such as Mark A. Runco, have compared global evaluations of creativity in children's art portfolios with judgments made using more specific criteria, such as originality, aesthetic appeal, and technical skill.

Perhaps the world's most influential program of research using global assessments of creativity in products is that of Teresa M. Amabile. In numerous studies, she and her fellow investigators have used expert judges to evaluate creative products using the CAT. Within given parameters, participants are asked to create something on the spot (such as a collage, story, or poem), which is then rated by experts for creativity. The CAT assumes that experts over the course of years have developed their own implicit criteria within their own domains by which they evaluate creative products. Amabile sees no advantage in specifying criteria to be used by the judges in making their evaluations. The inter-judge reliabilities of the creativity assessments have typically been high enough that even if the criteria have not been made explicit, the judges must have been exercising implicit criteria which their experience and discipline-related expertise had internalized, a practice often used in the art world to evaluate works of art.

One drawback to the CAT is that creativity scores can be compared only within a particular sample; no norms can be established for comparisons with products from other samples. However, for many research and educational uses, within-group comparisons are enough. A second issue is that in a few CAT studies, judges' ratings of creativity have been highly correlated (as high as 0.94) with their liking for the products. High correlations with likability suggest that global judgments of creativity may be clouded by preference; for this reason, it is sometimes recommended that aesthetic appeal or technical aspects should be rated as well. Judgments of products made using the CAT have been found to have good to excellent reliability and validity in numerous studies.

Specifying Criteria to Evaluate Creative Products

There is no question that indirect and global measures have advanced the field of creativity. In addition, some authors have examined the specific attributes of creativity in products. Only a few measures have been developed with general criteria applicable to products in many different content areas. More specific types of measures have been developed to assess creative products in specific domains such as art, engineering, chemistry, design, new product development, and education.

Criteria applicable to many domains

An early attempt to specify general criteria was made in 1975 by Irving A. Taylor. He described a scale of product attributes for creativity assessment. In the Creative Product Inventory, he suggested seven criteria for product evaluation: generation, reformulation, originality, relevancy, hedonics, complexity, and condensation.

The most thorough of the few attempts to develop a criteria-based measure that could apply to creative products in many domains was made by Susan Besemer and her colleagues. With Donald Treffinger, she completed an in-depth analysis of the literature of creativity and evaluation in many fields. Based upon a review of more than 90 sources in the creativity literature, and the literature of invention and patents, education, business, and the arts, approximately 125 criteria were identified, and drawn into the three-dimensional CPAM. This theoretical model led Besemer and her coauthor Karen O’Quin to develop the Creative Product Semantic Scale (CPSS). It contained 55 items organized into subscales meant to measure three major dimensions of creative products: Novelty, Resolution, and Style (Elaboration and Synthesis).

Besemer and O’Quin later completed many additional studies taking the broader approach recommended by MacKinnon. Their research focused on the products themselves to identify their characteristics. In 1998, Besemer revised and reorganized the subscales, and has continued to clarify the definitions of the factors and facets. **Table 1** presents the most recent version of Besemer’s three-dimensional model of creative product analysis, which has been refined and changed through many published and unpublished empirical studies using a wide variety of creative products. Several studies have also yielded support for the three-dimensional nature of the CPSS.

Novelty is universally agreed to be important, but some have been uncertain about whether facets of the Resolution dimension are indeed applicable across many domains; for example, it is sometimes said that artistic products are not useful. However, the history of art is full of examples of art which has been useful for religious, ritual, patriotic, or

propaganda purposes. One can also consider the psychological usefulness of art, both to the creator, and to the viewer who may be stimulated by the work of art in several ways, from simple enjoyment to more complex cognitive effort. Another problem associated with Resolution is the concept valuable; does it mean valuable monetarily or conceptually? In empirical testing, valuable has been highly reliable, indicating good agreement about the value of a stimulus product. The Style facets have been questioned because some people feel that such aspects of products are subjective, ambiguous, and difficult to agree upon. However, empirical testing has shown a high degree of reliability in these judgments as well.

Over the years, the CPSS has been extensively tested, both by its authors, and by others who had a need for a structured approach for considering product creativity. It has been used for the purpose of creative product analysis, or a careful consideration of the characteristics of products, typically to improve them. Scholars in such fields as computer-assisted design, textile design, business, education, engineering, and management information systems, have found the instrument useful in their studies. In addition, Global Fortune 500 companies have used the online version in their product development efforts.

Criteria specific to individual domains

Many judging instruments have been developed that are specific to different domains. In the education field, there have been several important efforts. One example is provided by the Student Product Assessment Form developed by Sally Reis and Joseph Renzulli. It contains 15 items which ask judges to rate both individual aspects of the product (such as appropriateness of resources, originality, and logic, sequence and transition) and to make global assessments of the overall excellence of the product. For the nine individual ratings, judges are provided with a summary statement and examples of high quality work to help them establish clear criteria for judgment. Reis and Renzulli’s studies, mostly with gifted children, have yielded good reliability and encouraging evidence for validity of their measure.

Table 1 Revised Creative Product Analysis Model (CPAM)

<i>Novelty</i>	<i>Resolution</i>	<i>Style</i>
The extent of newness in the product, in terms of the number and extent of new processes, new techniques, new concepts included; in terms of the newness of the product both in and out of field	The degree to which the product fits or meets the needs of the problematic situation. How well the product works or functions to solve the problem for which it was created	The way that the product presents itself to the user, viewer, or listener. Its ‘personality’ includes esthetic aspects that can capture the attention of the user and cause an emotional reaction
Facets	Facets	Facets
Surprising: The product presents unexpected or unanticipated information to the user, listener, or viewer	Logical: The product or solution follows the acceptable and understood rules for the discipline	Organic: The product has a sense of wholeness or completeness about it. All the parts fit together in a harmonious or natural way
Original: The product is unusual or infrequently seen in a universe of products made by people with similar experience and training	Useful: The product has clear, practical applications	Well-crafted: The product has been worked and reworked with care to develop it to its highest possible level for this point in time
	Valuable: The product is judged worthy because it fills a financial, physical, social, or psychological need	Elegant: The product shows a solution that is expressed in a refined, concise, and understated way
	Understandable: The product is presented in a communicative, self-disclosing way, which is ‘user-friendly.’	

In the art field, researchers have attempted to specify criteria for evaluating art works. An early example was provided by J. W. Getzels and Mihaly Csikszentmihalyi, who asked fine art students to complete a still-life drawing. Groups of judges (artists and art teachers) evaluated the drawings using three criteria: overall aesthetic value, originality, and craftsmanship or technical skill. More recently, Paul Silvia and his colleagues have also used explicit criteria to assess drawings. In the world of design, Henri H. C. M Christiaans investigated how designers (experts) and lay judges evaluated art works and designed objects. He found that experts judged differently than novices, and, when judging intuitively, had lower interrater reliability.

Examples of product evaluation using specific criteria from the business world have proliferated in recent years. In 2008, the entire final issue of the *Journal of Advertising* was devoted to studies which centered on creativity in advertising, many of which cited the CPSS. As new research builds on the older, sometimes later adapters have chosen to use only one or two of the three dimensions, and have changed or eliminated some items, which may negatively affect both reliability and validity. In marketing, Subin Im and John Workman adopted a ten-item scale from the CPSS; they created a dimension called meaningfulness (a construct including relevance, usefulness, suitability, and appropriateness) that was a better predictor of success than was novelty. This finding is congruent with the results of other studies and the common wisdom that it is possible for a product to have too much newness.

Several studies have investigated creative products in the world of computer science. David Brown considered the usefulness of the CPSS in developing computing systems that may someday actually create products. Diana Horn and Gavriel Salvendy created a measure for consumer products based loosely on the CPSS as well; this measure was later modified for the specific purpose of assessing website creativity.

Conceptual Issues

Four important conceptual issues have played central roles in the theory and research on creativity in products. First, what are the defining characteristics used to evaluate creativity in products? Second, what effects might evaluation have on potentially creative performance? Third, to what extent are the criteria used to evaluate products different across domains (the many diverse settings in which creative products are found)? Fourth, what are the effects of culture upon evaluations of creativity? Each of these questions is more complex than it appears on the surface.

The Problem of Definition

Beginning as early as Guilford's work, and throughout the subsequent years, the critical issue of the definition of creativity has lingered. Sometimes called the 'criterion problem,' it encapsulates an essential operational definition for the field, because the research questions of empirical studies are based on issues of definitions. Jonathan Plucker and his colleagues have discussed this problem several times, in one instance finding that only 38% of a sample of journal articles on the topic of creativity (including those in the top two journals in

the field) included an explicit definition of the term creativity. Plucker emphasized that the definition of creativity must include a perceptible product as the necessary evidence from which creativity can be inferred.

Effects of Evaluation

The fact that the things people make are always subject to the judgment of others can have important effects on the creator. Evaluation can sometimes inhibit the maker's best efforts. For example, Feirong Yuan and Jing Zhou found that students who were expecting to be evaluated generated fewer novel ideas (the judges were given a definition of novelty). But, under the proper conditions, evaluation can encourage the maker if the focus is descriptive and allows the creator to adjust his product to better achieve his goals; Yuan and Zhou's study showed that idea appropriateness was enhanced when the participants expected to be evaluated.

Although it must be acknowledged that products will be judged, the manner in which they are judged can be very important to the future efforts of artists, inventors, and others who are bringing new works into being. Much too often, the products created are judged in a quick, superficial way, without the kind of objective analysis which could benefit their creators and the field at large. The lightning speed evaluation of the art auction is a prime example; if a work of art does not meet the sellers' reserve (the lowest price at which a work will be sold) it is removed from the auction. It may later be offered again, held, donated to a museum or otherwise removed from the market, but the initial removal can have a devastating effect on the artist's reputation – especially because the auction selling time of any particular work of art (even masterpieces) is mere minutes.

Hasty evaluation is not limited to the art world. It can affect creativity in schools and in business. In schools, the standard typically exists that a student's creation must be a bit different, but not too dissimilar, from others in the same category. Sometimes businesses get stuck in the same paradox. While looking for that critical creative spark, there is a substantial pressure to select new product ideas which are product line extensions rather than the riskier, but potentially more profitable, truly novel product ideas. Note the frequency of movie sequels! While most new products are actually refinements and improvements of existing products, it is worthwhile for companies to develop a product portfolio which includes a strategic mix of new product offerings ranging from the evolutionary to the revolutionary.

Although it may seem that the arts would be more accepting of shocking novelty, art is judged within the framework of criteria for technical expertise which reinforce the standards of the culture and the time. Thornton maintains that nowadays some artists reject the traditional values of technical craftsmanship and are more interested in conceptual art dissimilar from the work of even the recent past. However, novelty for its own sake is still rejected by the art establishment. The truly novel 'outsider art' of unschooled artists is often (but not always) ignored in the mainstream art world. As we have seen, whether we are talking about highly novel products by children, new commercial products, or even art products, there is a fine line between having an attractive new twist and being

so far out that the product is rejected by powerful judges: teachers, consumers, or critics.

Are Expert Judges Needed?

Another issue related to evaluation is the question of whether or not untrained judges can make informed and valuable judgments. Besemer and Treffinger stated that there was little expectation that untrained judges could adequately evaluate works in areas where they had little expertise. An interesting paradox is that in subsequent empirical studies using the CPSS (based on their work), it was discovered that when employing a standard judging instrument with explicit criteria, there was great reliability in the evaluations of creative products made by untrained judges.

Numerous other authors have addressed this question. Amabile and the many other researchers using the CAT have emphasized that expert raters are needed. However, it is possible that because the CAT depends on judges having developed implicit definitions of creativity in their own fields, its use will always demand expert judges. When the criteria for judging are made explicit (as with the CPSS) and/or judges are trained, the need to use expert raters may become less important.

A second factor related to whether expert judges are needed is the extent to which the domain requires specialized skills or knowledge. Only experts in particle physics would have the knowledge necessary to be able to judge the creative work of a particle physicist.

Additionally, it seems likely that the more 'cutting edge' a product is in a specific domain, the more likely an expert judge will be required. For consumer goods, lay judges (consumers themselves) are an important part of the testing cycle of the new product development process. Some authors have suggested that judgments are more likely to converge with regard to 'mainstream' products, but less likely to be similar regarding extremely innovative products in particular domains.

It is also possible that professionals, although capable of making a product, might be unreliable or inaccurate when judging it, perhaps because they rely on high-level, esoteric, or idiosyncratic standards. For example, Mark Runco and his colleagues found that professional artists were relatively insensitive to differences among artworks produced by nonprofessionals. Advertising researchers have confirmed that expert judges' ratings do not always concur with those of consumers at whom the advertising is aimed. It seems useful to use expert judges in preliminary in-house testing of commercial products, but to expand to testing with the intended audience as products move through the product development cycle. When experts are available the CAT has been shown to be fruitful. But when testing products in real life settings with consumers, more explicit criteria can be useful, such as those of the CPSS.

Different Domains

Another issue in the study of creativity in products is an often implicit assumption that the discoveries about product characteristics in one discipline are unique to that field. There are so many different fields of creative production, including the arts, sciences, business, and education, that practitioners in each of these fields assume that their worlds are unique and need

special ways of evaluation that are exclusively theirs. This assumption encourages the development of specialized judging instruments which may limit the ability to make comparisons across disciplines.

It is true that all areas where judgments about creativity are being made have their own unique, often technical, criteria or standards of quality. For example, the website of the *Center for Universal Design* must focus on very specific criteria needed to design or redesign products for individuals in wheelchairs or with other diverse abilities. The designers of thermal clothing for fishermen must consider technical criteria including sweat absorption, ease of movement, resistance to sun and salt, and soiling propensity. Clearly, at this level of specificity, there is little overlap among domains even in the business world, let alone in the broader realm of creative activity.

However, at a slightly higher level of abstraction, it is possible to deduce similar schemes for analyzing and discussing the products of differing disciplines. Making comparisons at this level would allow different types of products to be compared, facilitating the general development of more widely applicable standards of judgment. For example, the CPSS has been used successfully with products ranging from t-shirts to magazine advertisements, and from medical equipment to cell phones.

Effects of Culture and Society

As many have said, creativity is in the eye of the beholder, so creativity judgments are subjective. Therefore, these judgments will be affected by the society and the time period in which they occur. Among the cultural factors that may play a role are social institutions, creative ideologies, economic support for creators, patronage, marketing outlets for creative products, and societal values about appropriateness. Even for research scientists (whom we stereotypically think might be isolated from this kind of pressure), the laboratory social environment, including power, independence, and communication issues, can affect creative productivity. One of the best-known theorists discussing this topic is Mihaly Csikszentmihalyi, who has made a strong argument for considering the effects of society and culture upon creativity. Simonton is another noted author who has addressed sociocultural factors, especially in the recognition of eminent people, including composers, psychologists, inventors, political leaders, and scientists.

Some people have suggested that because standards of evaluation are not absolute, researchers may as well abandon any attempts to specify criteria for creative production. We disagree. Although the varying effects of societal and cultural standards make the task more difficult, the notion that evaluation of some sort takes place is universal. Cross-cultural studies can identify similarities and differences in product perceptions across nations.

Relationship to Inventions and Innovations

Our purpose is not to examine the extensive literature on invention and innovation because they are addressed in separate chapters within this encyclopedia. The innovation literature tends to be process oriented, and the invention literature tends to focus less on the product itself and more on the marketing issues which affect the success of the product. To illustrate the market focus of inventions, the website

of the *Edison Awards* lists the nomination criteria, which include marketplace innovation, marketplace success, market structure innovation, and societal impact. However, there is an important overlap in definition: the website of the *US Patent Office* defines an invention as being new and useful, both of which are important criteria in the creative product literature.

The website of the *Innovation Institute* describes how the National Science Foundation, through its Innovation Centers Experiment, supported the development of a commercial innovation evaluation system. Prospective inventors take their ideas to a center to be evaluated. Gerald Udell pointed out that it was necessary to provide training and close supervision for evaluators at the centers to develop the competence necessary to make informed judgments; untrained evaluators were almost uniformly positive in their judgments. Udell also stated that it was necessary to formalize the criteria used by trained evaluators because they had been making inconsistent and unrealistic decisions. The website mentions 45 criteria, some of which evaluated the product itself, but most dealt with practical marketing issues such as legality, safety, business risks, market acceptance, etc.

Looking to the Future

When considering creative persons and creative processes, it is clear that even extremely creative individuals vary on the creativity shown in any particular work. Some products may be more or less creative because the makers were working in a new or a well-learned domain, were more or less successful that day at expressing their creativity, or had more or fewer restrictions on their work at the time. Makers may have been feeling well or ill during the time that they worked on the product, or they may or may not have been affected by environmental factors such as heat, light, or air quality. Because of the variance in the creativity of any particular product, it seems risky to expect a single product, made only as a result of an unexpected assignment on a creativity test, to be representative of a maker's usual level of creativity.

Likewise, few would expect a creative person to be equally creative in all domains of his or her life. Some exercise their creativity mathematically, some artistically, and some in business. Creativity tests which pose a creative task are most valid for those whose creativity is manifested in the domain which is being tested. To be evaluated poorly in the creativity shown in a drawing task, does not mean that one's mathematical or culinary creativity has been adequately assessed.

Another caution exists because of what we know about the process of creativity. Creativity may involve divergent thinking and the development of many ideas before the completion of the task. Creativity tests which demand that the first and only product of the exercise is judged for its creativity do not benefit from this awareness. The instruction, "Do this task now, and Be Creative!" can be intimidating to people who prefer to take their time and adopt a more experimental approach. Again the work produced may not be representative of the maker's usual creativity. A portfolio approach to assessment of creativity, in which a person's best works are evaluated, seems much more promising.

These cautions suggest the need for returning to the old questions posed by MacKinnon, "What are creative products, and by what qualities are they identified?" There remains a strong need, both in research and in the real world, for reliable and valid guideposts for identifying creativity in products. A great deal of progress has been made in the past decade, but researchers must still be persuaded of the importance of product measures of creativity, whether indirect, global, or facet. Further work with product measures such as the CAT, the CBI and its successors, and the CPSS will help advance the field, because as MacKinnon said, the study of creative products is the basis upon which all research in creativity rests.

Finally, in order for the field to advance, we need to develop a common language and common definitions to facilitate communication across different domains. Seeing similar criteria in the creative products of scientists, artists, dancers, chefs, schoolchildren, and entrepreneurs will help us to know the true meaning of creativity.

See also: Consensual Assessment; Divergent Thinking; Eminence; The Four Ps of Creativity: Person, Product, Process, and Press; Systems Approach.

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The Creative Sector and Class of Society

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Glossary

Bobo Bourgeois bohemian.

Class conflict Dispute between classes founded on economic inequality and opposition of interests.

Creative destruction Constant process of old products and services being replaced by new ones.

Creativity index Measurement tool, constructed by Richard Florida, to rank cities in terms of their creativity.

Malevolent creativity Use of creative ideas to inflict death and suffering on other individuals such as, for example, in acts of terrorism.

Postindustrial society Notion that ideas have become more important, social and economically, than physical acts of production.

Introduction

This topic involves an irksome amount of nitpicking about the meaning of words. Even assuming that we know what society is and agree on it, there are persistent problems of defining the 'creative sector and class of society' thanks to the work of Richard Florida. Let us begin with the simple premise that creative means being involved in the production of ideas rather than the routine production of material goods. Avoiding, for the moment, the issue of whether the ideas produced are new, original, worthwhile, etc. The routine production of material goods depend on the production of ideas in many cases. No one would claim that the worker who puts the latest lifestyle changing gizmo in its sales box for despatch is being creative in the 'creative class' sense of the word. This worker is, of course, having their job and income created in some sense by the creative workers whose ideas lead to the development of and marketing of the gizmo.

Turning to the use of the concept of class, we identify this idea with Marx and subsequent sociological thinkers. In view of this, a distinction needs to be made between a class as merely a collection of similar entities and a class as something which has social and economic meaning as a category. The Marxian concept of class falls in the latter category. In Marxian terms, the concept of class was intimately linked to the notion of opposition between classes who had mutually contradictory interests. They were thus destined to be antagonistic to each other. In contrast, this is not the nature of class in the use of the term 'creative class' which becomes rather part of a 'win-win' world where the creative class is the source of benefits to all. This will be expanded on further below in the section on critiques of Florida. The broad implications of identifying a class are that it contains a group of occupations that have something in common in terms of work. Also, the members of the class are likely to share ideology and pursue common goals. Apart from sharing occupational interests and ideological interests, a class might also be distinguished by shared traits in the consumption of goods and leisure activities. Aspiring to the leisure/consumption traits of a different class is one way people can attempt to escape from their economic class.

If one believes in the creative class concept it is possible to argue that there has always been a creative class but its

importance has been massively increased by technological developments. That is, physical production of products decreases in importance whilst production of ideas increases in importance. Florida, in his *Atlantic Monthly* article of 2009, stated:

The economy is different now. It no longer revolves around simply making and moving things. Instead, it depends on generating and transporting ideas.

Within the debate inspired by Florida, there is a further profusion of terminology such as the 'culturepreneur' and the 'bobo' – bourgeois bohemian. David Brooks, described by Florida as "a conservative critic," aspires to attack Bobo society as something inherently hypocritical and vacuous due to its incoherent reconciliation of the opposing concepts of conformity and radicalism. That is a reconciliation of creative values and business values. He argued that Bohemian values 'rule' in America today and have been absorbed by the corporate establishment and used to sell goods. Bobos are start-up capitalists, or visionaries like Bill Gates and Jeff Bezos. According to Brooks, Bobos love oxymoronic concepts like 'sustainable development,' 'cooperative individualism,' or 'liberation management.'

The notion of a bobo enshrines the dual consumption and production aspects of class. The historical notion of a bohemian class is one of a distinct antimarket nature. The mythical Bohemia is where 'artistic with a capital A' types of creatives hang out and shun the mores and conventions of the working class, the capitalists, and so on. The traditional Bohemian class does not figure prominently in Marx or other economic sociologists. This is because it would have no significance other than as a form of parasite begging, stealing or borrowing from the other classes. In terms which were dismissed by Adam Smith in *The Wealth of Nations*, but later resuscitated by some economists in the 1970s and 1980s, they are 'unproductive labor.'

In developed welfare capitalism, there has been an unintentional use of the unemployment benefit system to fund creative (in the bohemian sense) class activity. A prime example arose in the United Kingdom (being a nation with an atypically generous benefit system) in the late 1970s with the 'punk rock' revolt against the embourgeoisement of the (supposedly)

alternative class activity of 'rock and roll' music. The leading participants had colorful names not primarily for the purposes of distinction but in order to facilitate the maintenance of their benefit payments by making detection of paid work (as an entertainer) more difficult. It could be argued that the creative class activity, thus funded, revolutionized many areas of the economy and society. It did this by displacing the monopoly power of entrenched capitalists and a creative class that had become stagnant in terms of recycling activities that were once new and original. As Brooks would have it, the would-be revolutionaries eventually become integrated and thus eventually arrive at being 'Bobos' – bourgeois bohemians. Thus it appears that business sector values ultimately dominate those of the creative sector.

The contemporary notion of the creative class is a logical consequence of the move to the idea of a "Post Industrial Society" as posited by the sociologist Daniel Bell in the 1970s. He saw a shift from manufacturing towards theoretical knowledge as the source of innovation and policy formation for society. Other exponents of the postindustrial thesis have drawn further conclusions such as the demise of the role of the working class as agents of social change (as had been posited by Marx) and/or the rejection of materialist profit-oriented culture by young people. The agents of change are the creative class who possess the theoretical knowledge which society needs. They are no longer the mere servants of the capitalist class, like industrial chemists and electronic engineers, but now include anyone who is capable of generating ideas which may bring about change.

That agents of change exist, and that they might be deemed to be creative, can be accepted as an idea without it necessarily implying that they form a conceptually meaningful class or sector. The idea that they do form a meaningful aggregate currently attracts debate primarily due to Richard Florida.

The Work of Richard Florida

As indicated, the current treatment of the creative class fits comfortably into the postindustrialism thesis of Daniel Bell and others. The prominence of the creative class idea at present is largely due to the promotional efforts of Richard Florida. A large part of Florida's impact is due to his promoting the idea that governments should actively seek to use expansion of the creative sector to spur economic growth. He has recently even taken (BBC Radio 4) to claiming that the British Government should talk to Elton John and the Rolling Stones about how to reinvigorate the economy. This is premised on the idea that these creative (thus 'not business') people produced massive wealth which tends to ignore the fact that business entrepreneurs (and mainly multinational corporations) generated their incomes by exploiting their potential as products and product deliverers.

Precursors

The role of cities

As with all gestalt shifts, the work of Florida did not arise from a vacuum. It is particularly linked to the role of the city in economic and social development. Florida himself continually

gives credit to the work of Jane Jacobs on the economy of cities. Looking at Jacobs work now, it is striking how little (practically no) mention is made of any kind of creative class. Even when speculating on the future growth of cities, at the end of the book, Jacobs does not draw on the work, which was by then appearing, from Chicago economists, on the role of human capital and knowledge in economic growth and development.

However, the analysis is firmly centered on the importance of classes in generating the growth of cities. The growth of cities is seen as the key feature of the growth of economies. Jacobs argued that manufacturing would decline in importance to be replaced by services. This is therefore another tributary in the postindustrial society literature. She discussed Marx and class conflict in Chapter 8, "Some Patterns of Future Development." She argued that class conflict has not arisen between workers and capitalists nor has it been characteristic of more industrialized and developed nations. Rather, class conflict will be found between emerging sectors of economic activity and those entrenched sectors which stand to lose their position. If this is to be more than just a conflict of interest and, instead, become a fully-fledged class conflict there would need to be shared ideology and some degree of collective action within those designated as being in a class. There would also have to be a degree of inertia or laxity on behalf of entrenched interests.

Looking at mass publishing, for example, this does not generally seem to be the case. Large-scale newspapers and magazines have embraced internet publishing and integrated it into their operations. It is thus difficult to see that there has been much class conflict within the sphere of news and general interest media. Likewise the class conflict in distribution media (music, films, computer games) has not been between 'old' and 'new' notwithstanding that new media is the locus of David Brooks' iconic Bobo figures. Rather conflict here has been centered on those seen as stealers of ideas usually represented as pirates. Conflict occupied only a small portion of Jacobs' work. It is fair to say that it has taken up relatively little place in Florida's work where the main conflict seems to be between himself and his critics.

In more recent times, there have been attempts to reposition the dialogue in urban development in terms of the shift from materials-based production to idea-driven production. For example, Joel Garreau, in his book *Edge City* based on interviews of well-paid white-collar workers, identified the phenomenon of the gentrification of districts that were on the (physical) edge of cities near busy roads and decaying industrial sites. The revival of these areas and the consequent property boom, due to incoming professionals, tended to make it difficult for the genuine bohemian old-style 'creative' to live there. This would thus seem to create some sort of class conflict, as those who made the neighborhood attractive in the first place find it hard to be able to afford to live in it. Although Garreau identified the 'funky neighborhood' as an important social development he did not go on to categorize his lawyer and business interviewees as members of a creative class.

The knowledge economy

Although it has not rapidly percolated through to intermediate economics textbooks, the developing importance of the role of ideas in production has been gathering pace as a subject in various areas of economics. As mentioned above, this began in

the 1960s with Chicago economists who positioned human capital at the center of the growth process. Economists also became interested in the importance of information thus resurrecting the old cliché that 'knowledge is power.' The development of interest in large corporations highlighted the association between large research and development expenditures and corporate growth. Research and development is the corporate enshrinement of creativity as research involves initiating either a new product or a new process (in the sense of new arrangements of existing methods) and development involves bringing it to the market. However, within the discipline of economics, the sector/class identity of research and development personnel has been somewhat shadowy. In some theoretical models, the group of people who supply research and development ideas were not identified as a specific sector of the economy at all. Rather, they were left as a floating set of individuals somewhat like the archetypal 'mad inventor' pursuing endless patents from his or her garden shed. Outside of mainstream economics, the rise of meritocratic groups of scientists and researchers was noted by industrial sociologists and maverick economists like J. K. Galbraith in his *New Industrial State*.

Florida

The impetus for Florida's work comes from the changing nature of cities which find themselves saddled with areas of degeneration due to the decline of the manufacturing culture. In a market society, there is no automatic balancing mechanism that harmonizes the class structure of a city or region. A city could end up, through unregulated market processes, with very few of the creative class residing in it. According to Florida, this would lead to its decline which could be reversed by injecting a creative class. A city could survive as a parasitic server of noncreative services (cleaning, waste disposal, filing) to a nearby city which is expanding due to its creative dynamism. In such a context, it may still nominally and legally be a city but conceptually will have declined to be a shadow or satellite of the 'host' city. In social and symbolic terms, it will not really be a city because it has no vitality. Logically, it would seem that this does not mean that it could not be economically successful as an exporter of goods and services even though it has little or no creative class. Such a city is still distinct from a suburb as a suburb is seen as a place of residence rather than a place of work.

Florida asserts that cities can be regenerated by expanding the creative class/sector. This is based on examination of 'empirical' evidence of various types including anecdotal inferences from descriptive statistics and most problematically inferences from regression equations. These equations are used to impute a figure to the impact which changes in the size of the creative class (proxied by the degree of presence of a gay population in the neighborhood) have on the economic development of a region.

Florida's Definition of the Creative Class

Marx defined class in terms of ownership of physical and financial assets. A creative class, by extension of this, could possibly be defined as ownership of ideas. Florida's definition is not strictly this kind of transference. The Bay Area figures

prominently in Florida's work such as his book *The Rise of the Creative Class*. San Francisco is the prototype for the kind of city Florida celebrates. It shows up with Austin and Seattle at the top of his 'Creativity Index.' Florida divides the Creative Class into a smaller subset – the 'Super-Creative Core' – which includes the fields of computers and math, architecture and engineering, the social sciences, education, arts, design, entertainment, sports, and media. This core group – which already represents a very generous definition of creativity – constitutes a little under 12% of the workforce. The widest definition covers 'creative professionals,' encompassing management, business and financial operations, law, health care, and high-end sales and management. This brings the creative class up to around a one-third of the United States labor force. This includes "fashion designers, musicians, film directors, artists, and – yes – psychiatrists."

Florida (2009) said:

The economy is different now. It no longer revolves around simply making and moving things. Instead, it depends on generating and transporting ideas. The places that thrive today are those with the highest velocity of ideas, the highest density of talented and creative people, the highest rate of metabolism.

Government Policy Inspired by the Creative Class Idea

There can be no doubt that the notion of a creative class figures prominently in the thinking of the major liberal democracies. In the United Kingdom, this showed itself in Labour Prime Minister, Tony Blair's promotion of the creative industries to the center of attention. This has been carried on by his successor Gordon Brown. For example, *Creative Britain: New Talents for the New Economy* published in 2008 has the following contents:

1. Giving all children a creative education.
2. Turning talent into jobs.
3. Supporting research.
4. Helping creative business grow and access finance.
5. Fostering and protecting intellectual property.
6. Supporting creative clusters.
7. Promoting Britain as the world's creative hub.
8. Keeping the strategy up to date.

This document consists almost totally of marketing-speak. Its overwhelming aim is to promote Britain's creative identity as part of the 'brand' of Britain which will ensure success in global competition. Curiously, Chapter 7 only identifies the areas of ceramics and textiles (the former of which has, ironically, lost one of its most prestigious firms to bankruptcy in the current recession), some media companies (EMI, BBC), and a bit of architecture. EMI is essentially a multinational firm sitting on a legacy of international property. It is difficult to see what is creatively 'brand Britain' in its portfolio. The legacy of the BBC represents the precise opposite of the spontaneous emergence of creative class output in a free market. That is, its collected works represent massive state subsidy from enforced payments by taxpayers.

Movements towards stronger copyright protection (explicitly dealt with in Chapter 5 in this document and found all over the rest of it) of unauthorized internet transfers/use of creative works is further evidence of government support for the

importance of creativity in the economy. Subsidy in the United Kingdom has come via NESTA which typifies the win-win tendency in seeking to finance creativity out of lottery money. The notion that the creative sector can drive economic activity has also been embraced by local governments who have generated an explosion of festival activity where the justification of the festivals has been that they are cultural and thus generate a magnetism effect.

Critiques of Florida

There have been a range of negative reactions to the idea of a creative class. Various questions have been asked. Are we dealing with genuinely meaningful changes in social structure or just changes in the words used to describe relatively unimportant changes or in fact no change at all? Are we entitled to say 'so what?' to the notion that growth and creative class magnitude go hand in hand? Does the notion of creative class help explain relevant phenomena in some way that could not be done by other ideas? Aside from the explanatory issue, there is the matter of policy relevance – does paying serious attention to such ideas enable us to better solve important problems?

It is convenient to divide the criticisms into four main areas.

Perversion of the Concept of Creativity

Is Florida really talking about creativity when he describes the creative class? This has been disputed particularly by people who like to think of themselves as being creative in the artistic sense and are feeling demeaned by the admission of psychiatrists, and the traditionally unbohemian class of businessmen, into their ranks. For example, an internet posting by Karrie Jacobs argued that the cities which are vaunted as high points of creativity are in fact anything but. She said:

One cool business district looks pretty much like the next, just the way one suburban mall looks pretty much like the next. And once you start thinking about creativity in terms of class, hipness as a monoculture seems like the inevitable outcome.

This harks back to the notion amongst creativity researchers that the key characteristics of creativity are novelty and the attendant element of originality. Something which is not novel and surprising to some extent might tautologically seem to be devoid of creativity. However, surprise cannot be maintained indefinitely as exposure to novel events and ideas progressively diminishes the element of surprise. Painting in the style of Picasso and playing guitar in the manner of Jimi Hendrix are, by now, yet more established brands woven into the fabric of capitalism.

It follows that attacking 'identikit' neighborhoods, where the creative class drink their designer coffees and plan their marketing strategies, may be a displaced 'category mistake' argument. It might be useful to enter into the comparison with MacDonalds Hamburgers at this point. Once upon a time, the opening of MacDonald's was a creative act by mere dint of the fact that no one had thought of it before. It was thus original not only as a business concept but as an idea in general. It is not impossible for individuals to be creative in a MacDonalds or a Starbucks. They could, for example, be

magnificently creative on a laptop they have brought with them. However, the ethos of such corporations is not conducive to user creativity as its aim is to rapidly throughput customers all taking identical products. From time to time it may innovate, in response to identified demand shifts, in its provision of products. The aim of this is to reestablish the fundamental core business concept, not be creative in the usual sense of the word. The Austrian economist, Joseph Schumpeter, in a sense, endorsed the notion that MacDonalds is part of the creative sector in his analysis of the 'gale of creative destruction' that is typical of the capitalist process. That is, he sees new entities which replace existing entities in their field as 'creatively destructive' because they are adding value by destroying the thing they replace. This may not entirely cohere with the notion of creativity espoused by creativity researchers.

The core definitional problem in the 'is this really creativity?' argument is that it would appear that the term creative is now being applied to *absolutely anyone who is some kind of problem-solver who does not work with materially tangible goods*. (In this definition, I am absencing plumbers, electricians, and computer repairers from the creative class.) Advertising geniuses solve the problem of selling people things they do not really need and psychiatrists (hopefully) solve deep-seated emotional crises. Hence they graduate into the creative sector. The prevalence of seeing creative as 'almost any' problem-solving is further encountered in the discussion on malevolent creativity.

If the argument that the term 'creative' has been wrongfully subverted is convincing, there needs to be some reconstruction of what being creative does 'really mean.' If it is not just problem-solving for the furtherance of the capitalist system then it would seem appeal has to be made to creativity as something which embodies higher social, spiritual, or humanitarian values. This is a notion of creativity which has tended to drop out of sight during the creative class debate which has been focused rather on the money-making potential of creativity. That is, modern creatives are not generally viewed as someone with a 'higher' vocational calling. Rather, they take on the mantle of entrepreneurs. This is particularly evident in the visual arts world where careers are built on shock and novelty rather than intrinsic value.

Source of Value Fallacy

One might claim that Florida's ideas are a resurrection of the 'source of value' fallacy enshrined in the pioneering economic work of the French Physiocrats of the eighteenth century. Histories of economic ideas present the French Physiocrats as somewhere on the cusp of prescientific economic thinking. Their major failing was the attribution of the cause of economic wealth to a single source, agriculture, from which all other activities were derivative. The esteem in which Adam Smith's 1776 Wealth of Nations is held is, in some part, due to his overturning the attempt to establish single factors as 'causes of value.' Single factor value theories would have a renaissance in the works of Ricardo and Marx where attempts were made to ascribe all value in goods to their labor content.

Florida would not be so ridiculous as to try to claim that *only* the creative class generates value. Nevertheless, there would be little point to the song and dance he makes about its importance, if it was not to be concluded that it is the

primary determinant of value. This is backed up by some of the quotes given above. The major critique of all uncausal explanations is that they overlook the importance of co-operation and synergy. The creative sector is only able to be important when it is properly accompanied by the relevant factors of production from other sectors. It therefore becomes problematic to attempt to separate the productive contribution of different sectors using aggregate statistical analysis on data which was not designed to test any such hypotheses. In the terms used by economists, we face the problem of separating the marginal product of the creative class from that of the labor or capital classes.

Shortage of Convincing Empirical Evidence

Ideas which gain popular currency can have a variety of relationships to empirical evidence. They may not rely on any support from it whatsoever. They may be thoroughly and rigorously supported by it. Or, they may have some tangential and ephemeral support which acquires mythical and rhetorical status amongst supporters. Critics of Florida would assert that the last situation is the most apt description. Florida's empirical evidence is of two types: broad casual assertion and causal analysis of relationships. The former is shown in his construction of indices of creativity and the latter in his attempt to link measures of the bohemian nature of an area to its economic success. The use of data on the 'gayness' of an area has been something of a red herring in this matter. Florida has claimed that some attacks on him have been due to people thinking he is gay (which he is not) or homophobia in general. This can not be said of the strong critique by economist Daniel Glaeser which is based on the traditional statistical philosophy of testing the robustness of the point estimates and confidence intervals, of any estimated relationship to modest changes in the parameters of the investigation. Glaeser concluded that Florida's estimates are not robust. Even if they were, there is still the perennial causation problem that prosperous areas may have attracted creative classes and not the other way round.

Total Absence of Any Kind of Class Analysis

Although the derivation of the idea of inevitable class conflict, from the existence of classes, is no longer taken seriously by most social scientists, the ideas of Marx and Weber are still important if the notion of a 'class' is to have any useful meaning. This requires both shared economic interests and shared social behavior. The latter may reinforce the former. Consumption interests, such as tastes in literature and music, may help the formation of a bourgeois bohemian, or other, type of ideology which helps sustain the dominance of the class in society.

As indicated previously, Jane Jacobs provided a fleeting and unconvincing analysis of class conflict and Florida has tended to follow this. Marxian class conflict was expected to end in bloody revolutions where the exploited eventually paid to the hegemony of the exploiter. This is only one possibility and one that seems unlikely in western democracies. Here, it could be argued, conflict is meliorated by the fact that the creative classes are seen as not being exploitative at all. In the terms used by modern American economists they are opportunistic 'rent seekers' who find ways of encouraging transfers of income that exceed their productive contribution in their direction.

One such bunch of 'creatives' is found in the advertising industry whose role is to intervene in the competitive process to redistribute profits between existing products. It also encourages the expansion of consumption beyond what the consumer wishes to spend. Florida could be seen as an ideologue who is essentially an apologist for capitalism, rather than a serious social analyst. In this vein, he can be compared to economists like McCloskey and Klammer who attributed one-quarter of US GDP to persuasion giving us a nice ballpark figure in a comparable zone to Florida's 30% of the economy in the creative sector' claim. They argued that persuasion (such as advertising) is a good thing which improves human well-being.

Wider Issues of a Creative Class or Sector

The prominence of writings about the creative class/sector has occurred at a time of unprecedented global expansion. This has now unfortunately come to a halt in the guise of the 'credit crunch.' As house values tumble, unemployment rises, and bankers sink into disgrace one is entitled to ask where the creative class fits into all this. Is it the cause of the problem or will it save the day? In general discussion, blame has been firmly placed on the shoulders of bankers as they were at the decision-making helm when the trouble occurred. However, in a deeper analysis of a holistic nature *we* might lay the blame on the underlying nature of capitalism. A parasitic creative class would be symptomatic of the exploitative nature of capitalism.

Florida's recent work stops short of the counter-claim that the creative sector will solve the current problems of the economy but notes that the creative sector is doing better, during the global recession, than other parts of the economy. Even if this is true, in a wider arena than the data he consults, it is not clear that it says anything very much. A class conflict analysis would suggest that this may merely reflect the exploitative hegemony of the creative class which makes them better able to protect themselves.

As will be clear by now, the popularity of the creative class idea carries with it upbeat notions of economic and social benefits. It would seem absurd that anyone would want to stifle creativity lest it lead to bad, dangerous or catastrophic ends. The obvious counter to this is that Hiroshima and the threat of the end of the world due to nuclear reaction are products of allowing human creativity full reign. Two things might be said against this. One is that the problems are not the fault of the creative sector per se but the fault of others, as being creative does not thereby render one a moral guardian of the universe. The second is that these problems are problems of the scientific sector, which might be seen as different from the creative sector, even though creativity, in the literal sense, is involved.

The *Creativity Research Journal* carried a special theme in its issue for April-June 2008, on the topic of 'Malevolent Creativity.' This was not concerned with the aforementioned dangerous scientific research issue but rather the creativity of those involved in acts of crime and terrorism. The paper by James and Drown looks for lessons from 9/11 and the transportation of hazardous materials by truckers. This article and the other commentaries in the *Creativity Research Journal* are

framed in the context of the normative assumptions of the traditional discussions of the creative class. That is, they are looking for useful policy conclusions in the shape of improving ways to prevent malevolent activity.

The key features in the analyses of malevolent activity are the same as those in the general analysis of creativity. Malevolent acts require problem solving and thus call on creativity in a broad sense. In this vein it has been argued that 9/11 was certainly a creative act along with other unsavory acts, including the strategic activities of terrorist organizations. For example, attention has been drawn to the IRA (Irish Republican Army) as being extremely creative in their ability to use readily everyday items as materials for reliable and effective bomb-making devices. There are many ways to blow up a building for example. Some will be more successful than others and some will be more ingenious. If the malevolent actor gets direct benefits from displaying ingenuity then they may prefer the more creative, but less efficient method, to a tactically superior one.

Not all creative acts that fall outside the normative framework endorsing benevolent creativity would necessarily be entirely malevolent. The most conspicuous examples of this occur in the areas of digital downloading. The landmark events in this have been the Napster and Pirate Bay trials. Ostensibly these cases have reflected the triumph of the creative class, supported by the state, over a parasitical class which attempts to live off their labor. That is, the kind of class conflict speculated upon by Jane Jacobs. However, we may note that industry insiders are now admitting that the handling of the Napster case was a mistake and that they should, at that time, have seen that the problems faced were a wake-up call to arrive at a new business model to deal with changing technical conditions. Coupled with this, it is reported that since the Pirate Bay defeat, the site has been sold for a large amount of money thus indicating the brand name value incorporated in the piratical creativity.

A couple of complexities need to be unravelled here. One is that the actions of the Pirate Bay in particular have been represented as nonmalevolent. Essentially they would then be a form of class antagonism against profit-skimming oligopolists.

Conclusion

In this article we have looked at the creative sector/class. This notion has been very much put on the map by the recent writings of Richard Florida. It thus resurrects concepts of classes and sectors in society which have been somewhat dormant in economic and social thinking for a while. The notion of a creative class has been seen to be used in some cases as a designation for a group of functionally similar individuals but has also been used to represent ideologically unified agents. This comes to the fore in Brooks' critique of 'Bobo' society and also when we come to look at the issue of malevolent creativity. The most distinctive feature of the creative class literature is that it seems to minimize the importance of

conflict and exploitation. These have been the hallmark of the original uses of the concept of class in social analysis. It remains an open question whether branding those who engage in creative activity as a class contributes anything useful to the understanding of relevant phenomena. Inevitably, debate must also rage as to who is to be included in the definition of a creative class which, under Florida's broadest definition has controversially expanded to include psychiatrists amongst others.

See also: The Dark Side of Creativity; Everyday Creativity.

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Creative Trajectories

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Glossary

Continuum of adaptive creative behaviors A continuum of seven levels that explains the connection between creativity in childhood and in the eminent.

Domain A body of organized knowledge, skills, and traits underlying a discipline, requiring specific preparation to reach high levels.

Expertise High levels of skills and knowledge developed through training and practice over long periods.

Networks of enterprise Productive endeavors in a variety of domains that connect and interact.

Pathway A course followed that has attributes of a social system having structures that constrain or enhance development.

Retrospective Working backwards from an endpoint; a research method that involves looking back at key change points, accomplishments, and connections in the past, typically used for studying creative trajectories.

Trajectory The general patterns of a life course associated with creative fruition as well as the specific itineraries taken by individuals.

Creative Trajectories

Although trajectories are an aspect of development, they describe the path or course taken over the life span and the end point of development (*final causes*: ends toward which development occurs that explain the organization and pattern of change), rather than focusing on specific changes over time, transitions, or stages on the journey (*formal causes*: underlying structures, rules, or forms that explain temporary stability of an organization). Individuals each have their own unique trajectory, although common patterns have been found across eminent creators. To understand creative trajectories requires studying a life retrospectively, considering both continuous and discontinuous processes and the unique person–environmental interactions that are mutually determining and reciprocal, according to Jane McLeod and Elbert Almazan. At the same time, understanding where early personality and intellectual patterns and educational opportunities may lead can help in considering the types of creative trajectories we wish to support in childhood.

Defining Trajectories

Trajectories are defined as a path of a moving object, a chosen or taken course, or, in Aaron Pallas' educational pathway terms, "well travelled sequences of transitions that are shaped by cultural and structural forces." Linda George noted that trajectories are long-term patterns of change and stability that are "unlikely to conform to simple monotonic linear, or even curvilinear forms." Pallas differentiated the terms trajectories and pathways, stating that educational trajectories are "an attribute of an individual whereas a pathway is an attribute of a social system." In this article trajectories are both the general patterns of a life course associated with creative fruition as well as the specific itineraries taken by individuals.

Socio-Economic Context for Creative Trajectories Development

According to Jean Piaget, although all young children are creative because they must invent the world, to reach higher creative levels typically requires supportive environments, with sufficient socioeconomic and familial possibilities. Pallas suggested that pathways can illuminate structures that support or inhibit this development through constraints, choices, or incentives. Opportunity structures, such as parents who value education or a social network that enhances job possibilities, as well as individual agency, the zeal to pursue a passion, can both lead to status attainment. He noted that while some young people by virtue of their socio-economic status have pathways that offer greater educational opportunities, which lead them toward higher educational levels and hence, greater creative possibilities, some individual trajectories may be influenced positively or negatively by the choices a person makes. However, Pallas stated that generally inequalities get passed along and forward, with the 'Matthew Effect' of keeping the rich, rich and the poor, poor. Thus, children who are fortunate enough to attend good schools, have supportive families, and positive role models are more likely to attain higher levels of creative development, in part because they believe they can. Victor Gecas stated that "self-efficacy concepts formed early become self-fulfilling prophecies" through early experiences, wherein individuals develop a sense of self-efficacy, motivation, and levels of aspiration.

Don Ambrose noted that individuals from low socio-economic classes, even though highly capable, often face insurmountable barriers in imagining or attaining their aspirations, while more affluent youngsters have greater opportunity. He called for schools and teachers to look for and support children of less privilege in order to optimize their development. However, there is no guarantee that bright children even from privileged backgrounds will attain their creative aspirations.

Confluences of Factors

To develop talents that reach high levels, Rena Subotnick and Paula Oleszewski-Kubilius described “intense involvement during childhood and adolescence,” as a forecaster of adult accomplishment and a hallmark of eminence. Ellen Winner, while acknowledging that there is limited room at the top of a field for greatness, suggested that eminent development may be better predicted by three dominant characteristics of gifted children: a rapid pace of development in a particular domain or domains, such as music or writing; enhanced ability for self-directed learning and intellectual independence; and the ‘the rage to master,’ an intense need to learn and understand that helps to sustain effort and practice needed to become great. Likewise, Mark Runco found that eminent creativity is not just based on innate talent, but on persistence, immersion in their domain, and family support.

Stephen Gorard, Gareth Rees, Ralph Fevre, and Trevor Welland described the set of confluences that bring individual choices together with opportunity determinants, such as time, place, age, gender, family background, and schooling. These choices are “affected by ‘horizons of action’, a view of what might be deemed appropriate for ‘someone like me’,” which can both enable and restrict. They also found in their retrospective life histories of over 1000 individuals that in addition to these opportunity determinants, the role of leisure interests and being an autodidact affected learning trajectories.

Age Curves: Typical Creative Trajectory Patterns

In his landmark study, Dean Keith Simonton statistically analyzed creative trajectories of a large number of creators in varied domains, finding predictable age curves for periods of high productivity and greatest contributions. These trajectories varied by discipline and onset time of the career, but most creators peaked in terms of greatest productivity and accomplishments about 20 years after starting their training (typically late 30s or early 40s). However, Simonton clarified that because the figures are averaged, “no creative person is forced to have his or her career follow the exact same course.” In a different study, he also noted that especially in some domains such as music, a swan song phenomenon is often observed, with late peaks. On the other hand, Laura Tahir and Howard Gruber suggested that such approaches oversimplify creative trajectories. They noted that “since every creative achievement is unique” and varies by task and individual over the lifespan, there is no average peak or age for best work. Rather, utilizing the evolving systems approach that considers knowledge, purpose, and affect in context across numerous cases, Tahir and Gruber stated that creative individuals have unique trajectories that differ from person to person, are marked by different peaks, different rates, and unique styles of collaboration. They suggested that creative work often continues into old age as a process of these productive evolving systems, with particular emphasis on collaboration and “the need to share the work with future generations” for immortality.

Educational Trajectories

Trajectories are typically studied retrospectively, looking at educational milestones and career transition points. Completing grade school, middle school, high school, and so forth are the milestones or transition points that lead toward creative career development. Studying trajectories of students with developmental disorders, infants, and other groups compared to those exhibiting typical development has been productive, especially when compared to chronological and mental age-matched control groups. One possibility might be to consider a similar analysis of trajectories of gifted and/or creative children. At issue is whether creative trajectories can be predicted from childhood. School-based transitions are probably less likely to predict eminent development than are personal qualities, domain capacities, interests, opportunities to work creatively, the willingness to put forth effort, and an amazing confluence of chance, historical, cultural, and other factors. Again, it is important to remember the uniqueness of each creator, a pre-tuned individual, in considering creative trajectories, the two major ones considered next.

Two Major Creative Trajectories: Poles on a Continuum

In the literature, creative lives are shown to follow two major trajectories, which can be considered as unfolding at opposite ends of a continuum. On one end are linear paths which involve the acquisition of expertise; on the opposite pole are networks of enterprises, varied domain involvements woven together. In my own work, I have shown that both acquisition of expertise in a field and development of networks of interest or enterprise outside one’s area of specialization appear to be essential requirements for high levels of creative accomplishment. These two poles are attractions that interact differently within the person and set in motion pulls on the creator. It would be problematic for a symphony composer with a more linear trajectory to not have an abundant array of interests and material to weave into the musical compositions. At the same time, in order to know what the problems and contradictions are at the periphery of a domain, the renaissance person must cultivate ample expertise in one or more areas. The two major poles on the continuum are described next.

Linear Trajectory

The linear trajectory is best described by Jonathan Baer, Benjamin Bloom, Sidney Pressey and the rich work on academic acceleration, such as studies by Mirica Gross, Karen Rogers, and Julian Stanley. Developmental psychologist David Feldman stated that great creativity can occur only when the individual has uniquely mastered a specific domain. For him, the creation of something new and unique in a field – the hallmark of creativity – occurs when a person has mastered that domain in such a distinctive way that he or she can make an original contribution to it. Such proficiency, according to K. Anders Ericsson and Andreas Lehman, necessitates an enduring commitment for accomplished performance. Robert Weisberg found it requires persistent practice from a young age designed

by coaches and teachers who prepare the young person with the objective of increasing the current level of achievement. He noted that to make mature contributions to a field typically entails at least ten years of vigorous learning of what is already known in a domain for competence and proficiency, requiring hours of focused, intense practice during those years to become an expert. In 2008, Malcolm Gladwell called this the “10,000 hour rule,” the time needed for extraordinary mastery.

A linear trajectory on the expertise-acquisition end of the continuum is typical of those persons who make contributions in mathematics, sports, chess-playing, musical performance, and more rarely, the fine arts. The young person becomes very accomplished at something, demonstrating extraordinary talent in a given field and occasionally mastering that domain to a level of adult expertise when quite young. Child prodigy studies have elucidated and provided insight into this type of trajectory (i.e., David Feldman, Martha Morelock).

Network Trajectory

Howard Gruber and colleagues offer a network view of creativity, the opposite end of the continuum. In his studies of Piaget and Darwin using his evolving systems approach, Gruber stated that creativity is the result of sustained work over long periods through the interactions of the systems of knowledge, affect and purpose in a network of enterprises (areas of productive endeavor and interest that relate to and influence each other).

It is the networks developed among and between these undertakings and supported through feelings and purpose that underpin the construction of originality and sustain the effort needed to bring processes or products to actualization in one-of-a-kind, pre-tuned individuals. Such network trajectories are consistent with individuals who may revolutionize a field or create new ones, in persons sometimes called geniuses or renaissance persons by the gate keepers in their field (although this does not always happen during the creator’s lifetime). Rather than following a single linear course, these network creators become productive and engrossed in several quite distinct areas of endeavor.

From a young age, Charles Darwin and Piaget both had multiple areas of involvement in which they did productive work. For example, Darwin was involved in such varied topics as coral reefs, animal and human emotions, earthworms, and geology, as well as theory building. Piaget studied certain mollusks and sedums and the notion of structure in a variety of disciplines such as mathematics and philosophy, as well as infant and child learning. Both men are examples of renaissance people who not only revolutionized their fields, but also the world in which we live. A question arises, however, as to whether such network creators spent intense, long years acquiring expertise in one domain, acquired expertise across several domains simultaneously, or developed the knowledge and skills needed for mature creative work somewhat differently.

Between the Poles

Between these two poles are creators who must assimilate knowledge and skills broadly in order to perceive the

characteristic properties and very essence of their domains of effort – individuals who make major contributions in the social sciences, philosophy, theoretical physics, writing, and other complex fields that are not set up and learned in a hierarchical or linear manner.

The poles are not completely exclusive. In fact, according to Robert and Michelle Root-Bernstein, cross-disciplinary approaches are important in the development of superior levels of creativity in any field. For example, in another study, Robert Root-Bernstein found that creative musicians often are polymaths who think across the disciplines, particularly mathematics and music, even though expertise in music is typically considered a more linear trajectory. Similarly, Simonton found that opera composers were more renowned if they employed versatility or cross training, composing in diverse modalities, such as Mozart, Debussy, and Tchaikovsky, in contrast to those who exhibited complex more focused expertise and only composed opera, such as Rossini or Puccini. The field of opera composing, he noted, involves integrating music with libretto, acting, costumes, and stage design, already requiring interdisciplinary thinking.

At the same time, network-type creators must be deeply knowledgeable about their domains. They must master one or more at the level of expertise required to know what is missing or what the problems are in order to do creative work. So linear creators benefit from cross training and network creators must develop expertise. In fact, Robert Sternberg suggested that just in the domain of creative leadership there may be as many as eight types of ‘propulsions’, which are similar in some ways to trajectories, in that individuals make decisions and orient activities in relation to their field, effecting changes in that field. But how these trajectories develop from infancy through eminence is little understood.

Development of Creative Trajectories

To understand how creative trajectories develop, creativity in early childhood as well as creativity across the lifespan needs to be considered. One perspective is based on ‘mini-c’, another on a continuum of adaptive, creative behaviors.

Mini-c, Pro-c, Little-c, Big-C Creativity

James Kaufman and Ronald Beghetto propose that all creativity begins at the ‘mini-c’ level, novel and personally meaningful creativity that is part of the learning process in interpreting events, actions, or experiences in all individuals. They noted that little has been done to recognize the importance of these early learning aspects or to consider the connection to Pro-c, the expertise-acquisition aspect and how individuals move from this level to ‘little-c’ creativity, wherein an individual has developed knowledge in a domain and may make a beautiful table, write a short story, or choreograph a school dance number. To go from little-c to ‘Big-C’ creativity depends on the subjective views of individuals functioning as leaders in the field, the gatekeepers of a domain who judge the product as a breakthrough or extraordinary and allow the creation to change the domain.

Continuum of Adaptive Creative Behaviors

From a different perspective, in *A Continuum of Adaptive Creative Behaviors*, I suggested that development of creativity spans seven discontinuous levels from earliest childhood through mature adulthood:

- Level 1: Universal Creativity (in all people from infancy; also when learning something totally new)
- Level 2: Rare Compared to Peers (the child or adult creates unusual perspectives, actions, products, questions)
- Level 3: Developing Talents (expertise acquisition of knowledge and skills)
- Level 4: Developing Heuristics (expertise acquisition of strategies and ways of doing things)
- Level 5: Producing Information (shift from adapting to a field to beginning to add information to it)
- Level 6: Creating by Extending a Field (linear trajectory)
- Level 7: Transforming or Revolutionizing a Field (network trajectory)

These distinctions are based on six variables: *adaptation* (initially the individual adapts to the world. Between Levels 4 and 5, the world begins to adapt to the individual); *purpose* (shifting from mastery, through extension, to transformation); *novelty* (new to the individual, then rare compared to age peers, finally new to the world); *value* (initially to the self, then others, then world); *speed* (rapid in early levels, very protracted at later levels); and *mental structures* (incomplete though transformational). It is in Levels 3 (Demonstrating Talents) and 4 (Developing Heuristics) that the individual works on acquiring domain mastery, probably more simultaneously. The two highest levels that typify highly creative adults, Level 6, Creating by Extending a Field and Level 7, Creating by Revolutionizing a Field, are themselves a continuum, representing the two polar trajectories just described. Level 6 is typical of creators who are more linear and acquire expertise in their own field, those who extend the domains in which they work. They often, however, connect interests and content outside their own domains to make creative contributions. Level 7, transformational or revolutionary creativity, is attained most often by creators who develop networks of enterprise and make connections among their own specialty and others. In addition, they must establish extensive proficiency in at least one domain.

Importance of Early Interests

My colleague, Judy Gelbrich, and I also pointed out that interests which begin in very early childhood are the seeds of creative development. Born of disequilibrium among and between systems of knowledge, affect and other internal systems in interaction with the external world, the child cultivates passionate interest quests around 'centers of action'. Patterns in these quests become apparent quite early with interests clustered around six themes. Similarly, Jonathan Feinstein associated interests from childhood and young adulthood with creative development, wherein passions and interests direct the creator's attention. In the developmental phase, individuals connect to and conceptualize these interests; in the exploration phase, they engage with receptiveness in these involvements and develop unique structures in interest areas;

and finally, they execute projects embedded in pursuits that lead to creative work and significant contributions. It is the interest passions, the 'fire in the crucible' that lead the child to vigorously pursue an area and to work toward mastery, perhaps connecting this passion to other areas of interest and to the potential for creative trajectory development.

Conclusion

It is not possible to predict which child will make major contributions in either the linear or network type of trajectory. As Jane McLeod and Elbert Almazan noted, the focus is on person-environmental interactions that are mutually determining and reciprocal, with discontinuities as the rule, not the exception. They suggested that focus should be on the "relationship between structure and agency and the nature of psychological and social structures, how they are perceived, and how they influence behavioral choices." At the same time, there are proclivities and characteristics in children that are more likely to suggest potential for high levels of creativity, given opportunity, chance factors, personal drive, and the right mix of people, history, and culture. But to recognize that there are different pathways, linear, network, and in-between, implies that tuning into the passions of childhood and providing supportive environments in and out of school, rather than channeling direction too soon, may yield greater possibilities for creativity at the highest levels.

See also: Adaptation, Adaptiveness, and Creativity; Creative Environments, Conditions, and Settings; Developmental Trends in Creative Abilities and Potentials; Domains of Creativity; Education and Creativity; Evolving Systems Approach; Expertise.

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Creativity Complex

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Glossary

Art bias The unjustified assumption that creativity is only manifested in art.

Complex Often used in clinical psychology and psychiatry to describe systems of interrelated characteristics that covary and are related to a particular psychopathology.

Disappearance of the problem Someone becomes so interested in solving a problem that it is transformed into an

enjoyable challenge and the person no longer views it as a problem.

Parsimony A guiding principle of modern science that emphasizes simplicity of explanation. All other things being equal, the simple explanation is best.

Syndrome A set of symptoms or indicators, often used to define or predict disorders or behavioral tendencies.

Introduction

Creativity has only been recognized as a fitting topic of scientific study for 30 or perhaps 40 years. There were several systematic investigations well before that – including Catherine Patrick's series of studies with various professions in the 1930s – but archival analyses of publications and citations on the topic of creativity show that empirical work was sparse until the 1960s. There were several reasons for this. One is that creativity was (and often still is) equated with art. That in turn ties it to aesthetics and values and topics that are so closely connected with subjective processes that most scientists assume they best belong in the nonempirical domain. The assumption that creativity is always tied to art is still quite common and has been called an *art bias*. It is especially problematic in education because it may lead teachers to assume that only students with clear artistic talents are creative.

A second reason creativity was excluded from the behavioral sciences for so long is that it has varied etiology and possible expression. It is influenced by personality, cognitive and extra-cognitive processes, settings and culture, development, mood, attitude, affect, and even *Zeitgeist*. It is also expressed in a variety of ways, including artistically, but also technologically and in innovation, entrepreneurship, invention, and diverse kinds of problem solving. No wonder creativity has been defined, almost from day 1, as a 'complex' or 'syndrome.'

This article reviews theories which explicitly define creativity as a complex. It also examines their assumptions and contrasts the definition of a complex with the opposite view, namely the *parsimonious theory of creativity*. Coverage is probably broader than may be suggested by the label *creativity complex*. That is because the creativity complex often goes by other names. *Creativity syndrome* was used in 1965 by Donald MacKinnon, a key figure in the early research done at the *Institute of Personality Assessment and Research* (see IPAR in volume 1 of the *Encyclopedia of Creativity*), and by Michael Mumford and Sigrid Gusgafson in their influential article from 1988 in the *Psychological Bulletin*. They also referred to *multivariate perspectives* on creativity. Then there is the idea of a *multilevel theory* of creativity. The last of these is an attempt to emphasize the fact that creativity is often influenced by the individual, the immediate setting, and

the general culture (be it organizational, geographical, or both). As we shall see when the advantages and disadvantages of the definition of creativity as complex are reviewed, the best label for the complex may be *multivariate*. That covers all of the different theories that explicitly describe the variety of influences and expressions of creativity, and it avoids unwanted connotations. More will be said about this below, after the facets of the complex are covered.

Defining Creativity

The research on creativity certainly does point to a large number of influences and correlates, some personal (e.g., affect, cognition, personality), some environmental (e.g., setting and resources), and some cultural (e.g., values) and interpersonal (e.g., encouragement and support). The idea of a complex also allows diversity of expression, which is quite important given the differences among domains of creative endeavor and among kinds and levels of creative performance. Creativity can be expressed by a child, using his or her imagination, for example, but it can also be used by world-class experts when solving highly technical or far-reaching social problems. In slightly different terms, creative talent is often apparent in the lives of eminent persons, but 'everyday creativity' also allows each of us to deal with the hassles and surprises of our existence. The point is that creativity is complex in two very different ways, one representing its etiology and the other its expression.

As a matter of fact the complexity of creativity is apparent even if the focus is on one particular creative event or product and not only when its diverse expressions are examined. That is because all creative things, be they inventions, innovations, works of art, scientific breakthroughs, or original solutions to everyday problems, share more than one attribute. There is one primary attribute, which is originality. All creative things are novel, unusual, unique, or in some fashion original. Originality is necessary but not sufficient for creativity. It is not sufficient for creativity because original things are sometimes not creative. Something may be original but useless or ineffective. This is where the third kind of complexity comes in (to go along with its complex etiology and expression): creative

things are, at a minimum, both original and effective. Further, each of these two attributes can be defined in more than one fashion! An original thing might be entirely unique, for example, or it might be merely highly unusual. Even more to the point, the effectiveness of creative things may be determined in numerous ways. In the case of creative solutions to problems, effectiveness is supported by the fact that the problem is solved. But not all creativity involves problem solving. In the arts the effectiveness of creative things is typically aesthetic rather than purely functional. Along the same lines, creative art may be produced to express oneself rather than to solve a problem. Admittedly artists sometimes have problems finding the best ways to express themselves. Conversely, someone may be so interested in solving a problem that it is transformed into an enjoyable challenge and the person no longer views it as a problem. This has been called *the disappearance of the problem*.

Some definitions of creativity include a social component. The assumption is that things or people are only creative if an audience attributes creativity to them. Although many domains do in fact rely on audiences and social judgment, there are serious problems with any definition that requires social attributions. This would, for example, exclude many everyday creative efforts, and these may constitute the largest of domain of creative efforts by far. A social requirement would also exclude children's creativity, at least if it assumes that creative things must be original when compared to social norms and standards. Children may be original, in play or imagination, but much of what they do is original only on a personal level and not if compared to what others have done.

The real problem with a social requirement in the definition of creativity is that it confuses creation with reaction. To include attributions would be a bit like saying that the talent of a public speaker depends on the hearing of his or her audience. For the scientific study of creativity, it is best to keep creation separate from reception and from possible attributions. For this reason the list of influences given below to exemplify creativity as a complex focuses on individual factors, such as cognitive talent or personality. It excludes social and cultural influences. These may actually influence creative efforts, especially if you consider that creative potentials are probably not developed unless they are valued by the culture and society in which they are expressed. Still, the focus here is on personal and intrapersonal influences and excludes social influences. In addition to being consistent with the notion of creativity as creation and not superfluous social reaction, this insures that the conclusions about the creativity complex offered below are, if anything, conservative. Creativity would be even more complex if social attributions were included. Quite a few social and cultural influences, including those experienced in the home, school, or work setting, are detailed elsewhere in this same volume.

Diverse Influences on and Expressions of Creativity

The view that creativity is a syndrome or complex is typically justified by the fact that there are diverse influences on its development and diverse forms of expression. Examples of these diverse influence and diverse forms of expression are

easy to find. Several different kinds of cognitive capacity and skill have, for example, been associated with creative thinking. Creative thinking may involve imagination and insightfulness, for example, as well as a tendency towards divergent thought. Divergent thinking in turn is usually operationalized in terms of several kinds of ideation, including fluency and originality. Creativity also seems to benefit from metacognitive processes, such as an intentional attempt to shift one's perspective or to put a problem aside to allow incubation.

Diverse cognitive influences on creative thought are also apparent in stage theories of the creative process. Wallas' four-stage model is the best known of these, though presented long ago (1926). It includes preparation, incubation, illumination, and verification. More recent renditions include an implementation stage, which makes sense if the emphasis is on innovation or practical applications of creative thinking. A two-tiered model of the creative process includes many of the same stages but views preparation as a kind of problem finding. It divides this into problem identification and problem definition, which of course adds complexity. There is also an ideation stage, which is divided into those same tendencies mentioned above (fluency, originality, flexibility), and evaluation, which may be divided into *valuation* and *evaluation* (the former being appreciative, the latter critical) and into inter- and intrapersonal judgments. The two-tier process model also recognizes the potential impact of knowledge and motivation, and as you might expect divides the former into procedural and declarative (or conceptual) knowledge, and the latter into intrinsic and extrinsic motives.

Various *cognitive styles* have been associated with creative thinking. There is, for example, empirical data on the role of assimilator innovator, adaptors, and explorer styles. Even the long-standing style theory that contrasts deliberate with impulsive tendencies has been associated with creative thinking.

Complexity is also suggested by the fact that creative thinking differs with the domain or subject matter. Creative thought can draw on verbal skills, but it may also rely on imagery, preverbal processes, and 'preinventive forms.' Because many of these differences in the mode of thought can be understood as domain differences, more will be said about them below, in the section on diverse expressions of creativity. At this point it should be clear that, even within the cognitive category of influences, there are numerous possibilities. The concept of a complex makes sense.

The same is true when considering the influence of personality on creative efforts. The most important personality traits for creativity seem to be openness, autonomy, wide interests, flexibility, and intrinsic motivation. The last of these suggests that there are motivational and therefore affective bases to creativity. Plenty of research indicates that mood influences the thinking tendencies that support or inhibit the likelihood of finding original insights.

Attitudes also play a role in creative efforts. Again, there are a number of different possibilities, including openness to divergence – which fits well with theories of divergent thinking – playfulness, and tolerance. There are also attitudes which most likely inhibit creative behavior, including tendencies towards *satisficing* or premature closure. Note here the idea that there are supports for creativity as well as probable

inhibitors. This same dichotomy applies to virtually all influences, be they cognitive, personality, attitudinal, or whatever. It may not literally double the complexity of creativity, but it certainly does dramatically increase the range of influences.

The diverse expressions of creativity, which also help explain why it is viewed as a complex, are very easy to summarize. Much of the early research on creativity – including that mentioned above and conducted at the *Institute for Personality Assessment and Research* – involved writers, architects, and other professional groups, and data supported the idea that creativity differ from group to group (and domain to domain). Howard Gardner's theory may be the most formalized delineation of domains. It includes verbal, mathematical, spatial, bodily-kinesthetic, intrapersonal, interpersonal, musical, and naturalistic domains. Gardner argued convincingly that these differ from one another in their biological, developmental, and cognitive bases. His is not a theory just of creativity but subsequent research has largely supported the same set of domains.

Subdomains are also described in the creativity literature, and they too imply that creative talents can be expressed in diverse ways. Even in an area such as language there are differences between poetry, drama, novels, lyrics, and oral communication, just to name a sample of what might be called subdomains. The various sciences also differ, especially if the hard sciences are contrasted with the social sciences. Then there are the different possible expressions of creativity at different ages, as implied by what was said above about children's creativity. Although there is a bit of discussion in the creativity research about the possibility that there is a commonality among domains and all possible expressions, that would not really eliminate the obvious fact that creativity takes many forms. At most, if a commonality is uncovered, it would mean that there are both similarities and differences among domains and the possible expressions of creativity. Thus, given its etiology (e.g., the influences mentioned above) and its varied expression, it is easy to see why it is so common to view creativity as a complex.

Parsimonious Creativity

The definition of creativity as a complex is consistent with much of the research on the topic and has a number of advantages. It applies very broadly, for example, as is apparent in the long list of influences and diverse domains of expression mentioned just above. Yet there are also disadvantages. One is suggested by the connection of 'complex' and 'syndrome' to psychopathology. These labels are in some ways applicable to creativity—they both imply that there is a set or system of relevant symptoms or indicators – but those labels frequently connote psychopathology. Given misconceptions of the association of creativity with psychopathology (e.g., creator as 'mad genius' or necessarily bipolar or suicidal), this is a potential disadvantage. That is why earlier I suggested that it may be best to view creativity as *multivariate* in its etiology and expression. That label also allows for a set of indicators but does not have the same connotations as *complex* or *syndrome*.

A second concern with the creativity complex is more significant. This reflects what is inherent in any complex: it is complicated. More to the point, it is not *parsimonious*.

Parsimony is an important part of all sciences. It requires simplicity of explanation. All other things being equal, the simple explanation is best. Is a parsimonious definition of creativity possible? To define creativity in this fashion, there must be something common to all creativity.

It may be difficult to see what is common to all creativity, given all of the various influences and diverse expressions (e.g., domains and differences at different ages). Perhaps a commonality can be found if one step is taken at a time, to narrow the field and remove each unnecessary part of the complex in a systematic fashion.

The first step towards parsimony is dictated by the scientific concern for *causality*. Without a doubt, at the heart of all scientific theories is an interest in uncovering actual explanations for events and actions. Good science does not merely describe; it also explains, and a good explanation must identify specific causal factors. This is why experimental research is so highly respected: it eliminates confounding factors and nuisance variables so causes can be unambiguously tied to effects. A parsimonious theory of creativity should focus on explanations rather than descriptions. It must identify causes.

Thus the first step towards simplifying the complex involves eliminating effects of creativity. These may be interesting, and socially or personally useful, but they are not causes and not really explanatory. A great deal of the creativity literature describes effects, and all of those findings can be ignored for a parsimonious theory. Effects are on the wrong side of the causal equation and thus do not advance the parsimonious theory of creativity. Certainly causes can sometimes be inferred from effects, but it may not be necessary to resort to such inferences.

As a matter of fact, many of things that make creativity seem complex are effects of creative behavior. As such they make themselves known only after creativity has occurred! Recall here that social definitions of creativity were dismissed above because they are reactive and not a part of the actual creation. Other effects and results include the products which are so often studied in creativity studies. They too can be put aside since they do not offer direct information about causality. Creative products are original and useful, and they may be highly desirable, but they do not explain creativity. They cannot be used to control the creative process, and any theory based on them is post hoc and much more descriptive than explanatory. It will also lack generality, given that many creative experiences do not lead to a lasting product.

A second but more difficult step towards parsimony involves putting aside all 'mere influences' on creativity. Influences can be dismissed because they offer no guarantees. They are not really determinants. Influences may have some impact, but that is not the same thing as causality. Mere influences are much weaker than actual causes, much less reliable, and insufficient as scientific explanations.

Think back on the influences reviewed above, when the theory of a creativity complex was being outlined. Consider each of these individually and ask, does all creativity depend on this influence? Does all creativity depend on, say, intrinsic motivation? It does not; there are many cases where extrinsic incentives are key. Is all creativity a result of a particular mood, or even dependent on a particular cognitive process? Far from it: for some tasks, one mood seems to be best, while for others,

another mood is conducive to creativity. Or it may be that the most supportive mood varies from stage to stage of the creative process. The same thing can be said about cognitive processes. In fact it can be said about all potential influences. They do not apply all of the time.

Creativity can be defined parsimoniously if it includes only what is always vital and necessary. All else is extraneous. This allows us to exclude even more than products, effects, and results of the creative process. The literature on influences probably constitutes the largest portion of creativity studies. And like the research on products, it is useful. It may suggest how to make creative work more likely, for some people, some tasks, some of the time. But a parsimonious definition of creativity includes only what is necessary, not just what is sometimes influential.

There really is very little that is vital and necessary for all creativity. In fact, the only things that are universal and necessary were mentioned above. They are (a) originality and (b) effectiveness. Granted, there is variation in the wording. Sometimes originality is labeled novelty, for example, and sometimes effectiveness is labeled adaptive, fit, or appropriateness. Whatever the label, originality and effectiveness are vital for all creativity. This is not all that constraining, either. Originality and effectiveness apply to all domains and all categories of research. Thus (a) creative products are original and useful; (b) creative persons have the capacity to be original and find or produce useful things; (c) creative places are those that support the production of original and useful things; and (d) the creative process is involved when a person produces something that is original and useful.

The objective of a parsimonious theory is to keep things as simple as possible. That does not necessarily mean that everything is removed and excluded, one by one, until only one causal factor remains. Obviously the epitome of parsimony would be a theory which points to one causal factor that explains everything. But parsimony can be taken too far, in which case it loses its value. If too much is removed, just for the sake of simplicity, accuracy and understanding are lost and parsimony has done science a disservice. Even though the method used here, which excluded influences and factors which do not apply to all creativity, only reduced the list to two requirements, originality and effectiveness, that may be the best we can do. It may not be possible to distill theories any further, at least if we wish to accurately understand true creativity. But a two-factor theory of creativity is much more parsimonious than those relying on the idea of a creativity complex.

Conclusions

The idea of a creativity complex is in some ways useful. It suggests that original and effective behavior in diverse domains can all be considered under the general umbrella, 'creativity.' It offers breadth.

There are, however, several problems with the idea of complex. One is just semantic – the connotations of the labels complex or syndrome. The other is much more significant. It implies that studies of creativity are still not entirely scientific. After all, the sciences focus on causality and value parsimony, and the creativity complex is nearly the opposite of parsimony and includes many things that offer little or no causal information.

The scientific requirement of parsimony is usually taken to mean that, when there are various explanations for some phenomenon, the simplest one is best. That in turn supports the parsimonious theory of creativity that only includes originality and effectiveness. Parsimony requires that everything that which is not vital is excluded. This really just means that the creativity complex can be simplified if the focus is on that which is involved in all creativity, not just some creative things.

The idea of a complex is untenable according to the primary goals of science, which are prediction and control. These two things, prediction and control, were used by B. F. Skinner as standards of rigorous science. Think of the benefits if creativity could be accurately predicted and controlled. Those make the parsimonious approach to creativity all that more attractive.

See also: Attitudes and Creativity; Developmental Trends in Creative Abilities and Potentials; Divergent Thinking; Organizational Development; Personal Creativity; Tactics and Strategies for Creativity; Zeitgeist.

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Creativity in Science

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Glossary

Analogy Involves seeing how something new (target) is like something old (source).

Metaphor An 'as if' comparison, thinking about *X* as if it were *Y*.

Psychology of science The scientific study of both implicit and explicit scientific thought and behavior.

Scientific creativity Any thought or behavior in science that is both novel and useful; with creative thought or behavior in science being manifested throughout the scientific process, from theory construction and hypothesis formation, research and study design, to publication and communication of results.

Creativity in Science

When many people are asked about creative activities, they inevitably conjure up artistic creations: poems, novels, photographs, plays, sculptures, songs, etc. And if asked if they are creative they often say no precisely because they are not involved in such activities. Yet creativity is hardly the sole province of art. Creative thought and behavior happen in any and all domains of life, from cooking, building, and surviving to science. Indeed, science ranks up there with art as an occupation that would not exist if it were not for creative ideas and creative solutions to problems.

Although science requires as much creativity as art, its form and expression are somewhat different. Whereas artistic creations may involve often personal visions and emotional reactions to one's world, scientific creations involve ways to test our ideas about how the world works – and the world is not just the physical world, but rather the biological and social worlds as well. Creative insight is a must in science.

How is creativity in science manifested? The simple answer is nearly every aspect of science – from grand theory building to minute technical solutions to lab problems – involves creative thought. After all, as many other writers in this *Encyclopedia* have pointed out, creative thought and behavior must be both novel/original and useful/adaptive. Therefore, 'scientific creativity' is simply any thought or behavior in science that is both novel and useful; with creative thought or behavior in science being manifested throughout the scientific process, from theory construction and hypothesis formation, research and study design, to publication and communication of results. New and important discoveries in science come about often because of creative ideas and hunches of the scientists behind them. Of the thousands of new scientific articles being published world-wide each month, the vast majority of them are published precisely because they report some original finding, technique, or discovery. Creativity in science is less and less manifested in the 'lone genius' and more and more in the scientific team or laboratory. Creativity in science occurs both at the individual and the group level. Either way, it is clear that science and creativity go hand in hand. What does the scientific literature have to say about the nature of scientific creativity?

The Science of Scientific Creativity

There is a newly established discipline that is well-situated to explore and uncover the nature of scientific creativity and that discipline is the psychology of science. The 'psychology of science' is the scientific study of both implicit and explicit scientific thought and behavior. As Feist argued in *The Psychology of Science and the Origins of the Scientific Mind*, psychology is the only study of science that examines scientific thought and behavior from an empirical and even experimental perspective. Hence, the psychology of science is well-situated to uncover the nature of scientific creativity. In 2006, the first organized society in the psychology of science formed, the 'International Society for the Psychology of Science and Technology' (ISPST). Psychologists of science systematically study scientific interest, thought and behavior, often with a particular interest in genius, talent, and creative thought in science. The psychology of science has empirically focused on at least four major elements of creativity in science: neural complexity, development of scientific talent and achievement, personality traits of highly creative scientists, and creative cognition in science.

Neural Complexity

One of the more exciting recent perspectives on creativity is the neuroscientific perspective. Each year, more and more is being uncovered about the neural foundations of creative thought, including scientific creativity. One general conclusion from this research is the brains of creative people are often marked by more complex and more highly interconnected neural circuits than those of less creative people. That is, highly creative people appear to have greater neural connectivity between all major associative regions of the brain. Such a finding would be consistent with one of their most consistent and robust abilities in the creativity literature, namely, that creative people generate many more ideas, and the ideas they generate are looser and more remote in their associations. They are more cognitively fluent. This may be so because of a brain that simply has more connections, making rich associations more likely. Idea generation is as much about making connections as anything. Indeed, the frontal lobes themselves may well be especially important in this overall greater neural connectivity

given the frontal lobes do more to connect various regions of the brain than any other lobe.

The neurological condition known as synesthesia appears to be related to creative associations. Synesthesia occurs when two or more of a person's sensory modalities (taste, smell, touch, seeing, and hearing) get mixed. For example, a synesthete may experience colors when perceiving numbers or smell words. More than a few of our most creative scientists, inventors have had synesthesia, including Richard Feynman, Daniel Tammet, and Nikola Tesla. One compelling theory for synesthesia put forth by Ramachandran and Hubbard is that it results from a cross-wiring or cross-activation of sensory neurons in various parts of the brain such that, for instance, brain regions involved in color perception get cross-activated with sensations of numbers. Some extraordinary mathematical ability results from synesthetic perception of number, as most clearly seen in the savant Daniel Tammet. Creativity and synesthesia share neural complexity in common.

Development of Scientific Talent

A recent documentary film, 'Whiz Kids,' documents the coming of age drama and scientific talent and drive of three high school Intel Science Talent Search applicants. The film portrays the intelligence, drive, emotion, and personality of students as they navigate the world of world-class – and competitive – science.

Indeed, another critical question examined by psychologists of science is a developmental question: Where does scientific creativity come from? Like all creative achievement, scientific talent has a life-span trajectory. Certain children, based on a combination of talent and training, are more likely to go into science than others, and even particular kinds of science than other kinds. But going from childhood interest to adult scientific achievement is a long and complex process. Many obstacles and life circumstance intervene and many potential scientists change career paths. Moreover, once a scientist, there is a wide range of creative ability and the focus in this chapter is on creative talent and achievement in science. What, then, are the psychological factors behind creative talent and achievement in science and how do these factors change across the lifespan? Taken as a whole, the literature on these questions does provide some pieces to the puzzle of scientific productivity.

Scientific creativity and talent across the lifespan

Historically, the first scientific work on the development of scientific talent and creativity develops was conducted by Francis Galton in the 1870s. Most relevant to the current chapter, Galton's book *English Men of Science* in 1874 pioneered work on birth-order and scientists and found that scientists were more likely to be first-born children than nonscientists.

The first systematic and longitudinal research program that shed light on the development of scientific talent was conducted by Lewis Terman, beginning in the 1920s. His study included children if they had tested IQs of 140 or higher. More than 1500 children qualified and participated, with the first sample being tested in 1921 (when most of the children were about ten years old). They were assessed once or twice a decade for the next 60 years. By following the cohorts over their entire adult lives, Terman and his colleagues were able to answer the

important question of what happens to our brightest children. Do they go on to very productive and creative careers? The answer is 'yes' to productive, but 'not really' to creative. Although the sample as a whole achieved higher than normal levels of education and career success, if one uses standard creativity criteria (impact, productivity, and honors and awards), the Terman group in general was surprisingly uncreative over the course of their careers. No major writers, artists, or scientists emerged from this 'genius' level IQ group. Indeed, two future scientists who were tested by Terman – William Shockley and Luis Alvarez – but did 'not make the cut' went on to outperform any of the Terman subjects by receiving Nobel prizes in physics.

The next major longitudinal investigation that focused even more closely on scientific talent development was begun by Julian Stanley at Johns Hopkins in the 1970s and has continued under the leadership of Stanley's students Camilla Benbow and David Lubinski, now at Vanderbilt University. The project is known as the Study of Mathematically Precocious Youth (SMPY) and it targets children under the age of 13 who show precocious signs of mathematical talent. Results from these studies have reported that precocious ability does predict achievement in high school and in college. More recently, Benbow and colleagues reported that approximately 90% of the SMPY sample go on to earn bachelor's degrees, slightly less than 40% get master's degrees, and about 25% receive doctorates. These figures are well above the base-rates for such degrees in the general population (with 23%, 7%, and 1% being the national figures, respectively). Similarly, Lubinski and colleagues reported in 2006 that talent-search SMYP participants who scored 700 or above on either one of the SAT subscales (quantitative or verbal) before age 13 went on to have very successful careers 20 years later, especially in math, science, or engineering. For example, nearly half of them were postsecondary teachers, scientists, or engineers. More specifically, about 15% of the talent-search females and about 9% of the talent-search males were in tenure track or tenured positions by age 33 – rates much higher than the general population.

Most directly relevant to scientific creativity and talent, Rena Subotnik and her colleagues were the first psychologists to systematically examine the longitudinal paths of scientifically talented young people. She focused on finalists and semifinalists for the country's most prestigious and elite science talent search competition, the so-called Westinghouse competition (now known as the Intel competition). It involves more than 1500 high school juniors and seniors every year, of which the top 300 are semifinalists and the top 40 are finalists. Subotnik followed up one cohort of semifinalists from 1983 and were able to collect data on approximately 100 of the 300 finalists/semifinalists. Eight years after being semi-finalists and finalists, 49 of the 60 males (82%) but only 25 of the 38 females (66%) were still in science or science related fields (including graduate school). Moreover, as Joseph Berger has reported on the entire sample of Westinghouse finalists, they do garner awards and recognition for their continued excellence for scholastic and career achievements. For instance, in the entire population of finalists up through 1994 five have gone on to earn Nobel prizes, 28 have become members of the National Academy of Sciences, and at least eight MacArthur Fellows have been awarded.

A few researchers have addressed the question of who is likely to make significant contributions to science and if so did they show early signs of their talent. Feist, for instance, examined the development of scientific interest in Westinghouse finalists and members of the NAS. For Westinghouse finalists, both men and women knew science was for them at an equally young age – by age 12. Members of the National Academy also developed an interest in science at a very early age, with 25% knowing they wanted to be a scientist by age 14, 50% knowing by age 18, and 75% knowing by age 20. In terms of first realizing they had talent for science, 25% of the NAS members realized their talent by age 13, 50% by age 16, and 75% by age 21. The range was ages 5–33. Finally, NAS members began doing science early, with 75% having participated in formal research by age 21, and no gender difference between men and women. Half of the NAS members had published a scientific article by age 23, and at least one member had published by age 16. Those who go on to have real talent in science as adults seem to realize at a young age that they want to become a scientist. Given that most college students change their major many times during their four years as an undergraduate, to have a group know by the end of high school or before that a particular career is right for them is quite remarkable. Early and clear insight into one's career calling is often an indicator that one knows where one's talents lies, and indeed such 'crystallizing experiences,' as Howard Gardner has called them, are frequently seen in adolescents who go on to be our most creative adults.

Age and scientific productivity

The oldest and most established question concerning the development of scientific productivity is of growth curves and publication rates, that is, how productivity (i.e., publication rates) changes with age. As Dean Keith Simonton has often reported in his reviews of the literature, the findings have converged on the conclusion that the relationship between age and productivity in science (and other professions) is curvilinear: scientific productivity increases steadily over the first 20 years of a scientist's career, plateaus, and then gradually declines. In other words, it forms an inverted-U.

Similarly, in a study of National Academy of Science (NAS) members Feist reported three unconditional growth curve models that were constructed to test Simonton's curvilinear model of age and productivity, namely a linear model, a quadratic model, and a cubic model. Each model provided a close fit to the data, suggesting that publication rates increase over time. Out of the three models, however, the curvilinear model provided a better fit than the linear model, and the cubic model a better fit than the curvilinear model. In other words, a model with two peaks (approximately 20 years into one's career and then again at the very end) was the best model of age and productivity.

Related to age and productivity there is the question of whether early recognition of talent and producing works early in life predicts later levels of productivity. The empirical consensus is that early levels of high productivity do regularly predict continued levels of high productivity across one's lifetime. Those who are prolific early in their careers tend to continue to be productive for the longest periods of time.

Lastly, there is also the question of whether the age at which one's talent for science is first expressed predicts lifetime

achievement in science. Regarding age of recognized talent, Feist predicted that in a sample of NAS members, age of talent should predict age of publishing and obtaining the Ph.D., which in turn should predict productivity and impact. Results showed that the four precocity variables were modestly positively correlated with age of first publication, which is an intermediate variable between precocity and achievement. In other words, the younger NAS members were when they and others recognized their scientific talent, when they wanted to be a scientist, and when they first conducted scientific research, the younger they were when they published their first paper. Age of first publication in turn predicted total publication rate over the lifetime, meaning the earlier one publishes the more productive one will be. This pattern of relationships – from precocity to age of first publication to lifetime productivity – implies an indirect connection between precocity and publication rate. The only precocity variable that predicted lifetime productivity was age that one first conducted formal research.

Creative Personality in Science

The development of scientific talent, achievement and productivity over the life course is one focus of psychologists of science who are interested in scientific creativity. Another focus is the unique personality characteristics of highly creative scientists.

One model of personality that explains the connection between personality traits and behavior, including scientific creativity, is the so-called functional model. The basic idea of this model is that traits function to lower behavioral thresholds. If a person has a particular trait, then corresponding behaviors are more likely (have lower thresholds) in given situations. A person with a friendly personality, for instance, is more likely to behave in a friendly and warm way than a person without such a trait. Applied to creative behavior, certain personality traits make creative thought and behavior more likely. What then are these personality traits, in particular as they relate to scientific creativity? A meta-analysis published in 1998 by Feist addressed the question of which traits make creativity and eminence in science more likely and what their magnitude of effect was (see Batey and Furnham for a recent qualitative review of the general creativity and personality literature). The traits can be arranged into three psychologically meaningful categories: cognitive, motivational, and social.

Cognitive traits

A consistent finding in the personality and creativity in science literature has been that creative and eminent scientists tend to be more open to experience and more flexible in thought than less creative and eminent scientists (see [Table 1](#)). Many of these findings stem from data on the flexibility (Fe) and tolerance (To) scales of the California Psychological Inventory. The Fe scale, for instance, taps into flexibility and adaptability of thought and behavior as well as the preference for change and novelty. The few studies that have reported either no effect or a negative effect of flexibility in scientific creativity have been with student samples. For instance, in 2003 Feist and Barron examined personality and creative achievement in a 44-year longitudinal study. More specifically, they found that personality variables (such as tolerance and psychological mindedness) explained up to 20% of the variance over and

Table 1 Personality traits that make scientific creativity more likely

Cognitive traits
Openness to experience
Tolerance
Flexibility
Motivational traits
Driven
Ambitious
Intrinsically motivated
Social traits
Dominance
Arrogance
Hostility
Introversion
Self-confidence

above potential and intellect. Specifically, two measures of personality – California Psychological Inventory scales of Tolerance (To) and Psychological Mindedness (Py) – resulted in the 20% increase in variance explained (20%) over and above potential and intellect. The more tolerant and psychologically minded the student was, the more likely he was to make creative achievements over his lifetime.

Motivational traits

The most eminent and creative scientists also tend to be more driven, ambitious, intrinsically motivated, and achievement oriented than their less eminent peers (see [Table 1](#)). In 1984 Busse and Mansfield, for example, studied the personality characteristics of 196 biologists, 201 chemists, and 171 physicists, and commitment to work (i.e., ‘need to concentrate intensively over long periods of time on one’s work’) was the strongest predictor of productivity (i.e., publication quantity) even when holding age and professional age constant. Similarly, Helmreich and colleagues studied a group of 196 academic psychologists and found that different components of achievement and drive had different relationships with objective measures of attainment (i.e., publications and citations). With a self-report measure, they assessed three different aspects of achievement: ‘mastery’ preferring challenging and difficult tasks; ‘work’ enjoying working hard; and ‘competitiveness’ liking interpersonal competition and bettering others. Helmreich and his colleagues found that mastery and work were positively related to both publication and citation totals, whereas competitiveness was positively related to publications but negatively related to citations. Being intrinsically motivated (mastery and work) appears to increase one’s productivity and positive evaluation by peers (citations), whereas wanting to be superior to peers leads to an increased productivity, and yet a lower positive evaluation by peers. The inference here is that being driven by the need for superiority may backfire in terms of having an impact on the field.

Social traits

In the highly competitive world of science, especially big science, where the most productive and influential continue to be rewarded with more and more of the resources, success is more likely for those who thrive in competitive environments, that is for the dominant, arrogant, hostile, and self-confident

(see [Table 1](#)). In a classic study in the 1950s, Van Zelst and Kerr collected personality self-descriptions on 514 technical and scientific personnel from a research foundation and a university. Holding age constant, they reported significant partial correlations between productivity and describing oneself as ‘argumentative,’ ‘assertive,’ and ‘self-confident.’ In one of the few studies to examine female scientists, Bachtold and Werner administered Cattell’s 16 Personality Factor to 146 women scientists and found that they were significantly different from women in general on nine of the 16 scales, including dominance (Factor E) and self-confidence (Factor O). Similarly, Feist in the 1990s reported a structural equation model of scientific eminence in which the path between observer-rated hostility and eminence was direct and the path between arrogant working style and eminence was indirect but significant.

The scientific elite also tend to be more aloof, asocial and introverted than their less creative peers. In a classic study from the 1950s concerning the creative person in science, Anne Roe found that creative scientists were more achievement oriented and less affiliative than less creative scientists. In another seminal study of the scientific personality, Bernice Eiduson found that scientists were independent, curious, sensitive, intelligent, emotionally invested in intellectual work, and relatively happy. Similarly, Jack Chambers reported that creative psychologists and chemists were markedly more dominant, ambitious, self-sufficient, and had more initiative compared to less creative peers. More recently, J. P. Rushton and his colleagues conducted factor analyses of the personality traits most strongly loading on the ‘research’ factor (in contrast to a ‘teaching’ factor) in two separate samples of academic psychologists. Among other results, they found that ‘independence’ tended to load on the research factor, whereas ‘extraversion’ tended to load on the teaching factor.

To summarize the distinguishing traits of creative scientists: they are generally more open and flexible, driven and ambitious, and although they tend to be relatively asocial, when they do interact with others, they tend to be somewhat prone to arrogance, self-confidence, and hostility.

Creative Cognition in Science

As Ryan Tweney once wrote: science, by its very nature, is a cognitive act. We could add that creativity, by its nature, is a cognitive act. Hence, creativity in science inevitably must involve unique and consistent cognitive processes and strategies. It does and psychologists of science have concluded that at least four cognitive processes are consistently involved in scientific creativity, namely analogy, metaphor, visualization, and fluency and flexibility of association.

Analogy

‘Analogy’ involves seeing how something new (target) is like something old (source). Our mind seems to do this automatically and intuitively almost any time we are confronted with a new idea or new experience. Analogy is one of the more ubiquitous ways the brain takes sensory experience and gives it meaning. In *The Way We Think*, the cognitive scientists Gilles Fauconnier and Mark Turner put it this way: ‘Analogy has traditionally been viewed as a powerful engine of discovery, for the scientist, the mathematician, the artist, and the child.’

There is a well-developed literature on the importance of analogy and metaphor in scientific problem solving and creativity. The consensual conclusion from this literature is that analogy is a crucial problem-solving heuristic that allows scientists to apply schemas, models, and mental maps from known to unknown domains in order to solve problems. The success and richness of the analogy depend on how deep the similarity is between old and new. Associations no doubt play a critical role in analogical thinking, with the similarity being touched off via an association. In science, these analogies also often serve as the foundation for hypotheses.

Let us look at one of the most powerful scientific analogies in the history of science: Darwin's tree branch analogy and evolution. Species that are more closely related are closer together on a common branch. This branching analogy is used in current taxonomic systems. The branching tree analogy also makes clear that evolution is not a linear progressive process with humans at the apex, as many evolutionists at the time had argued. Rather, evolution consists of many dead ends and extinct species and is simply a process of the birth, growth, and death of species, all going back to one common origin. This was a truly powerful and revolutionary insight: *all life* on the planet is related! Another foundational analogy used by Darwin was the comparison between natural selection and artificial selection seen in human breeding of plants and animals. Indeed, Darwin's first chapter to *Origins* begins with the well-known principles of 'Variation under Domestication,' which lays the foundation for using similar principles in nature in the next chapter, entitled 'Variation under Nature.'

Analysis of historical cases also consistently reports creative scientists often use analogies to solve problems. In their chapter in *Psychology of Science: Contributions to a Metascience*, Dedre Gentner and Michael Jeziorski compared the way two physical scientists (Robert Boyle and Sadi Carnot) used analogies to the way alchemists employed them. They concluded that following particular rules when using analogies (e.g., avoiding mixed analogies, understanding that analogy is not causation) was the key to distinguishing scientific from pseudoscientific reasoning. But Carnot and Boyle had different styles of analogical reasoning: the former relied on a single analogy, deriving principles from it, whereas the latter preferred to work with a whole family of analogies. Similarly, Nancy Nersessian observed that James Clerk Maxwell used analogies iteratively, that is, he constantly modified them to fit his growing understanding of the constraints of the target domain. Michael Gorman has demonstrated that Alexander Graham Bell deliberately 'followed the analogy of nature' and used the human ear as a mental model for his telephone; like Maxwell, he was able to modify this analogy as he learned more about his target domain.

Metaphor

Metaphor is similar to analogy in that they both involve applying similarity from an old source to a new target. In this sense many metaphors are analogies. The essence of 'metaphor' is an 'as if' comparison, thinking about *X* as if it were *Y*. By applying one phrase or idea to another different one that is not literally the same, we again make the unknown known.

As psycholinguists as George Lakoff, Mark Johnson, and Steven Pinker have made clear, metaphors are so ubiquitous

that we often do not even recognize the metaphorical nature of much of our thought. For instance, Pinker gives the following examples of the metaphorical use of *went*: 'the messenger went from Paris to Istanbul,' 'the inheritance went to Fred,' 'the light went from green to red,' and 'the meeting went from 3:00 to 4:00.' Only in the first phrase is 'went' used literally to mean moving from one place to the other. In each of the other instances, 'went' is used metaphorically. Our minds seem well equipped to make such connections and to transfer similarities as a way of understanding the new and unknown.

It is no surprise, therefore, that science is replete with metaphors. Indeed, most major scientific insights have involved some kind of analogical metaphor. Robin Dunbar has pointed out that metaphorical use of language is especially rampant in particle physics and evolutionary biology. Particle physicists refer to the different kinds of quarks as 'top,' 'down,' 'bottom,' 'up,' 'charmed,' and 'strange.' Such everyday common words could hardly be more literally removed from the abstract, unobserved, and probably unobservable quarks, and yet that is part of the joke or pun of the inventors of these terms. Mathematicians also commonly refer to equations as 'beautiful,' or 'well behaved.' Evolutionary biology is also littered with such metaphors: 'the selfish gene,' 'kamikaze sperm hypothesis,' or the 'red-queen hypothesis' (from Alice in Wonderland), just to name a few. I would also point out that computer science is perhaps even more prone to metaphor: 'user-friendly,' 'mouse,' 'crash,' 'boot-up,' 'file,' 'window,' and so on. As Dunbar goes on to argue, however, there is good reason for such widespread use of metaphor in these fields: they are far removed from everyday experience and we simply have no words to describe the phenomena. Therefore scientists have little choice but to either use metaphors or invent new technical terms. Sometimes scientists do the latter, but more often than not they choose the former, and the terms 'strike us' as 'warmer,' and 'friendlier' than technical jargon (note the metaphorical use of these words).

Metaphor and analogy are common in and out of science precisely because they are so useful to hypothesis and theory formation, thought experiments, creativity, and problem solving. They provide useful constraints to solutions to problems by focusing strategies and preventing random and fruitless searches for a solution. Scientists, and especially the best scientists, tend to use them more readily than novices and thereby go down fewer dead ends when trying to solve a problem. Of course, analogies and metaphors offer such cognitive advantage only if they are appropriate and useful. Often the more creative scientists have a feel for (i.e., an intuition for) a good and productive analogy or metaphor. When they are useful, they make problem solving much more efficient than it would be otherwise.

Visualization

Another cognitive strategy or heuristic often used in but not unique to scientific creativity is visual imagery. The historian of science Arthur I. Miller in his book *Insight of Genius* and elsewhere has written at great length about the important role of visualization and imagery in science. After detailing case after case in the history of physics, he summarized his main point about the role of visual imagery in creative scientific thinking: visual imagery plays an important role in scientific creativity

(e.g., Einstein's thought experiments) and in scientific advance, and it can carry truth value (e.g., Feynman diagrams).

Einstein is one of the more noteworthy examples of the importance of visual thinking. The gestalt psychologist Max Wertheimer spent hours and hours interviewing Einstein in 1916 about how his theory of relativity came about, and among other things, Einstein remarked that he rarely thought in words and used words only after the idea came to him so that it could be communicated to others. The physical world after all is made up of objects and the ability to think in images would be of great help in solving physical problems. Visual intuition, to be sure, was crucial for all of Einstein's great insights: imagining himself traveling at the speed of light, imagining himself simultaneously jumping off of a roof and dropping a stone (which led to his insight that gravity and acceleration are relative quantities), and imagining two observers riding on either the northern or southern pole of a magnet. Most of these visual thought experiments occurred in the 20-year period between 1895 and 1915, and by all accounts this was the period of Einstein's singular creative genius. In fact, other physicists such as Richard Feynman remarked on the lack of creativity in Einstein's later life being connected to his decline in his use of visual imagery.

Physics as a whole became less comprehensible when it moved beyond what we observe in everyday life and can easily visualize. Quantum mechanics is the prime example because it deals with matter at a fundamentally different level than the observable Newtonian world. From about 1925 (with the death of Bohr's 'atom as solar system' model) until 1949, quantum physics moved decidedly away from the use of visual images and toward purely mathematical formulations. In Niels Bohr's 1922 Nobel prize lecture, the limitations of his own model were already clear to him:

We are therefore obliged to be modest in our demands and content ourselves with concepts which are formal in the sense that they do not provide a visual picture of the sort one is accustomed to require.

In 1949, however, Richard Feynman was to change this by advancing his graphic 'Feynman diagrams' to explain how subatomic particles interact. As quoted in Gleick's biography *Genius*, Feynman described what he was doing with Feynman diagrams:

What I am really trying to do is bring birth to clarity, which is really a half-assedly thought-out pictorial semi-vision thing. I would see the jiggle-jiggle-jiggle or the wiggle of the path. Even now when I talk about the influence functional, I see the coupling and I take this turn – like as if there was a big bag of stuff – and try to collect it away and to push it. It's all visual. It's hard to explain.

Most recently, string theory has added concreteness to a concept that right now is orders of magnitude away from being observed, namely, 'strings.' Strings are an excellent example of both how visual images and metaphor are used in the construction of scientific theory.

Fluency and flexibility of associations

In addition to the cognitive processes already discussed (analogy, metaphor, and visualization), a number of cognitive traits cluster around creative ability: remote and loose associations,

overinclusive and disinhibited thinking (latent inhibition), fluency, flexibility, novelty and originality. Sarnoff Mednick's theory of remote associations underscores the associational richness of creative thinkers. J. P. Guilford built a theory of creativity around ideational fluency, flexibility, and originality, arguing that creative thinking results from having many ideas (fluency) that cross boundaries and categories (flexibility) and that are novel and original. Hans Eysenck proposed that the defining cognitive characteristic of highly creative individuals, besides at least a moderately high level of intelligence, is their overinclusive and disinhibited thinking. In other words, creative people automatically have a wider range of associations and have difficulty inhibiting associations and focusing on a narrow range of relevant stimuli. For this reason, they score high in what Eysenck called 'psychoticism.' Finally, Dean Keith Simonton, borrowing from Donald Campbell, put forth the chance configuration theory of creativity, which posits that ideational and associational fluency are the foundation for creative thought. In a very Darwinian fashion, ideas are first generated in great number (variation), get combined (chance permutation), and those permutations that are adaptive and useful get selected and reproduced (retention). Just as in biological natural selection, some ideas are adaptive solutions ('hits') and these get selected and retained, whereas others are not adaptive or useful ('misses') and these do not survive. Creative scientists, like all creative people, are able to produce a richer and deeper set of associations, many of which are not useful, but some of which are. These survive and become the foundation for creative ideas in science.

Conclusion

Science would not exist if it were not for the creative ideas of its participants. The psychology of science has empirically addressed and answered the questions of who becomes a creative scientist. The answers provide particular profiles of neural complexity, development, personality, and cognition. This article summarizes these literatures and provides an integrated profile of the creative scientist. For example, the creative scientist compared to the less creative scientist is called to the life of science at a younger age, remains highly productive, is more confident, asocial, flexible, and hostile, and solves problems more often using analogy, metaphor, and visual imagery.

See also: Discovery; Genius and Greatness.

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Relevant Websites

- <http://www.psychologyofscience.org> – Psychology of Science website.
- <http://whizkidsmovie.com/> – Whiz Kids - documentary film.

Creativity Through History

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Glossary

Behaviorism Behaviorism is a philosophy of psychology that focuses on human behavior. These observable behaviors can be described scientifically without any discussion of thinking, feeling, or the unconscious.

Correlation Correlation is a statistical relationship between two variables. For example, children usually grow taller as they grow older. We would say there is usually a positive correlation between children's height and age.

Labeling theory Labeling theory originated in sociology and criminology. It is concerned with how our identities and behaviors may be influenced by the terms other people use to describe us. It is associated with the concepts of self-fulfilling prophecy and stereotyping.

Pathology Pathology is the study of disease. In psychology, the term is used to refer to certain behaviors as abnormal and the people who engage in them as mentally ill.

Self-actualization Self-actualization is a term from several psychology theories. It is to realize all of one's potential – to be all that we can be.

Disciplines that Study Creativity

Creativity has been pondered on and written about throughout recorded history. In modern times, discussions of creativity are drawn from psychology and psychiatry in areas of experimental research, testing, and clinical practice; from education in counseling, curriculum development for and classroom management of gifted children; and from sociology and anthropology in areas of change, diffusion of innovation, and the role of the social environment. Additional areas include the teaching and practice of art, literature, music, engineering, business, and the sciences. More recently, the fields of artificial intelligence, neurobiology, and evolutionary biology have addressed the topic.

Education and psychology have many subdivisions in which creativity is addressed. Carl Rogers and Abraham Maslow devoted most of their lives to the study of self-actualization and psychological health. They saw self-actualization as a prerequisite for creativity in any form. Some authors concentrated on tests to measure the gift of creativity; facets of intelligence, creativity, and wisdom; or the characteristics of those who think divergently or are creative. Others look at gifted child and adult development, counseling the gifted on life issues or career problems, or how to educate and manage gifted children in the nation's classrooms. History, with a somewhat interdisciplinary perspective, may speak of progress, historical genius, the geographic distribution of inventiveness, scientific investigation, or paradigmatic shifts. The study of creativity is inherently interdisciplinary.

Along with the variety of disciplines has come a variety of terminologies. Each group has constructed its terminology to reflect the particular use and aspect of creativity applicable to them. Creativity appears to be a core concept that is then interpreted and redefined as a different aspect or application is emphasized by each discipline. Although some authors speak from an interdisciplinary perspective, borrow individual terms from each other, or share terms, each discipline has a tendency to focus on a specific aspect of creativity, and thus use their own particular words or phrases.

Those in the arts speak of imagination, inspiration, and the unconscious. Those in sociology speak of change, the diffusion of innovation, and resistance to innovation. Some authors discuss creativity and resistance to creativity as seen in American culture. Psychology and psychiatry both discuss the role of the unconscious. Psychology and sociology discuss conformity, deviance, and authoritarianism as factors that can inhibit one's willingness to be independent or creative and the role of labeling. They also discuss the tendency of people either to do things better (adapters) or to do things differently (innovators) and the characteristics of innovative organizations.

In short, the language of creativity is far ranging and methodologies stretch across academic disciplines. The study of creativity may be influenced by current events and reflect the scientific method in use at a particular time. However, the concerns have been remarkably constant. These questions are repeatedly addressed:

1. What is creativity?
2. What is the creative process?
3. What characteristics do creative people have?
4. Can creativity be increased?
5. Who should benefit from creativity?
6. Do we really want creativity?

Early Observations

The earliest writing on creativity is found in myths and personal observation, often about the arts. To be creative was to be divine. The Old Testament God, Odin of Norse mythology, Ormazd of Zoroastrianism, and Brahma from the Hindu trinity created because they had divine power. Among the ancient Greeks, creativity was inspired by the Muses who were the daughters of the god Zeus. The idea of creativity as a divine gift has not completely disappeared. Even today, when writers describe an episode of writer's block, they may say that their Muse has left them. Many creative people say that the ability to be creative just happens. They do not know where it comes from. It is a gift.

The Greeks limited creativity to the poets – everything else was using existing materials to make something. Greek writers addressed questions about the creative process. Plato, in the fourth century BCE, observed that necessity is the mother of invention. Epictetus (CE 60) addressed what later writers would call incubation and/or perseverance when he said that there must be time for great things to be created.

Research into creativity did not really begin until the nineteenth century. However, earlier reactions to change can tell us a little about early views of creativity and the on-going tension between change and the *status quo*. Humans have always been as likely to resist innovation, invention, and change as to embrace it. Mohammed's statement that every innovation is an error and every error leads to hell fire stands in dramatic contrast to the fact that the Middle East was a center of learning, famous for hundreds of years for its libraries and universities. Sometimes the stories of early resistance seem almost unbelievable – an English citizen was tried, condemned, and executed in 1306 for burning coal rather than wood. "The textile industry was the first battleground of machine technology against hand tools" (Stern, 1937, p. 55). The conflict started in the thirteenth and fourteenth centuries and continued until the Luddite riots into the nineteenth century. From the time of Philip the Fair (1268–1314) many innovations in transportation have been blocked.

Developments in communication were also blocked. Governor Berkeley of Virginia expressed a widely held opinion in 1670 when he thanked God Virginia had no free schools or printing presses. He believed learning brought disobedience and heresy. Printing made that information available to all and threatened the existing government.

Nineteenth Century Creativity

Before the twentieth century, creativity was usually addressed within discussions of genius, a term which may have originally meant possession by genii, which is reminiscent of the Greek Muses. More formal writing about creativity during the nineteenth century was characterized by a broad, generalist perspective, usually with little experimental basis for its conclusions. Early work was conducted in the study of philosophy, intuition, mysticism, literary criticism, art, invention, and genius.

The authors tended to be generalists, and their work reflected that fact. For example, George Washington Bethune was an American clergyman, poet, musician, orator, and gentleman scholar. In his address to the Literary Societies of Union College in 1837, Bethune defined what he meant by genius, discussed how to increase it, refuted common errors concerning genius, and then concluded with the role of democracy in creativity.

Although few authors presented a formal definition of creativity, such definitions can still be found. These definitions often blur the distinction between intellectual genius and creative genius. Some are based on criteria of newness and importance. Authors also addressed such issues as types of creativity, intellectual components, and the creative process. They presented concepts that are still a major part of

the literature: new combinations, divergence, background knowledge, building on previous work, incubation, illumination or inspiration, and the evaluation of results.

These authors wrote during the nineteenth century ferment of the colonial British Empire, Darwinism, and the development of new scholastic disciplines. It was a time when the scientific method of investigation was still developing. Thus, the authors tended to draw from what today would be considered a combination of disciplines and questionable methodology. Many of their conclusions were based on personal observation. Some conclusions were presented with little information as to the data that prompted them. In addition, there are problems in tracing the sources of these early writers. Because they did not always include footnotes and tended to refer to another's work by last name only, it is sometimes difficult to find their sources or to be assured that the source located is indeed the correct one.

Often these earlier discussions explored the questions and issues in depth. Much of the discussion centered on presenting, defining, and analyzing the questions given above. There was a philosophical wisdom to this early work that disappeared by the middle of the twentieth century, to be replaced by an emphasis on quantitative analysis. While there was a richness to this earlier work, present day scholars would probably say that rigorous methodology was missing from these discussions.

Discussions of who had creativity usually centered on whether creativity was an inherited ability, or whether everyone could be creative. There was a tendency to stress the role of heredity, rather than the environment.

Determining the characteristics of creative people seems to have involved two issues. Were they so different that they were to be considered deviant, and perhaps even pathological? What intellectual characteristics were necessary for creativity?

Discussions of increasing creativity usually centered on individuals or groups. Individuals could increase creativity by developing work habits and thinking styles that would foster it. Group creativity was less clear. Some saw a strong connection between the promotion of individualism or democracy and the creativity of a culture. Others argued over whether times of great creativity were caused by geniuses, or whether the spirit of the times allowed the geniuses to flourish. There was also a strong connection between creative genius and democracy.

During the nineteenth century, there was some explicit discussion of the benefits of creativity. Bethune stressed that the end product of creativity be useful. Genius was a gift from God that should be used in His honor and for the good of all. Those gifted with this God-like power of creation were not to waste it on personal enjoyment or fame.

One might expect that creativity would be embraced during this century of explosive national and industrial development. However, that did not always happen. Sometimes resistance seems almost irrational in the light of twenty-first century technology – the bathtub was rejected in the 1840s because it would corrupt our democratic simplicity. Inventors who worked to develop steam engines and submarines were ridiculed, scorned, and considered insane. Railroads were attacked because money would be needed to build insane asylums when people were driven mad with terror at seeing the

locomotives move without horses to pull them. Railroads were also condemned because the Bible did not mention them. The managing editor of the New York Herald censured his city editor for publishing an article about Thomas Edison's light bulb because it was against the laws of nature.

Some people objected to a proposed 6-month typing class for women in 1881 because the stress would cause women to break down completely. When automatic telephone switchboards were introduced, some leading engineers denounced them. Eminent scientists – and even H. G. Wells who has been characterized as the father of modern science fiction – repeatedly dismissed airplane travel as impossible.

What would cause people to raise objections that in hindsight are so obviously groundless and illogical? Were people trying to be responsible and anticipate the consequences of their actions, based on what they currently knew? That is always difficult to do because it assumes that what is currently known is correct. It is also dependent on how well the author can extrapolate. At the time of the typing class educated people believed women's mental and emotional strength was limited because women had smaller brains than men did. Based on that belief they were proposing a legitimate reason for concern. But to conclude that women who managed families and households could not learn to type without having a nervous breakdown is ludicrous to us now.

Were people simply worn out from too much change that came too quickly? Had the events of the nineteenth century exhausted their ability to cope with change: the War of 1812, the westward expansion, the Civil War, the industrial revolution, several economic depressions, and the beginning of sophisticated technology based on electricity? Or is resistance the normal human response?

Determining what is driving resistance becomes even more difficult when one takes into account the fact that sometimes the objections turn out to be valid. For example, people were concerned about the noxious smoke that would billow from trains and cause health problems. For decades, this fear remained groundless. When Bernard Stern submitted his report to the National Resources Committee Subcommittee on Technology in 1937, he cited this as an example of resistance to innovation. It was just another example of people's silly opposition to change. Decades later when we were overcome with atmospheric pollution, it was no longer a silly concern. Those objections had successfully predicted our new reality.

At the close of the nineteenth century, Théodore Ribot issued a call for further research into creativity. He called for investigation into the development of creativity in children, primitive myth-building peoples, and geniuses. He also called for more rigorous examination of the different types of creativity in all areas – aesthetic, scientific, philosophical, mystical, practical, mechanical, industrial, commercial, and military. It is somewhat remarkable that his request was almost a prediction. Research on creativity has, in general, followed the paths he outlined.

First Half of the Twentieth Century

The literature in the first half of the twentieth century reflected growing academic specialization and developing experimental

techniques. The questions addressed during this time centered on how is creativity defined, who has it, what are their characteristics, and how can it be increased. The effect of the environment and a milieu of opposing forces began to be examined.

A cursory look at the creativity literature during the first half of the twentieth century shows a large amount being done in Europe – in European languages. Topics included the role of inspiration, esthetic behavior, the unconscious, and imagination in the arts. Publications also dealt with productive invention and creation in the sciences. Eliot Dole Hutchinson wrote that as of 1931 German literary criticism contained the most vital discussion of creative ability. Europe was seen as the center for basic creative research. The United States was seen as successful in applied research and development, but fundamental research and the scientific and creative thinkers producing it were often imported from abroad.

When looking for explanations for this apparent lack of American interest in creativity, one could make a case for the fact that the new country had put much of its energy into settling the frontier. One might suggest that they were so busy being creative, they did not have an interest in studying it. One could also mention the impact of American democratic ideals that would tend to make America reluctant to investigate striking differences among its citizens. Europe has had a tradition of extremely high respect for learning and education. The anti-intellectualism, noticed by some writers as rampant in American culture, was largely unknown in Europe. For whatever reason, early in the twentieth century, American study of creativity did not have a strong theoretical foundation.

In the 1920s, imagination and invention began to be investigated in America under the title of creativity. Throughout the 1930s and 1940s there seems to have been a call for creativity, both in industry and in the schools. The discussion of creativity began to be more focused, sometimes more practical, and more concerned with education. It became less philosophical, and more in the tradition of modern psychology. Rather than reflecting the musings of an armchair philosopher, the work began to show the results of experimental studies. While this might be considered to have increased the quality of the work, it also meant that the philosophical wisdom and insights of the earlier period were no longer available, and no longer valued.

The First World War called for a mass mobilization of men and matériel. Men had to be assessed quickly and placed where individual abilities could best be utilized. The testing of individual abilities grew out of this need, which would occur again during the Second World War. The need for creativity can be illustrated by the fact that the employee suggestion system first used in Scotland in 1880 by shipbuilder William Denny was first utilized in the United States by the Navy in 1918.

The massive mobilization of the Second World War included the scientific community as well as industry. The damage done by Germany's rockets, its progress toward an atom bomb, and finally, America's successful development of an atom bomb all highlighted the need for creativity. After the Second World War America's industry expanded, in part, because Europe's industrial ability had been destroyed. Creativity continued to be needed and to be a topic of study.

However, in one of those paradoxes typical of discussions of creativity, war could also reduce the incentive to be creative. High taxes to support the war, pressures generated by unions, and the lack of items such as rubber, silk, and scientific laboratory glassware (which had been manufactured only in Germany) all affected the creative output of the United States. When it was all over many, including social scientists, were appalled and intrigued by the dynamics of the fascist cultures in Germany and Italy. Psychologists began to study areas indirectly related to creativity, such as authoritarianism and conformity.

During this period, most of the critical analysis within the field concerned the quality of the work, and the need for more creativity research. Thomas Knowlson attributed the lack of research to the nineteenth century belief that genius was a gift that needed neither training nor experience. Rollo Walter Brown pointed out the irony of America, which boasted of its progress, also neglecting and stifling creativity – even treating it as a symptom of a grave disorder. In 1931, Hutchinson reviewed the creativity literature, but concluded that it was so small and scattered in so many disciplines, it could hardly be called a literature.

Definitions of creativity during this period usually included criteria whereby something could be judged creative. Also included were discussions of whether creativity is a rational process or a mystical experience beyond examination by the senses or intellect.

Graham Wallas is credited by many as being the first in 1926 to articulate a complete description of the basic creative process. During the first stage, preparation, the problem is investigated thoroughly. Knowledge and intellectual techniques are acquired. The second stage, incubation, is a period when the problem is not being worked on at a conscious level. However, the unconscious continues to work on the problem. The third stage, illumination, is that flash of insight that appears almost as if by magic. The final stage was verification, in which the idea was put to the test, and further honed or developed.

Discussions of who has creativity usually centered on identifying those with creativity and deciding whether everyone could be creative. Some like J. Henri Poincaré seemed to take it for granted that not everyone could invent. Others felt that all had creative ability. This discussion can still be found in the literature.

The testing of creative ability had already begun by the time Guy Montrose Whipple reviewed five tests of imagination and invention in his 1910 manual on physical and mental tests. He saw invention as part of intelligence, and believed that any measurement of intelligence must include the testing of imagination and invention.

Ray Simpson proposed that people could have different forms of creative imagery – visual, auditory, verbal, kinesthetic, or logical. While he struggled with how one could measure the quantity of new ideas, he also wrestled with the issue of assessing quality. He asked whether a typewriter or Rembrandt painting was of more creative significance.

In the early 1920s, Edwin Slosson and June Downey worked to develop a creativity test that would be as accurate and helpful as the Binet intelligence tests were becoming. They hoped to be able not only to identify those gifted with creativity, but also to develop it, and offer vocational guidance.

Discussions of the characteristics of creative individuals usually included physical or psychological traits, and whether or not these were normal. They also often addressed the question of the underlying and necessary cognitive components of creativity.

The idea that the gifted had a more intense interaction with their environment had been mentioned as early as 1902 by William James, and would be echoed by Ruth Strang in 1960. However, in 1938 Kazimierz Dabrowski introduced the term *psychic overexcitability* to describe an expanded and intensified experience in five dimensions. These were: high energy, or excitability in the neuromuscular system; heightened experience of the senses; intellectual; rich imagery, visualization, and impressions; and strong attachments and intense feelings.

More than one author struggled with the question regarding the mental health of geniuses, including creative geniuses. Was genius a normal variation or pathological? Would one characterize the energy that came from those gifted with creativity as an ungovernable desire? That would reinforce the belief that geniuses run amok. Most rejected the idea that geniuses were insane, but they were frequently different, which brought the authors back to the original question: Is different normal? Is different pathological?

Discussions of increasing creativity were often blurred with discussions of the role of the environment. Those that clearly focused on increasing creativity discussed how an individual might increase his or her own creative ability and how schools could increase creativity. Should the schools provide general education or specialized education in creativity itself? Some of these discussions began to address the role of self-actualization.

During the late nineteenth and early twentieth centuries, child-centered education began to be an educational issue. It was an effort to individualize education, rather than ensure adjustment to society for the greater social good. In 1928, Harold Rugg and Ann Shumaker discussed the relationship between creativity and the industrial revolution, creativity in education, and the conflict between creativity and conformity. They saw the mass school in America as a replica of the mass mind of America – a result of 200 years of industrial revolution. Because of the pragmatic and exploitive spirit of the age, those who might have been creative artists were moved into technological development. The role of the child-centered school was to allow creativity to flower. This emphasis on self-expression and growth was an issue that would rise again in humanistic education and in the workplace through the human relations movement of the 1950s and 1960s.

Discussions of the environment looked at the effect of the environment on creativity. Some maintained that creativity would always rise, no matter what the environment. Others argued that only an individualistic, democratic environment with a certain level of prosperity would foster creativity. In addition, the industrial revolution that was allowing American prosperity was seen by some as a spiritual suicide. They believed the dehumanizing conditions in factories and company towns, the boring and repetitive nature of assembly line work, the lack of control over their own lives, and the lack of opportunity for originality robbed the industrial worker of the opportunity to be creative.

When discussing the dynamics of creativity as seen in individuals, groups, and cultures, invention of a visible product was often mentioned. These discussions of creativity, innovation, and invention usually centered on the relationship between the inventor and either a local environment, such as the workplace, or the larger social context.

Some such as Knowlson and Ralph Linton saw only the individual as creative; groups did not create. Inventors were usually rewarded only when the group realized its needs were not being met, or when it was seriously threatened. As a general rule anything too different would be suspicious and bring ridicule rather than prestige.

Linton also defined two types of inventions, both of which build on the knowledge base of the culture: basic inventions that involve new principles and inventions that improve on an existing invention. Basic inventions were frequently little more than a toy or curiosity at first—sometimes considered worthless. He believed that, as a rule, basic inventions resulted from the efforts of conscious inventors, working alone, not as part of institutional invention. For every invention that has been incorporated into a culture there have been many which have been rejected. Linton believed that the same things were invented and rejected repeatedly until changes in the culture prepared a place for them. No society had ever used even a tenth of its inventive ability.

As mentioned earlier, in the late 1930s Stern compiled a historical analysis of socioeconomic and psychological factors involved in resistance to innovation from the early Greeks to the twentieth century. He recounted in detail many instances of rejection. He mentioned patents bought up and held so no one could use them, high service charges added so customers would be less likely to use the new item, and the continued use of hand methods for years after new machinery had been proven effective. In many cases, scientists, engineers, and educated leaders were involved in the rejection.

Bankers refused to lend farmers money with which to buy tractors because the farmer would have too much leisure time. In 1934, prefabricated houses were attacked by the director of the New England division of the American Institute of Architects as causing people to substitute a life of vagrancy for responsible citizenship.

Stern concluded from his historical analysis that resistance to change comes from habit, fear, the desire to maintain the *status quo*, personal status, and the pressures of group conformity. These predisposing factors function within a cultural context, which is affected by economic, political, and religious factors. The strongest of these, economic factors, puts employees at risk. In fact, during times of great economic stress, many countries have requested moratoriums on science and invention. Small, incremental innovations may at that point have the best chance of being accepted. This would be expected, not only because invention builds on previous knowledge, but also because it lessens resistance.

As authors had done in past decades, Stern criticized education in the United States as doing little to help people handle technological innovation. With few people trained to verify data or analyze proof, Americans were forced to rely on expert authority, which Stern saw as being historically conservative and resistant to change.

Second Half of the Twentieth Century: 1950–1985

With the beginning of the 1950s came changes in the study of creativity. Psychologists began to be deeply involved in identifying and understanding creative gifts. As Josiah Royce had spoken on creativity in his address to the annual meeting of the American Psychological Association in 1897, J. Paul Guilford, as president of the Association, addressed it on the same topic in 1950. He had just received a grant from the Office of Naval Research for a project to study the aptitudes of high-level personnel – a project later characterized as the most profound study of creativity ever undertaken. Guilford characterized the neglect of psychological creativity research as appalling – a conclusion voiced by others for years before and after this seminal speech. He cited the concerns of industry and governmental agencies in recognizing and developing creative ability both in leaders and in scientific and technical personnel. Writers in the 1960s credited this speech as providing the impetus for creativity research over the next 12 years. The listings of articles in the academic indices of this time confirm an increase in the number of articles and books written.

During these years, researchers became more focused. For example, some, such as E. Paul Torrance, concentrated on testing for creativity. Others, such as Guilford, looked at the cognitive factors that contributed to creativity.

Definitions of creativity during this time can be illustrated by a matrix (Figure 1). Definitions can be placed along one continuum ranging from a practical, rational, problem-solving technique at one end to an inexplicable event, or beyond examination by the senses or intellect, at the other end. Definitions also range along another continuum between explicit, or clearly stated, and implied.

Some authors addressed the creative process by itself. Most who explicitly described a creative process described one similar to the one outlined earlier by Wallas and Poincaré. It was a four-step process consisting of preparation, incubation, illumination, and verification. A few stages, such as implementation, have been added, as has the likely recursion or recycling through stages more than once.

As Albert Rothenberg and Bette Greenberg pointed out in 1976, the issue of who has creativity involves several questions.

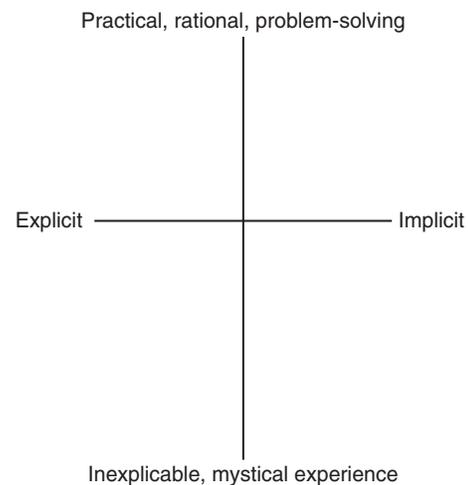


Figure 1 Definitions of creativity.

Is creativity uniformly distributed across the population, with everyone having the potential to be creative if taught and nurtured, or is it a gift to only a few? If everyone is creative to some degree, then what characteristics do those who are most creative have? If only some are creative, and those individuals are different, what are those differences.

Ideas about the distribution of creativity also appear to fall along a dimension with 'only a few are creative' at one end and 'everyone can be creative' at the other end (Figure 2). Again, some authors were explicit in their view; others were implicit, as if they were not themselves sure. Rothenberg was somewhat typical of this in 1970 when he acknowledged that creativity was probably common throughout history, but that true creators were unique.

During this time, many researchers concentrated on the characteristics of highly creative people. Researchers studied children as well as adults, and in fields that ranged from the arts to the sciences. Although the studies varied widely, authors frequently mentioned that creative people seem able to integrate into their personalities many opposing qualities. For example, they appear to be more masculine and yet more feminine; more independent, yet more receptive to suggestions; more playful, and yet more serious. They also seem to be comfortable with the unknown and ideas that were in conflict.

Researchers also began to study cognitive abilities and styles in more depth. Was creativity a part of intelligence? There were correlations between the two, but were these components of cognitive ability or two different abilities?

The question of whether or not those with unusual gifts were normal was asked during this time, as it had been before. Some discussed self-actualizing creativity as a sign of psychological health. Others felt that since high ability was on the edges of normal distribution, it was only reasonable to call it a deviance, and still others saw the behaviors of creative people as indicators of pathology.

In 1978, George Becker termed this the mad genius controversy. He used labeling theory to examine changes in the nineteenth century that led medicine and science to redefine genius as insanity. He concluded that in an effort to differentiate themselves from those less gifted and their artistic predecessors, intellectuals and artists during the Romantic

period (last half of the eighteenth century and first half of the nineteenth century) adopted idiosyncratic behaviors. Many Romantic geniuses may have assisted in a labeling process that worked perhaps too well and they ended up being seen as mad.

Given the political environment at the time, it is not surprising that numerous researchers worked on developing a test of creativity. After all, in order to provide guidance and furnish a supportive environment one must first identify creative people. Theoretically, this could be done through nominations, tests, behavior checklists, and profiles. In terms of practical application, however, it did not materialize. There was nothing that would allow a teacher or manager to administer a 50-min test and conclude that the tested individual was and would be creative in the classroom and office.

Several reasons for this were proposed. There were few creativity theories, methodological problems with previous work, the need for interdisciplinary work, and the need for longitudinal studies using large samples. It was also difficult to evaluate creativity. Judges had difficulties distinguishing creativity from other abilities such as intelligence and achievement. It was even more difficult to discriminate between various dimensions of creativity.

As Dennis Hocevar pointed out in 1981, if each method of testing for creativity actually measured creativity, the methods should have a reasonably high level of correlation. While results based on the same method tended to have high correlations, results from different methods did not. Individuals would be ranked differently on creativity depending on the method used. Were researchers studying different phenomena and did not realize it?

Authors addressed three ways of increasing creativity through the environment: the role of the home and school environment in encouraging the development of creative personalities, the role of instruction and/or reinforcement, and maintaining the general environment so as to nurture higher creativity for all.

Inherent in any discussion of manipulating the environment to increase creativity is the assumption that the environment influences creativity. The three ways in which this might occur all hark back to questions asked in the pre-twentieth century literature: does the environment produce the creative individual, does the creative individual create the environment, or does creativity occur as an interaction between the two?

Amid all the research being conducted on parenting styles, classroom environment, rewarding the development of specific personality traits, and similar topics, two authors stand out. In the 1960s, Arnold Toynbee and Richard Hofstadter both addressed the negative effect American culture had on creativity. Toynbee was concerned that American public opinion valued social conformity. He attributed it to a perversion of democracy that promoted the idea that all inequalities are undemocratic.

While Hofstadter agreed that America has an anti-ability bias, he disagreed with Toynbee's statement that this was a recent development. Hofstadter was strong in his belief that America had never valued it. It had been part of American culture since the beginning of the colonies.

Because creativity involves an unconventional stepping outside normal habit and thinking, sociological studies on

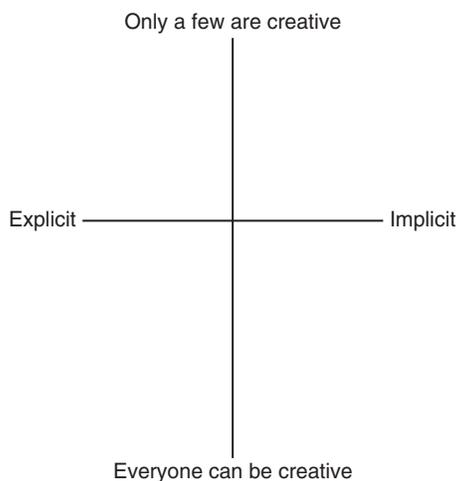


Figure 2 Distribution of creativity.

conformity and authoritarianism provided some insight into the dynamics of noncreativity. What Pauline Pepinsky termed productive nonconformity in 1961 is remarkably close to a definition of creativity – an independence that can make a positive and significant contribution to an individual or group accomplishing a task. She found the characteristics of those who were productively nonconforming to be similar to those found in highly creative individuals. They were independent, spontaneous, and yet had self-control.

Investigators working in the areas of social change and progress explored the differences between those who innovate and those adapt. Others discussed such topics as differences in cultural attitudes and expectations about progress, and what motivates individuals and societies to seek or resist change, and how that resistance manifests itself. Additional topics included tensions between individuals and the group, tensions between competing groups, and how innovations are diffused throughout a culture, or to another culture.

During this time, there was also the beginning of efforts to map the field of creativity, to organize or categorize the body of creativity knowledge into patterns, continua, or matrices. Once again, there was little consensus on how to do that. Should creativity research be categorized by where it was on one of these continua: process versus product, focus of control versus interaction, mystical versus rational, or normal versus pathological? Alternatively, should the classification system be based on cognitive functions of thinking, feeling, sensing, and intuiting? Or was it more important to classify the work by the methodology: theory-based, experimental, psychological testing, interviews, or historical data of famous people? Or was it as simple as the three main focal points outlined by Morris Stein and Shirley Heinze: the individual, the environment, and interactions between the individual and his or her environment?

An implicit theme ran through many of the articles and books, although sometimes it was stated explicitly. It was the idea that creativity was considered a crucial element in winning the cold war. Concerned over an already advancing technological race between America and the Soviets, authors pointed out that the lone inventor of the eighteenth and nineteenth century had been replaced by the industrial research laboratory. They questioned whether the research laboratory could produce the creativity that was needed.

This cold war theme became even stronger once the Russian Sputnik went into orbit in 1957 when all of American education came under attack. The call for creativity became part of the general restructuring of American education. The teaching of children who were gifted both intellectually and creatively became a priority; they came close to being considered cold war resources.

Second Half of the Twentieth Century: 1980 to Present

Although it may be too soon for the distance needed for an historical analysis, there appear to be several characteristics of the literature during this period. The first is that authors are writing two types of creativity articles. In the first, authors or researchers observe creativity, define it, learn to identify it, and then control it. In the second type, authors evaluate or critically analyze the work in creativity.

A second characteristic is the seeming expansion of the human potential movement, self-actualization, and positive psychology perspective that almost seems to have brought us full circle back to a more mystical, meta-physical view of creativity. The third characteristic lies in the development and recognition of creativity theories and models.

The fourth characteristic is the efforts to classify those theories and models into perspectives or paradigms. Although there were writers throughout earlier periods who reviewed available knowledge, the literature during this period reflects growing efforts at critical analysis within the field. More writers are consolidating information, conducting meta-analyses, and proposing classification patterns in how creativity is defined and studied.

The tremendous increase in the use of the internet, as well as its very nature, causes one to ask what its impact will be on creativity. The effect of the printing press on learning and the resulting spread of ideas are well documented. One can only assume something similar will result from the internet. With the internet, the potential for collaboration increases dramatically. In addition, we have access to new ideas more quickly than ever before. We can incorporate the new material into our own developing ideas and build on them. One question more difficult to answer is, what will be the relationship between democracy, the internet, and creativity. That will be an interesting trend to watch over the coming years.

Summary

The range of creativity research is great, covering many different disciplines. It contains many different models, perspectives, or schools of thought. There is still no single, unifying theory of creativity that could be embraced by all researchers and practitioners. Given the complexity of the subject, that may not be possible.

The metaphor of the blind men examining the elephant is appropriate. For almost everything about creativity that someone knows, someone else knows its exact opposite. For example, everyone can be creative; only a special few are really creative. Creative people are a little crazy; creative people are more psychologically healthy. Creative people are very different; they are just like the rest of us. Creativity can be taught; one has it or one does not.

We are still wrestling with whether there is only one type of creativity, or whether it is domain specific. Many are still using the creative process formulated by Wallas in 1926, even though there is some evidence we use it because it feels right, rather than because it has been substantiated by empirical study.

We still ask why some people are more creative than others are. In spite of its political incorrectness, we still wonder if creativity might depend on the physical structure of the brain or genetic inheritance. We have examined the childhood environments of creative people, but we still wonder whether the environment produced the child or the child produced the environment, and whether or not a similar environment in the workplace would increase creativity.

We do know something about the personality characteristics of creative people, but we still have questions regarding the

relationship between these characteristics and creativity. Some investigators almost seem to assume that the characteristics cause the creativity. They recommend changing personal qualities as a way of increasing creativity.

We are not certain whether very creative people have more of these characteristics, or more of only specific characteristics. Where we have obtained the criteria for defining the normal characteristics to which we compare creative people has not been addressed. What has been the role of white male values and definitions in determining what constitutes unconventional behavior? What effect have male values had on those definitions of creativity that stress a rational, problem-solving process? And how have the values of males affected cultural and organizational reactions to creativity?

We also seem to assume that negative qualities are inherent in the creative person. We have not investigated the relationship of societal reactions to the creative individual as a possible causal factor in the development of what is seen as rude, brash, or self-centered behavior.

We continue to disagree over training for creativity. Does it increase creativity, test-taking ability, or only certain aspects of creativity? We know little about its transferability to a task.

We still are not clear on whether a few very creative individuals push a culture toward progress, or whether the culture, its

needs and norms, draws the creativity out of them. The inter-relationship between groups or cultures and creativity continues to be an area of potential study.

After more than 100 years of systematic study, we seem to have defined the basic issues or topics of creativity research. Somewhat surprisingly, they appear to be the same questions asked during the beginning of that study in the nineteenth century.

See also: Distribution of Creativity.

Further Reading

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Creativity Training

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Using Training to Increase Creative Thinking

Creativity has been linked to many outcomes people generally find desirable. Cropley published work in 1990 suggesting creativity can be linked to helping individuals adapt to the rigors of daily life. Mumford and Moertl in 2003 argued that the development of new social institutions can be linked to creative thinking. Similarly, Simonton suggested in 1999 that organizational survivability can also be linked to creative work by organizational members. Furthermore, several researchers such as Enson, Cottam, and Band in 2001 and McGourty, Tarshis, and Dominick in 1996, suggested that creativity will continue to be increasingly important as information becomes more readily available and jobs become progressively more complex. As such, it is not surprising that researchers have not only studied creativity extensively but have also tried to increase people's creative capacity using a number of approaches. These interventions have taken the form of offering incentives or rewards for being creative, helping people gain knowledge or expertise in a given area of interest, or working to create an organizational climate conducive to creative work. However, one intervention that has shown particular promise is training people to be creative, as demonstrated by three meta-analytic works published by Torrance in 1972, Rose and Lin in 1984, Scott, Leritz, and Mumford in 2004.

A Brief History of Creativity Training

In their 2004 meta-analysis of training effectiveness on creative outcomes, Scott, Leritz, and Mumford synthesized a wide range of creativity definitions throughout the academic literature to define creativity as the production of useful, novel products or ideas. As such it has been viewed by many to be an important contributor to individual and organizational performance. This is especially true when the environment is one that presents a series of challenging, novel, or ambiguous problems. While this definition of creativity may be generally agreed upon, approaches for increasing an individual's ability to be creative vary widely. Many forms of creativity training have been created for various age groups, from young school children to adults, and for a wide variety of purposes, from strictly educational training to field specific professional training. In a 1998 review of creativity training Smith identified 172 techniques that have been used to develop divergent thinking skills, a cognitive process known to be closely related to creativity. Further, Bull, Montgomery, and Baloché in 1995 identified 70 training techniques that were considered important components of creativity training in their investigation of college level creativity courses. Given the number of unique techniques and instructional methods identified in these studies it is not surprising that creativity training programs vary widely in course content, method of

delivery, intended outcomes, and the theoretical approach used to promote creativity.

Fortunately, researchers have examined the existing creativity training courses and have identified several variables that promote effective training for creativity. Three primary sources provide us with comprehensive examinations of creativity training effectiveness. One of the earliest attempts to comprehensively review findings bearing on creativity training was work done by Torrance in 1972. In Torrance's assessment of 142 studies, it was found that 72% of the training interventions examined achieved the objective of promoting creativity as defined by those conducting the study. While this work provided a good starting point for the comprehensive examination of creativity training, it was subjective in nature and thus was subject to certain limitations. Two limitations are of primary concern. First, given that the criteria for success Torrance used was meeting the objectives laid out by the researchers conducting the study, there was no standard metric for assessing improvements in creative performance as a result of the training intervention. Second, Torrance's work was not quantitative in nature. Expert reviews of literature can offer important insight into a topic, but also leave the door open for subjective criteria to slip in unannounced. This could be of particular concern here given that 103 of the 142 studies reviewed by Torrance used the Torrance test of creative thinking as their primary criterion measure.

In order to address these concerns, Rose and Lin conducted a quantitative review of creativity training in 1984 using a meta-analytic technique. These researchers identified 46 studies in which creativity was measured using a standardized format. Specifically, they only used studies that measured creativity as fluency, flexibility, originality, and elaboration using the Torrance tests of creative thinking. Analysis of these studies provided further evidence that creativity training is effective across all four criteria of fluency, flexibility, originality, and elaboration, but that gains for originality were somewhat larger than for the other three creativity criteria.

The most recent review of creativity training effectiveness was conducted by Scott, Leritz, and Mumford in 2004. In addition to addressing concerns about the age of the prior work by Rose and Lin in 1984, these researchers aimed to identify specific aspects of creativity training that make a course more or less effective at enhancing performance on a variety of creativity-relevant criteria. Specifically, these researchers examined the theoretical approach used by course designers, the content of the course materials, the way in which that content was delivered, and the way in which creativity-relevant outcomes were measured. Knowledge about the effect of the theoretical framework of the course designer, course content, course delivery, and creativity criteria used could provide a more fully developed foundation upon which to draw inferences about existing courses and develop new ones.

Training Variables

Taken together, the subjective review by Torrance in 1972 and the systematic reviews by Rose and Lin in 1984, and Scott, Lertz, and Mumford in 2004 suggest that training is a useful tool for increasing an individual's ability to be creative. In the most recent review of the literature, that is Scott, Lertz, and Mumford's 2004 meta-analysis, researchers examined the effect of training on several creativity related outcome variables. These researchers classified the outcome variables of 70 creativity training studies into four groups: divergent thinking, problem-solving, creative performance, and attitudes towards creativity. These researchers also calculated a composite score of overall creativity based on scores from each of these four more specific outcome variables. They found that each of these outcomes can be increased significantly as a result of creativity training. However, the relationship between training and each of the creativity outcomes identified was complex.

Creativity Outcomes

Divergent thinking is one of the most well-studied aspects of creativity. In the 1950s, J. P. Guilford and his colleagues defined it as the ability to generate multiple alternative solutions to a given situation or problem. Although researchers still debate whether or not divergent thinking is necessary and sufficient for creativity, what is clear is that divergent thinking is a unique capacity that contributes to many forms of creativity.

One of the best known training programs is the Purdue Creative Thinking program. This training intervention was designed by Feldhusen and colleagues in the early 1980s and consists of 28 lessons on audio tape. Trainees listen to 30 minute instructional sessions and work through a series of exercises for each session. The goal of the course designers was to enhance the fluency, flexibility, originality, and elaboration of trainees' responses during creative thought.

As discussed by several creativity researchers since the development of the divergent thinking construct, creativity can also be thought of as the generation of novel, useful solutions to problems (i.e., problem-solving). Problem-solving is defined the act of resolving a complex, ill-defined problem using new ideas that have been developed using multiple pieces of information and expertise in order to provide a framework for implementing a solution. This represents a more extensive description of the processes contributing to creative thought than divergent thinking alone. Rather than emphasizing one process such as divergent thinking, researchers using this approach have identified a wide variety of cognitive processes contributing to creativity. Problem finding, conceptual combination, and idea evaluation are only a few processes that have been identified as being important contributors to the creative process.

The problem-solving approach to creativity spawned a well-known training program called the Creative Problem-Solving program. This program was developed by Sidney Parnes and colleagues during the 1970s and presents trainees with six stages of creative problem-solving. These six stages include mess finding, problem finding, information finding, idea finding, solution finding, and acceptance finding. This course was conducted as a lecture along with a discussion of the

model presented to trainees. Trainees then completed a set of exercises to practice the techniques they learned during training. Evidence bearing on the effectiveness of this program can be found in Reese, Parnes, Treffinger, and Kaltsounis in 1976 and Basadur, Graen, and Green in 1982. These researchers found gains in divergent thinking on a variety of tasks including social problem-solving and planning. Basadur, Graen, and Green stated that engineers in an industrial organization showing significant improvements in problem finding and problem-solving immediately after training and this finding held 2 weeks later on work related measures.

In addition to divergent thinking and problem-solving, creating innovative products, that is, measuring creativity in terms of productivity or performance, has been suggested as an alternative to divergent thinking or problem-solving. One benefit of using performance as a criterion for creativity is that performance is ultimately the outcome of primary concern in real-world settings. Spending time and energy to solve problems or engage in cognitive processes such as divergent thinking do not amount to much in the real-world if nothing is ever produced. Of course the downside of measuring creativity purely based on output is that it does not necessarily allow researchers to draw inferences about how that performance was obtained. However, it is clear is that a person's productivity is an important aspect of their creative performance and should be included in an examination of the effectiveness of creativity training.

Lastly, assessing an individual's response to creative work or examining the degree to which an individual accepts or even initiates creative action is an important aspect of creativity that should be examined. Members of organizations often approach creative ideas with skepticism or even resistance. While creative ideas are often the precursor to progress, they also indicate that change is needed and change often has its enemies. Pair this with the fact that creative ideas do not always work out as intended, it is not surprising that people have difficulty accepting creativity. However, assuming creativity is needed, and given that this article is focused on promoting creativity through training, it is valid to consider the degree to which creativity training helps people become more accepting of creative ideas.

Components of creativity training courses. Training courses can be thought of as being made up of four primary components: the design of the course, the content included in the course, the way course content is delivered, and the media used during instruction. Additionally, the theoretical framework a course designer used in developing the course is likely to have a pervasive influence on all four of these factors.

Course design includes the length of a creativity course, the types of practice opportunities trainees are given (if any), and how the different training sessions are scheduled (i.e., massed versus distributed). Course content includes the factual and conceptual knowledge about creativity the instructor attempts to communicate to the trainees but also includes the types of techniques the instructor promotes for increasing creativity. Course delivery includes variables such as how long the training lasts, the amount of lecture used, the amount of practice time given to trainees, the nature of the practice exercises, the amount of feedback provided to trainees, as well as other variables related to how the instructor communicated material

to trainees in order to facilitate learning the content incorporated into the course. Delivery media includes the types of materials that were used to convey material during the course. The use of lectures, A-V equipment, case-based material, or cooperative learning activities fall into this category.

Effective Creativity Training Interventions

Course Content

Theory

The fact that there is such a wide array of creativity training techniques suggests that course designers have approached creativity training from a variety of theoretical perspectives. This fact has important implications for creativity training in that the theoretical lens a course designer uses to understand creativity can have a pervasive influence on the type of course they develop. The way in which a course designer understands creativity influences the way creativity is defined and the types of interventions and information the designer believes will promote trainee creativity. Not only does this have implications for how creativity is measured in trainees, but it also has wide-ranging implications for the specific content a course designer incorporates in a training course and the way in which that material is presented.

Researchers have used a variety of theoretical approaches to study creativity. Not surprisingly, the use of different theories has led researchers to suggest and explore many different variables as contributors to creativity. This includes affect, organizational climate, psychological disorders and impairments, intelligence, disposition, and cognition just to name a few. Not all of these theoretical frameworks offer clear direction for designing a creativity training course. In 2004, Scott, Leritz, and Mumford classified existing creativity training courses according to the theoretical framework used and examined them in terms of their relative effectiveness in promoting creativity. They found that training based on a cognitive framework of creativity was the only one to yield consistently positive effects.

According to Baughman and Mumford's 1995 work, the cognitive view of creativity emphasizes how individuals use cognitive strategies to process information and work with their existing knowledge to be creative. A creativity training course developed from this framework would be expected to emphasize the use of knowledge and information, focus on the cognitive processes creative individuals use to work with that knowledge and information, and encourage purposeful thinking and action.

There are several reasons why a cognitive framework for creativity should prove useful for developing creativity training. First, a cognitive model of creativity encourages course developers to emphasize specific knowledge structures and provides direction for using that knowledge. Second, unlike dispositional or associational models of creativity, a researcher using a cognitive framework is more likely to focus on more trainable variables such as information gathering, idea generation, idea evaluation. That is, given that dispositional approaches focus on individual differences which are enduring traits and associational approaches emphasize processes that occur outside of one's own awareness, a researcher using a cognitive framework is more likely to focus on variables that are teachable when developing a creativity course.

Not only did Scott, Leritz, and Mumford find that courses developed from a cognitive theoretical framework were more effective than other approaches, they also found that courses that stressed specific cognitive processes during training were particularly effective. Specifically, emphasizing the processes of idea generations, problem finding, and conceptual combination proved to be especially helpful to trainees. It would appear that providing trainees with guidance about how to work with the knowledge and information they have about a problem is one important element of effective creativity training.

With regard to other theoretical approaches showing a lack of effectiveness, or worse a decrement in creative performance, there are two possible explanations. First, these approaches to understanding creativity are fundamentally flawed and do not provide useful framework for understanding creativity. Second, these approaches do offer value for understanding creativity, but do not emphasize constructs that can be taught in a creativity training course. Future work in these areas could help resolve this issue.

Processes

The cognitive processes individuals use as they do creative work are potentially key components of a creativity training course. A great deal of research has focused on identifying the cognitive processes people use when they do creative work. This can provide course designers with a wealth of information regarding the types of constructs to be addressed in a creativity training course. Given that cognitive frameworks have proven to be the most effective theoretical background for designing creativity courses it is important to consider the specific cognitive processes these courses emphasize. This can provide us with a better understanding of how effective emphasizing each of these processes is and whether or not some processes are better for some outcomes and worse for others.

In Scott, Leritz, and Mumford's analysis of creativity courses, it was found that programs emphasizing the process of problem identification were very effective for promoting general creativity. Upon closer inspection, problem identification training is especially useful for promoting positive attitudes towards creativity, problem-solving ability, and creative performance. It is also helpful for promoting divergent thinking, although the gains for divergent thinking are much more modest than the gains in problem-solving, performance, and attitudes. When one considers that divergent thinking is the process of generating multiple outcomes or solutions to a given situation it is not surprising that it is not impacted greatly by encouraging trainees to identify problems effectively. Similarly, given that problem identification involves the detection of environmental circumstances that can hinder progress towards a goal it is not surprising that it is helpful for promoting problem-solving ability and creative performance. The reasons behind the positive relationship between problem identification training and attitudes towards creativity may be less obvious. However, it is likely that helping people identify problems allows them to be more proactive in dealing with problems and can give them a sense of empowerment for dealing with their environment. Future research on the nature of this relationship can do much to clarify why problem identification training promotes more positive attitudes towards creativity.

Training emphasizing information gathering showed a more complex relationship with creativity related outcomes. Its effect on general creativity was negligible; however, trainees receiving information gathering training showed modest gains for problem-solving ability and notable gains in creative performance. Interestingly, information gathering training seemed to depress trainees ability to engage in divergent thinking. Information gathering helps individuals identify critical causes, relevant contingencies, limitations in resources, and emergent problems or goals inherent in a given set of circumstances. As such, information gathering is an important part of creativity as it is manifested in more applied settings, settings in which problem-solving and creative performance are more likely to occur.

The finding that training participants to gather information does not help them with regard to divergent thinking may at first blush seem paradoxical. Gathering more information might be expected to help trainees develop a wider variety of solutions. However, if information gathering helps trainees recognize that the issue they are facing is nested within a given situation, it is likely that solutions that fall outside of the given situation will not be considered. Thus encouraging information gathering may have positive effects for some creativity related outcomes and inhibitory effects for others. Given these findings it is likely that information gathering helps individuals focus on factors that are directly relevant to a given problem, but also act as a set of blinders that limit the individual's ability to consider 'outside the box' solutions. Future research could help clarify the role information gathering plays in promoting creativity.

Information organization, conceptual combination, and idea generation represent processes in which individuals work with information they have gathered along with their existing knowledge base in order to gain a clearer understanding of their situation, look for meaningful patterns, and begin forming ideas about how to deal with a given set of circumstances. Each of these processes demonstrates a very straightforward set of effects. They are beneficial for divergent thinking, problem-solving, performance, attitudes toward creativity, and creativity on a general level. This is in-line with many studies that suggest creativity is a cognitively engaging activity requiring high levels of active cognition. Here we see that this active cognition is, at least in part, due to working with information and knowledge and training emphasizing organizing and combining information and ideas is helpful for promoting a wide range of creativity related outcomes.

Another rather complex set of findings emerges when one examines the relationship between training emphasizing idea evaluation and specific creativity outcomes. On a general level, training for idea evaluation does not appear to encourage trainee creativity. This same finding holds for divergent thinking – training individuals on idea evaluation has little discernible effect on their ability to engage in the creation of multiple potential outcomes or solutions for a given situation. However, trainees who receive training on idea evaluation were found to perform much worse on creative performance measures but much better on measures of problem-solving and their attitudes towards creative efforts were more positive.

Idea evaluation is arguably one of the most neglected cognitive processes known to be related to creativity. It is likely

that the mixed findings with regard to idea evaluation's effect stem from a lack of understanding regarding this process. In 1989, Hennessy found evaluation to have an inhibitory effect on creativity. Similarly, Conti, Amabile, and Pollak in 1995 found that individuals who expected to be evaluated were less creative than those who were not expecting to be evaluated. Alternatively, in 2003 Mumford, Connelly, and Gaddis found support for the notion that a leader's idea generation can be stimulated by evaluative processes.

This is truly a puzzling set of findings that future research could do much to clarify. It would be beneficial to investigate whether or not encouraging idea evaluation should be done in some situations and not others or during certain phases of the creative thinking process and not during other phases. It is likely that idea evaluation can hinder the progress of viable ideas if that evaluation comes at a point in time when that idea has yet to be fully developed. Alternatively, promoting idea evaluation may be likely to promote the refinement of ideas or the selection of ideas when one is engaging in problem-solving. Similarly, ones attitudes and behaviors towards creative ideas might improve when they have been given strategies for evaluating those ideas. However, we hasten to add that these are speculative suggestions and future research to examine the effects of promoting idea evaluation should be conducted.

The final variables of interest regarding training cognitive processes are implementation planning and solution monitoring. Training for implementation planning and solution monitoring, two processes that occur rather late in the creative thinking cycle, have both shown sizable positive effects for problem-solving, performance, and attitudes. They showed more modest effects for divergent thinking, which is not surprising given that divergent thinking is a process that typically comes into play in the early or middle phases of creative thought when generating ideas is of more value.

Techniques

Creativity courses can offer a wide variety of techniques or strategies to trainees in the hope of promoting creative thought. Techniques that provide trainees with guidance on how to analyze problems using heuristics or strategies can provide valuable information for a relatively low cognitive cost. Giving people structured mechanisms to identify and analyze critical causes, outcomes to avoid, contingencies to monitor, and other problem specific variables is likely to be extremely effective in promoting creative thought. Alternatively, semi-structured or non-structured techniques are likely to be less effective because they provide little specific guidance and do not help reduce the cognitive load inherent in dealing with a novel, complex, and ambiguous set of problematic circumstances.

In examining the different types of techniques in use in creativity training courses, researchers found that trainees receiving convergent thinking training tended to improve in their overall creativity. Interestingly, the most notable gains were for problem-solving and attitudes towards creativity while a sizable negative effect was found for creative performance. Convergent thinking is a technique that encourages individuals to bring together disparate pieces of information in attempting to solve a particular problem. As such it is not surprising that convergent thinking training would have a large, positive effect on problem-solving. Attitudes may also be

increased because convergent thinking is a relatively simple technique that enables individuals to tackle difficult problems.

The finding that convergent thinking training had a negative impact on performance may at first be puzzling. However, when one considers the nature of convergent thinking it becomes apparent that it is a technique that is more appropriate for solving problems that have a clear and distinct correct solution. In a performance domain there are often multiple potential solutions. While some solutions may have advantages over others, performance is largely an issue of selecting an appropriate solution and then managing the weaknesses of that solution. One's ability to manage those weaknesses is an important factor in the development and selection of a problem solution.

Constraint identification was a technique that had relatively straightforward effects. It was effective for promoting general creativity as well as divergent thinking, problem-solving, performance, and attitudes. It is likely that encouraging trainees to identify constraints has beneficial effects for a number of reasons. First, identifying constraints is likely to help trainees narrow their thinking and in this way might actually stimulate a directed search rather than an less fruitful undirected search for information as the individual engages in divergent thinking. Second, problem solving and performance are two creative domains that primarily measure practical outcomes stemming from creative thought. The identification of constraints that must be attended to when solving a problem or performing a creative act is essential to the success of the effort. Should critical constraints be overlooked a potential solution is apt to fail because it cannot be implemented in a given set of circumstances or important aspects of the problem were not effectively addressed. Third, and lastly, identifying constraints helps individuals evaluate creative ideas. A problem solution that does not address critical constraints is obviously inferior to one that does address those constraints, thus is it likely that an individual's attitudes about working with creative ideas will improve given that are better able to select ideas that are more likely to have a successful completion.

Researchers also found that training emphasizing identifying strengths and weaknesses was beneficial for promoting divergent thinking and attitudes towards creativity. However, trainees who received training in this technique showed decrements in their creative performance. This complex set of findings related to identifying strengths and weaknesses suggests that further research on this technique is warranted. It could be that attending to the strengths and weaknesses of a course of action takes an individual's attention away from the problem at hand and forces them to focus on the plan rather than the problem, thus resulting in negligible effects on problem-solving ability and negative effects on performance. It could also be the case that encouraging trainees to focus on strengths and weaknesses induces a 'paralysis by analysis' in which individuals do nothing because they see obvious flaws with any course of action they could choose. While these are viable explanations, until further research is done on this technique the reason it has such a complex effect on creativity remains unclear.

The use of analogies is a fairly common technique in creativity training interventions. While its effectiveness on an overall level was found to be negligible, it does have some benefit

for promoting creative performance. The value of identifying an analog stems from the fact that knowledge from a similar case can be applied in a new situation. This can help the individual avoid unforeseen problems because similar problems were identified from the analog. Strategies that were unsuccessful in the analog can be avoided while successful strategies used in the analog can be selected. Additionally, using an analog can help an individual anticipate emergent opportunities or problems because they are suggested by the analog. The only real question for further research here is why aren't analog's shown to have larger effects than have been indicated thus far? It is likely that the value of using analogies in creative efforts depends upon identifying analogs that are substantively similar to current circumstances rather than using analogies that are similar only in surface features. Investigating how training can be used to help individuals identify the most useful analogies and to fully exploit the knowledge contained within them could be very useful.

Brainstorming, a technique in which trainees are taught to generate ideas without immediately evaluating them has been a historically popular method for stimulating creative thought in groups. However, Scott, Leritz, and Mumford found that this technique was marginally effective in promoting overall creativity. The largest gains were for attitudes towards creativity and more modest gains for problem-solving. Interesting, negligible effects for divergent thinking and performance were found. Given the popularity of this techniques it may be surprising to learn that it is actually not that effective. However, Mullen, Johnson, and Salas' 1991 meta-analytic review of findings regarding brainstorming would tend to support these findings. Using quantitative and qualitative measures of creative outcomes, these researchers found that brainstorming groups show large and consistent productivity losses compared with others working alone.

The fact that the brainstorming technique does not show larger effects on problem-solving and performance is interesting, especially when one considers that these techniques are often encouraged in applied settings where problem-solving and performance are highly valued. Future research on these techniques is warranted given that the evidence thus far casts their effectiveness on a practical level into doubt. However, the data here suggest that this technique could be quite useful for encouraging people to respond positively to new ideas. Exploring the relationship between brainstorming techniques, peoples' attitudes towards creative efforts, and organizational climate for creativity could be a useful line of research.

The use of less structured techniques such as imagery, metaphors, and expressive activities was found to be detrimental to overall creativity. Some might consider this a surprising finding. Upon closer inspection of the specific creativity outcomes assessed by Scott, Leritz, and Mumford the picture does not improve for these techniques. Trainees given instruction in imagery and metaphors actually showed sizable reductions in divergent thinking, problem-solving, and attitudes towards creativity. Training in expressive activities led to large decrements in problem-solving and performance and a more modest decrement in attitudes towards creativity. It is likely that the less structured nature of these more exploratory techniques limits their usefulness as interventions to promote creativity in a training course. Further research might find creativity-relevant

outcomes that these techniques promote, but the evidence gathered to date suggests that they are not effective interventions in creativity training courses.

Course Delivery

How the content of a course is delivered can have a significant impact on how well material is retained and applied by trainees. The length of the course, the nature of trainee activities, the technology used to communicate information, and the presentation method used by instructors are all course delivery issues that could impact the effectiveness of a training course on creativity.

Design

In line with findings suggesting that time on task contributes to learning and performance, the amount of practice trainees engaged in, as well as the number of minutes of course instruction showed beneficial effects on general creativity. However, the effects for divergent thinking were marginal at best. The findings for problem-solving, performance, and attitudes were sizable and positive.

Another variable that was shown to have a sizable effect on creativity training was the use of creativity models. Training courses that used a specific model of creativity rather than an ad hoc assembly of various techniques were far more effective in promoting trainee divergent thinking, problem-solving, performance, and attitudes towards creativity. The strongest effects were for problem-solving and attitudes, although the effects on divergent thinking and performance were still notable. It is likely that using a variety of independent techniques does not give the trainees a framework for developing a coherent understanding of creative work. Attempting to use a potpourri of more or less random techniques does not facilitate a focused and coherent analysis of a problematic set of circumstances, thus it is not altogether surprising that using a model of creativity can provide a unifying conceptual framework for understanding creativity.

One example of using a specific model to promote creativity training can be found with the use of the Creative Problem Solving (or CPS) framework originally proposed by Osborn in 1952. This method of providing creativity training has gone through at least six major revisions (Isaksen and Treffinger in 2004); however, the same basic components remained. The most recent version of the model consists of framing problems, constructing opportunities, exploring data, generating ideas, developing solutions, and building tasks (Isaksen, Dorval, and Treffinger in 2000). Over 50 impact studies have been conducted on the use of this model in creativity training, providing a robust body of research suggesting it is effective for promoting creative problem-solving in children, young adults and adults. Similarly, this training has demonstrated its effectiveness in work settings as well as educational settings (see Isaksen and Treffinger).

Interestingly, the use of domain specific exercises had a negligible effect on overall creativity. However, the use of domain specific exercises has a sizable, positive effect on performance and attitudes towards creativity. It is likely that by using domain specific exercises trainees begin to see the possibility of using creativity to solve real-world problems they face and as

a result become more favorably predisposed to creative ideas. Additionally, performance in many areas depends upon expertise in domain specific concerns. It is likely that creativity training that emphasizes domain specific application is going to be perceived as being more relevant but also will give specific techniques for enhancing creativity in that domain. Further research on the effect of domain specific creativity training is warranted, especially in light of the fact that its beneficial effects did not generalize to other creativity outcomes such as divergent thinking or problem-solving.

Training courses using realistic practices exercises and materials the trainees consider challenging are highly effective in promoting problem-solving, creative performance, and attitudes towards creativity. Although they were much less effective in promoting divergent thinking, the relationship was still moderately positive. Given that divergent thinking is a more abstract and general outcome related to creativity it is not surprising that activities that give trainees the opportunity to develop their skills in a concrete, realistic fashion do not do much to enhance divergent thinking.

In examining the difference between training programs that were massed versus those that were distributed it was not surprising to find that distributed training was more effective. Distributed training was especially beneficial for problem-solving and performance. These findings are in line with the findings of Donovan and Radosevich in 1999. In their meta-analysis of distributed practice techniques they found that providing longer rest periods between training sessions was very helpful for the acquisition and retention of complex material. To be certain, training individuals to be creative represents a complex task.

Delivery media

Another aspect of training that is important to consider is the type of media trainers used when delivering the training. As technology for displaying information advances a wider variety of delivery methods is becoming available. It can no longer be taken for granted that a training course has a lecture component. Some training programs rely predominantly on video or computer based instruction.

With regard to creativity training, two types of materials stood out: lecture and case-based materials. Both of these techniques were effective for promoting general creativity but also for divergent thinking, problem-solving, performance, and attitudes towards creativity. Further research could do much to clarify why lecture and case-based materials are so effective in promoting a wide variety of creative outcomes. However, a few speculative comments could be made regarding these two delivery methods. Creativity is a particularly complex topic and is rooted in the application of cognitive strategies for finding and implementing novel, useful ideas. Providing instruction in a lecture based format gives trainees a noteworthy advantage over self-paced interventions – it gives trainees access to an expert on the topic rather than forcing them to rely on developing that expertise alone. Thus lecture has the advantage that an expert can provide a depth of coverage that nonlecture materials cannot provide and trainees have the opportunity to ask questions in a lecture based format that would be difficult to ask in other formats. This may be particularly important for training creativity given its complex nature

and that it must be applied in real-world, domain specific circumstances.

The benefit of using case-based materials likely stems from the richness of information provided in materials of this type. Case-based material in creativity training courses typically describes and analyses a past situation in which an individual or a group of individuals have had to use a creative idea to accomplish a goal or overcome an obstacle. A wealth of information can be drawn from past scenarios because they are embedded within real-world circumstances that allows individuals to gain a more complete understanding of how creative work is done, likely contingencies to monitor, the likelihood of success, and the possible side-effect of putting a novel idea into action.

Cooperative learning materials were the only other media type to have noteworthy effects on trainee creativity. The evidence gathered thus far suggest that cooperative learning is most effective for promoting problem-solving outcomes. It is likely that the social exchange between trainees during cooperative learning helps individuals see problems from alternative perspectives and learn by seeing others apply the knowledge they have acquired during the course of training. Much more research could be done to further examine the relationship between cooperative learning and its effect on creativity training. Evidence for how cooperative learning helps or hinders peoples' attitudes towards creative ideas does not exist. Additionally, it is likely that cooperative learning is important for helping trainees learn some creativity related cognitive processes but may be less effective for others. Examining these issues could have an important impact on designing and delivering creativity training in the future.

Conclusion

Systematic reviews of literature on creativity training demonstrated that using training to improve creativity can be highly effective. Using a cognitive approach in the development of creativity training was the only approach that consistently contributed to the effectiveness of creativity training. Specifically, training that emphasizes idea generation, problem finding, conceptual combination, and idea generation were particularly important for promoting creativity.

In addition to characteristics that promote a systematic, cognitive approach to creativity, scholars have also identified delivery methods that appear to promote creativity. Making sure training materials are challenging, include real world, domain-specific exercises, and cover well-researched cognitive models of creativity in an in-depth fashion should promote trainee creativity. Training should involve some lecture-based components along with multiple opportunities for practice by trainees. Naturally, training that involves an in-depth, theoretically based consideration of creativity along with multiple opportunities for trainee practice on challenging, realistic,

domain-specific exercises is likely to be somewhat lengthy. In fact, lengthy training sessions have been found to be associated with higher levels of creativity.

When designing creativity training, incorporating elements that have been shown to promote trainee creativity that have been examined empirically and systematically is likely to enhance the effectiveness of creativity training. Investigating the use of techniques that are less structured like brainstorming or the use of imagery may be interesting, but should be avoided when designing creativity training courses, at least until the real utility of these techniques can be determined. It is our hope that this brief review of findings regarding creativity training has given the reader confidence that training to enhance creativity can, in fact, have notable effects. Additionally, we hope this effort has also informed the reader of specific topics and techniques that when used in creativity training courses can be effective in promoting creativity generally as well as specific aspects of creativity such as divergent thinking, problem-solving, performance, and attitudes towards creative efforts.

See also: Divergent Thinking; Rewards and Creativity.

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Crime and Creativity

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Glossary

Actus reus An illegal act.

Anomie The weakening of social norms. When anomie exists in a society, a person has few guidelines for socially appropriate behavior.

Beccaria, Cesare An eighteenth century Italian philosopher who argued that crime could be controlled by punishments only severe enough to counterbalance the pleasure obtained from them; creator of the idea that the punishment should fit the crime.

Consensus view of crime The belief that the majority of citizens in a society share common ideals and work toward a common good and that crimes are outlawed because they conflict with the rules of the majority and are harmful to society.

Diminished capacity Mental impairment less severe than insanity.

General intent The intent to commit the *actus reus*.

Labeling theory Society's response to crime defines some people as criminals.

Legal insanity The inability to distinguish between right and wrong.

Paradigm term popularized by Thomas Kuhn A paradigm is a collective, socially shared schema and serves to explain phenomena until replaced by a better paradigm.

Pendulum swing The alternating emphasis on crime control and due process in the history of criminal justice.

Recidivist Repeat offender.

Zeitgeist The tone of the times.

Types of Criminality

Creative ideas can be sharply divided between those that are warmly and enthusiastically embraced by the majority of persons, and those that are considered dangerous by some invested group or groups. Albert Einstein's theory of relativity is an example of the former type. Einstein became an instant celebrity upon the promulgation of his theory. His name became an analog for genius. Galileo's idea that the Earth was not the center of the universe is an example of the latter. After recanting his theory, the tribunal of the Inquisition sentenced him to house arrest for the remaining eight years of his life. In 1600 Giordano Bruno was burned to death for refusing to recant the view expressed in his philosophical treatise that the Earth was not the center of the universe. Surely Galileo would have been executed, as Bruno was, had he not recanted.

The criminality of creative individuals can be seen as two general types, (1) creative acts or creative products that are seen as criminal, or (2) lifestyles that are seen by society as criminal. Examples of the first type would include Jesus, Martin Luther King, Jr, Gandhi, Galileo, Egon Schiele, O. Henry, and Lenny Bruce; these are individuals who were jailed because their product, theory, or performance was considered criminal by society. The second type consists of individuals who are singled out as criminals because of their lifestyle; this would include Oscar Wilde, Cervantes, O. Henry, and Herman Melville. All were jailed because of activities and behaviors not directly related to their creative production. Oscar Wilde, for example, was jailed in Victorian England for homosexuality and pedophilia, and O. Henry was jailed for unpaid debts.

The main crimes that are perceived as threatening to the existence of the state have been relatively constant over the years. They are: (1) treason (levying war against the government), (2) sedition (stirring up treason or rebellion), and

(3) morality; crimes against public decency (illicit sexual conduct, gambling, unpaid financial debts).

The metaphor of a wedding cake has often been used for the criminal justice process. A wedding cake is narrow at the top and gets progressively wider toward the bottom. The wedding cake model of criminal justice divides cases into different tiers: (1) a few celebrated cases in the top tier, (2) a greater number of 'real crimes' in the second tier, (3) most ordinary felonies in the third tier, and (4) the vast numbers of misdemeanors in the fourth tier. By far, the greatest number of cases fall in this last category.

Creativity, Conformity, and Rebellion

There is a central problem for the creative mind, which is an essential tension between creativity and conformity. Conformity is doing things as others do and have done; on the other hand, creativity is doing things in a novel way as well as breaking out of established patterns. As a result of this break, the creator is frequently seen by society as a rebel, a deviant, and a gadfly. Creativity and deviance are in many ways synonymous. The creator must rebel against, contradict, and negate established ways of thinking. New ideas commonly are met with societal repression. It takes time for culture to accommodate to the unfamiliar. For these reasons, Galileo, Martin Luther King, Jr, Henry David Thoreau, and others have spent time in jail. The creator is often faced with a society that finds his or her production offensive, monstrous, or crazy. The school of painters known as impressionists were considered mad and their art decadent by many critics when it was first promulgated in the mid-1800s. The American poet Walt Whitman was considered an oddball and madman by many critics when his *Leaves of Grass* was first published.

Henry David Thoreau, Martin Luther King, Jr, Thomas More, Socrates, Galileo, Jesus Christ, and Joan of Arc are all historical figures whose names evoke awe and strong emotions. They have been immortalized in books, movies, and television programs, and some (Jesus Christ, Martin Luther King, Jr) have official holidays in the United States dedicated to them. One thing they have in common is they were all placed in jail by their cultures for their unorthodox, nonconformist views. Some of these individuals – Socrates, Joan of Arc, Thomas More, and Jesus Christ – were put to death by society. The views of these people were seen by conventional standards to be so dangerous that elimination of the individual was the only way to keep the rebellious thoughts from spreading. There are many other cases of individuals being persecuted for their nonconventional views. Victor Hugo, perhaps France's greatest writer and creator of *Les Miserables* and *The Hunchback of Notre Dame*, was forced to leave his homeland and go into self-exile to avoid being arrested by the French government because of his written attacks on that institution. Emile Zola, in response to writing *J'Accuse*, fled his homeland.

Exemplary Cases

Leni Riefenstahl was born on 22 August 1902. She is considered by some to be a war criminal and by others a film genius. Early on, she was a ballet dancer, painter, and actress; she was athletic and attractive. In 1932 she directed her first film and drew the attention of Adolf Hitler. Following his accession to power, he chose her to film a Nazi party rally. Riefenstahl used 36 cameramen and assistants to chronicle the rally in perhaps the most notorious documentary ever filmed, *Triumph of the Will* (1935). The film is a masterwork of montage, editing, camera angle, and *chiaroscuro*. After the Second World War she was imprisoned by the French for taking an active part in the Nazi propaganda machine and spent almost 4 years in various prisons and detention camps. She always contended she was merely a film-maker and had no intentions to support the Nazis. She later tried in vain to resurrect her career, failing several times to actualize filming projects in Africa and elsewhere, and worked instead as a still photographer for European magazines.

The French painter Gustave Courbet (1819–1877) was jailed due to his involvement as both an artist and an art administrator. Courbet served as chairman of the Art Commission under the short-lived commune; he was accused of having dismantled the Colonne Ven-dome and was imprisoned at Sainte-Pelagie, where he painted some fine still lifes. *The Stone-breakers* (1850) and *Burial at Ornans* (1851) were criticized as being 'distasteful.'

Edward Dmytryk (1908–present), a Canadian-born film director, made several socially oriented films in Hollywood in the 1940s. His fellow director Sam Wood appeared before the House Committee on Un-American Activities in the 1950s, during the great 'red scare' and blacklisting of perceived communists at the time, and gave Dmytryk's name as a possible communist sympathizer. Refusing to appear before the committee, Dmytryk was fired by RKO film studios and went to England to make movies there, unfettered by the severe limitations imposed in Hollywood by both the government and the

studio executives. Forced to return to the United States to renew his passport, he was arrested and jailed for six months. Later, he recanted and himself named names before the committee, and subsequently resumed making films in Hollywood.

In 1922 Gandhi (1869–1948) was given a six-year jail sentence, of which he served two years, for his nonviolent practice of mass civil disobedience. He was jailed for launching a civil disobedience movement that was pivotal in undermining the British political hold in India. His calling came to him late. In early adulthood, he went through a crisis in which he was a lawyer at his father's urgings. His efforts at law were disastrous; during one case before the bar, he reports in his autobiography that he got so tongue-tied that when he went to speak, nothing came out but a few incoherent stammerings. Gandhi's doctrine of 'passive resistance' was based on an idea he got from the American writer Henry David Thoreau.

Gandhi reports in his autobiography he had a succession of early experiences that shaped his vision of passive resistance. It was not, though, simply a matter of experiencing certain events, but rather Gandhi mentally operated on his experiences in such a way that it gave form and meaning to his philosophy and his actions. One of the most famous demonstrations of civil disobedience of all time was the Salt March of 1930, in which Gandhi demanded the abolition of the state tax on the sale of salt. The salt tax, he felt, was especially unethical and immoral since it had its greatest impact on the poorest of the Indian people. In pursuit of its abolishment, Gandhi organized a 165-mile walk to the sea so that people could procure their own salt. This demonstration brought a lot of empathetic international attention to Gandhi's cause and proved an enormous embarrassment to the British government. Subsequently, Gandhi and some of his followers, including Nehru, were jailed.

Emma Goldman (1869–1940) was an American anarchist; editor, and lecturer who devoted her adult life to social causes. She was born to Jewish parents in Kovno, Lithuania, and early demonstrated a rebellious spirit. At 16 years of age, she went to America with her sister, and they settled at Rochester, New York. In 1889 she moved to New York City to join anarchist causes. In 1893 she was jailed for nine months on a charge of inciting to riot after telling a crowd of unemployed workers to steal food and other things if they were in need. In 1906 she founded *Mother Earth*, an anarchist publication which she edited until its suppression in 1917. She was jailed again in New York in 1916 after giving a public speech favoring birth control. When the First World War began, Goldman opposed entry into the war, and was again jailed and sentenced to two years. When she completed her jail sentence, she was stripped of her US citizenship and deported to Russia. In Russia, she continued her anarchistic expressions and fled that country, fearful of social oppression and imprisonment. In 1931 she published her autobiography, *Living My Life*. While living and working in Toronto, she died from a stroke at age 70.

In Tahiti, in 1891, the artist Paul Gauguin (1848–1903) was jailed for writing a letter criticizing the local government officials. He was seen as a gadfly by the officials. Gauguin liked women. He set out to find one in Tahiti. At a neighboring village he was offered the hand of a young native named Tehura who was barely in her teens. Gauguin was immediately

attracted to her and she to him, and it was decided there would be a week's trial marriage to ensure that the partners were free of disease and willing to freely extend the relationship. After a week, she agreed to remain permanently, and, with Tehura by his side serving as a model, the artist was inspired to work hard and executed many works of his nude wife, including the famous, *The Spirit of the Dead Is Watching*.

Galileo Galilei (1564–1642) was considered a criminal for extending Nicolaus Copernicus's idea that the Earth was not the center of the universe. Nicolaus Copernicus (1473–1543), the noted Polish astronomer, outlines his theory that the Earth revolves around the Sun in his great work, *De Revolutionibus*, which was published in the last year of his life. For this reason, it is quite likely that he avoided societal repression, which is not the case for Galileo. Galileo had a history of confrontation as well as being an independent thinker. As a child he was an annoyance to his teachers; he questioned and contradicted at every turn. His father wanted him to be a physician but the youthful Galileo chose science. As a scientist, he entered Pisa University as a student in 1581. At 19 years of age he observed a swinging lamp in the cathedral at Pisa which led him to investigate the properties of a swinging pendulum. When only 25, he taught math at the University of Pisa. After three years he was forced to resign, in trouble due to his original ideas and forceful expressions. In 1592 he became professor of mathematics at Padua, where he made a telescope and his observations led to a number of discoveries that marked a scientific revolution in astronomy. Galileo discovered the satellites of Jupiter, supporting the planetary theory of Copernicus. In 1592, he moved to Florence as mathematician to the Duke of Tuscany. He observed sun spots and the existence of Saturn. From 1613 to 1615 he was confronted by the Holy Office of the Church and warned not to teach his neo-Copernican doctrine. In 1632, Galileo promulgated his great work, *The Dialogue of Two Systems of the World*, and the controversy of planetary motion was reopened. Summoned to Rome by the Church, he recanted and was placed under house arrest in Florence. He spent his remaining years there, becoming blind in 1637 and dying in 1642.

Aphra Behn (1640?–1689) has often been referred to as the first professional English woman writer to earn a living from her writing. Before she became a writer, Behn was employed in 1666 as a secret agent for the English government. As part of her assignment, she went to Antwerp to gain information about exiled Cromwellians and to relay Dutch military plans. During her activities as a secret agent, she used the name 'Astrea' as her alias; she would later use the name 'Astrea' as her literary name. She ran into enormous debts incurred during her royal service, and in 1667, when she returned to England, she was detained in a debtors' prison. Behn suffered enormously. She pleaded to the King to pay the debt. She wrote to a friend:

I have cried myself dead and could find in my heart to break through all and get to the king and never rise till he were pleased to pay this, but I am sick and weak and unfit for that or a prison. (Todd, 1992).

A generous friend, who remains unknown, eventually paid her debt and she was free to pursue her writing career. Behn entered the theatre as a playwright in 1670. She became a

literary celebrity, achieving success and fame as a playwright. Her prefaces to her plays openly defended her right as a woman to earn a living through the efforts of her pen. Two of her most frequently anthologized plays are *The Rover* (1677) and *The Lucky Chance* (1686). In 1687 she found herself in trouble with the King yet again. She offended King Charles II by attacking in an epilogue to her play, the King's illegitimate son, the Duke of Monmouth. She was arrested and briefly imprisoned for this offense. In the last years of her life she turned to fiction writing, and wrote more than a dozen novels, including *Oroonoko* and *Love Letters Between a Nobleman and His Sister*. The latter novel was based on the true scandalous story of the elopement of Lord Grey of Werk with his wife's sister, Lady Henrietta Berkeley. The novel was a best-seller. Behn had long been praised in literary circles as 'sole Empress of Land of Wit' (Todd, 1992). Her fame earned her a burial in the prestigious Westminster Abbey.

Daniel Defoe (1660–1731) turned to writing after his various business ventures failed. In 1702, he wrote a pamphlet, *The Shortest Way with the Dissenters*. Himself a Dissenter, Defoe, in the pamphlet, took a satirical stance by demanding the suppression of Dissenters. The pamphlet was judged to be critical of the Anglican Church of England. Defoe was ordered to pay a heavy fine, was ordered to stand in the Charring Cross Pillory, and sentenced indefinitely to Newgate Prison. He was released from prison with the help of Robert Harley, Tory Minister, for whom Defoe undertook intelligence and propaganda work. But Defoe's legal troubles did not end. In 1713 he was arrested for debt twice. He worked to recover his fortunes by serving as a political spy and propagandist for the successive Whig ministries, and by writing fiction. Defoe's most famous work of fiction, *Robinson Crusoe* was published in 1719. The novel was an immediate success, and became one of the top three best-selling novels of the eighteenth century. Defoe went on to write several more successful works of fiction, including *Moll Flanders* (1722), and *Roxana* (1724). Despite his financial gains from fiction writing, Defoe died in debt, hiding from his creditors.

The Zeitgeist and the Individual

Creativity by its very nature involves nonconformity and a departure from old, traditional ideas. There are mechanisms of society – roles, paradigms, habits, accepted ways of doing things – that resist change. However, a Zeitgeist – the entire philosophical and spiritual temperament of a culture – can vary as to the receptivity to new ideas. Einstein, for example, overturned Newtonian physics and was a hero; Galileo, on the other hand, overturned the then-conventional view that the Earth was the center of the universe and was condemned, detained, and forced to recant.

Certainly, many creators were immediately recognized by their contemporaries, such as William Shakespeare, Charles Dickens, Albert Einstein, and Walt Disney. On the other hand, some creators encountered enormous resistance to their ideas, such as Courbet, Egon Schiele, Walt Whitman, Charles Darwin, and Ignaz Semmelweis. In the case of Semmelweis, it might be said that today's rebellion can become tomorrow's conformity. In 1847, Ignaz Semmelweis (1818–1865), a Hungarian

physician, got the idea that patients were contracting puerperal fever due to the pre-examination procedure of the doctors. The disease, he reasoned, was being carried to the patients on the hands of the medical staff, and he devised a procedure in which the hospital personnel washed their hands immediately before the examination with a solution of chlorinated lime. Unfortunately, his ideas were not well received. He embarked on a crusade to have his procedure accepted, and in a great part due to the public ridicule and resistance that his idea received he had a mental breakdown and was assigned to an asylum in 1865. Some time later, Pasteur followed up with Semmelweis's discovery, and, partly because people were more willing to accept the idea and partly because Pasteur was a better salesperson than Semmelweis, the notion of washing hands in chlorinated lime before medical examinations found wide acceptance.

How the perceptions of *Zeitgeists* vary regarding deviance can be seen by comparing Lewis Carroll (1832–1898) and Egon Schiele (1890–1918). Both men used nude, under-aged girls as models; Carroll photographed them and Schiele painted them. However, Schiele was jailed for lewdness and Carroll was not. Carroll's *Zeitgeist* was nineteenth century and pre-Freudian; people did not see sexual implications in his conduct. Schiele's *Zeitgeist*, on the other hand, was twentieth century and post-Freudian; there was a heightened sensitivity to the sexualization of children and a changed attitude about a child as a sexual cathexis for an adult. Whether a given act is perceived as deviant, and leads to societal repression, depends in part on the nature of the act within the societal framework or *Zeitgeist*, and in part on what society does about it. There is another issue to consider. Even when an individual is persecuted by society, often there is a fence that divides supporters from detractors. Freud and Darwin, for example, were condemned by the religious community but staunchly supported by some members of the scientific community to which they belonged. A further dichotomy can be made. For some individuals, part of their total work might be accepted while another part is rejected; the sculptor Epstein provides an example of this type of division.

One of the most repressive *Zeitgeists* to be found historically is the society headed by the Nazis in Germany in the 1930s and 1940s. Many works of art, including paintings and musical compositions, were banned. The Nazi government sponsored art shows that displayed 'decadent' art (the artist/teacher Paul Klee was included). Many famous people, including Albert Einstein, Sigmund Freud, and the composer Richard Strauss, fled Germany to avoid persecution. In fact, German scientists who fled Germany played a pivotal role in developing military technology that helped win the Second World War for the United States and its allies.

Crime, Creativity, and Paradigms

Thomas Kuhn introduced the idea of a paradigm shift. Paradigms are patterned knowledge bases that are culturally shared to explain and give meaning to phenomena. Kuhn suggested that societies have paradigms to explain experiences. A paradigm will exist, according to Kuhn, until a better one comes along. In pre-Copernican days, for example, people believed

that the Earth was the center of the universe. Copernicus and Galileo suggested a different paradigm in which the Earth circled the Sun. The new paradigm was not warmly received by everyone, since it contradicted cherished beliefs. Extending Kuhn's idea of paradigm, we introduce a distinction between 'hard' paradigms and 'loose' paradigms. A hard paradigm is one in which cherished beliefs are protected and maintained for a number of reasons, including emotional, philosophical, and personal. On the other hand, a 'loose' paradigm has gaps, questions, and omissions for which people beg for answers; it welcomes a new perspective. Galileo stepped into and confronted a 'hard' paradigm; people who supported the prevailing *Zeitgeist* that existed prior to Galileo's theory were not interested nor motivated to seek or explore new explanations. Galileo was imprisoned. Einstein introduced his theory of relativity to a *Zeitgeist* that welcomed a fresh, novel, organized theory that explained the currently unexplainable. Einstein was a hero in the United States. He is a cultural icon. His face can be seen on t-shirts as well as innumerable posters.

The Psychology of Rebellion

By rebellion, the individual both affirms uniqueness and establishes a principled connection with all of humanity. It is, for example, an appropriate and normal part of a child's development to rebel. There are at least two important phases of developmental rebellion that all or most people negotiate: (1) the 'terrible twos' and (2) adolescence. Around two years of age, it is normal for the child to say 'no' to a host of demands from its caregivers. This negativism allows the child the opportunity to test the waters of autonomy. Adolescence, in addition, is notorious as a period of rebellion, and quite likely is a crucial epoch for the adolescent to establish an identity separate from the identities of others. Negativism as affirmation is part of the normal development of the self.

Creativity commonly involves two struggles: the struggle to have one's ideas accepted and the intrapsychic struggle for order. Creativity is an inner struggle to rebel against chaos, apathy, and death. All rebellion, ultimately, is a rebellion of the self.

We all have daily instances where deviance not only confirms our identities but also is an antidote for alienation in the face of oppression and impersonal conformity. Some individuals, however, for example, Gandhi and Galileo, go considerably beyond a daily, commonplace nonconformity.

It seems self-evident that there are times when conformity is a good and useful thing. For example, it is important for automobile drivers to conform to the rules of driving, otherwise there would be total chaos on our roads; individualized patterns of driving would be very dangerous, and it would be impossible to predict what any given driver would do. On the other hand, the conformity of blindly sending people to their deaths by execution during Hitler's regime was a bad type of conformity.

Probably the single most prevailing symptom of ineffective rebellion is the individual's unwillingness to understand or pay the price of the rebellion. Effective rebels are fully aware of the consequences of their decisions and actions. Benedict Arnold presents an example of ineffective rebellion. In 1777 Congress

passed over him and appointed five generals for the army. He was upset about this injustice, and General George Washington wrote that he intended to correct the unfair decision. In spite of Washington's support, Arnold was not promoted. Later, in 1778, he was promoted to a command in Philadelphia, but soon became involved in arguments with the local authorities, and was court-martialed. The court-martial decided that he be reprimanded by his commander, who was Washington. Washington reluctantly executed the request, and assured Arnold that he had his support. In 1780, Arnold was given a command at West Point, and apparently his bitterness resulted in his immediate plotting to surrender West Point to the British. The rest is history. The plot was uncovered, the British gave him refuge, and his name became associated forever with backstabbing treachery. He died in obscurity, despised by both Americans and British alike, his name forever linked with heinous deception.

The philosopher Kahlil Gibran has said that 'tolerance is strength'. Societies need not only to recognize their creative individuals but additionally need to afford a supportive climate that allows for a variety of perspectives. A social tapestry that is composed of a narrow, dichotomous range of values – for example, Nazi Germany – is aesthetically, emotionally, and philosophically empty, and lacks the internal integrity and energy for its own survival. Variety is strength, as Darwin well knew. It is not only a need to change that which currently exists but especially a love of life that motivates the creator to seek change. Love and the will to transform that which is loved are interconnected aspects of the creative process. Paul Klee noted that the creative life is one that finds delight in the presence of the seemingly most mundane events. Extraordinary creativity commonly requires extraordinary courage to pursue a vision in

the face of criticism, oppression, and the recoil of the emotional investment society has to continue what is, even though what is may no longer work or is not justifiable for ethical and moral reasons.

See also: The Dark Side of Creativity; Definitions of Creativity; Deviance; Mahatma Gandhi 1869–1948; Moral Issues in Creativity; Theories of Creativity; Zeitgeist.

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Critical Thinking

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Glossary

Convergent thinking Whereas divergent thinking allows the individual to find numerous and original ideas, convergent thinking allows the individual to find the one correct or conventional idea.

Divergent thinking This refers to the process of finding different solutions and answers to one problem.

Evaluation Evaluating involves the determination of the adequacy of a solution to a problem. It will play a major

role in determining what is and what is not considered creative.

Stage model of creativity This model maintains that the creative process involves different stages in a sequence. Critical thinking might be more important in later stages of the processes than at the beginning.

Valuation This process is selective, but it is not critical, nor evaluative. It involves mainly the identification of specific criteria.

Introduction

For some time, creative thinking was seen almost as synonymous with divergent thinking. Divergent thinking tests provided a sound alternative to the, by that time popular, IQ tests. Their validity and predictive power for creativity made them a widely used tool in creativity research, to the point that divergent thinking tests were seen as criteria for creativity. However, nowadays it is generally accepted that creative thinking also entails convergent and critical thinking. While divergent thinking involves the generation of ideas, convergent thinking refers to the capacity to provide a single (or few) adequate idea(s). Creativity is usually associated with the capacity to produce something new and adequate. Divergent thinking would be needed to generate ideas, and convergent thinking would be used for choosing adequate ideas. Critical thinking can be considered as a part of convergent thinking. It involves the evaluation, analysis, synthesis, and interpretation of something to provide a judgment. Critical thinking, thus provides the 'why' and 'how' of choosing one idea. In this sense, as creativity, it is always seen as a higher-order skill.

Aspects of Critical Thinking

As in the case of creativity, there is a lack of an agreed upon operational definition of critical thinking. However, there are certain aspects that are commonly addressed within research on critical thinking. Research in critical thinking is usually associated with two main traditions, one more psychologically oriented and focused on teaching meta-cognition skills – thinking how to think – and one more philosophically oriented, more interested in the ontological nature of the phenomena of thought and judgment.

In general terms, critical thinking is seen as a purposeful skill. This means that critical thinking is related to dispositions. As in the case of creativity, to be a critical thinker involves not only specific cognitive abilities, but also willingness to assess and evaluate information in a critical manner. In other words, the intention of a person to be critical is crucial to developing

critical thinking skills. In this sense, critical thinking has been seen as self-regulatory judgment.

Second, critical thinking generally involves the analysis and identification of central issues and assumptions. That is to say, critical thinking requires analyzing how arguments and thoughts are constructed and if they are robust in their formulation. Linda Elder and Richard Paul from the critical thinking community divide the elements of thought into point of view, purpose, questions at issue, information, interpretation and inference, concepts, assumptions and implications, and consequences.

Third, these elements of thought are evaluated in order to provide a judgment. This judgment, a single 'correct' answer, is generally based on the application of logical thinking. Because of this, certain advocates of critical thinking have maintained that critical thinking is about providing standards of thought. Judgments should be evaluated in terms of clarity, credibility, accuracy, precision, relevance, depth, breadth, and significance.

Finally, critical thinking is always associated with the identification of bias in ideas or statements.

From the above aspects, it can be seen that critical thinking can be considered a specific form of convergent thinking.

Critical Thinking in Relation to Creativity

Critical Thinking and the Stage Model of Creativity

Critical thinking and creative thinking have different conceptualizations. For this reason there are diverse perspectives on the relationship between critical thinking and creativity. A sequence or stage model of creativity would involve the idea that critical thinking is used in specific stages of the creative process, while it would, in fact, inhibit creativity in other stages. It is generally agreed that the first phases of the creative process involve divergent thinking and should not involve critical thinking. This is the case, for example in brainstorming techniques. In the first stage, brainstorming session participants are only asked to generate ideas, irrespective of their quality and without being critical about them. This idea relies on the assumption that the human mind adopts 'modes'

of thought for action, and that if one is set to use divergent thinking, without use of a regulatory mechanism that blocks inadequate ideas, these will flow more freely and easily. This is also the basis of some other creativity techniques developed by Edward de Bono, such as 'six thinking hats.' The technique consists of making people in a group work with imaginary hats on. Each of the hats determines what type of mental process the person is allowed to carry on at that specific time. A white hat, for example, involves the collection of facts and information, a red hat deals with the feelings and emotions associated with the problem, a black hat represents critical judgment, a yellow hat represent positive judgment, a green hat stands for new ideas, and a blue hat represents the mode of seeing the big picture. There is however no conclusive evidence on the claim that this is the way the mind works, and it is not clear if in a creative process a clear separation between divergent and convergent modes of thinking is strictly necessary.

First, providing a creative solution might involve critical thinking from an early stage. If critical thinking is understood as the capacity to produce self-regulatory judgment that results in interpretation of a phenomenon, then critical thinking is crucial for problem identification. As Mark Runco indicates in the conclusion to the book *Problem Finding, Problem Solving and Creativity*, problem finding skills constitute an important aspect of creativity. Problem identification derives from critical thinking, and thus creativity would be enhanced by it from the beginning. Even further, it may also be the case that critical thinking fosters the creative process during phases of generating ideas. Creativity involves the combination of complex, sometimes opposed cognitive, personality, and social characteristics, and it seems that the creative process is nurtured by movement between these opposite extremes. If this were the case, critical and convergent thinking might play a role in each of the phases of the creative process, and not just the final stages.

Critical Thinking and Intelligence

Another possible interpretation of the relationship between creative and critical thinking relates to intelligence. In most cases tests of intelligence involve convergent thinking skills. Items on tests of intelligence frequently have only one correct answer. It is thus necessary to critically evaluate the options provided. There seems to be evidence that the relationship between creativity and intelligence involves some sort of threshold, below which no creative performance is possible. Individuals above the threshold might or might not be creative. Below the threshold individuals lack basic information processing skills and are relatively uncreative. In this view, critical thinking will relate to creativity, but only above a certain threshold. That is to say, individuals without some threshold level of critical thinking will not be able to be creative.

Critical Thinking and Persuasion

There is another possible interpretation of the relationship between critical thinking and creativity. More and more, creativity research is acknowledging persuasion as an important component of the creative process. Creative individuals are

those who are not only capable of producing new adequate ideas, but who also have the capacity to 'sell' their ideas, so that the idea is taken further. This type of interpretation of creativity is more prominent in research related to innovation and economic perspectives on creativity. According to this approach, critical thinking is crucial in order to provide adequate arguments that make the idea attractive. This relates very much to the critical thinking movement, which calls for certain standards of thinking involving clarity, credibility, accuracy, precision, relevance, depth, breadth, and significance. It is likely that creative individuals with good persuasive abilities employ some of these elements when making an idea appealing to others.

Critical Thinking and the System Theory of Creativity

Yet another possible relationship between creativity and critical thinking can be taken from the system theory perspective. In this theory, Mihaly Csikszentmihalyi proposes that creativity can only be understood in terms of the interrelationship among three elements: the individual, the domain and the field. The domain refers to specific areas in the 'culture' where the creative product has been constructed: mathematics, poetry, music, etc. Thousand of domains compound the culture. The field refers to all the individuals who act as gatekeepers to the domain. They evaluate whether a product is or is not creative. The actor refers to the individuals who pursue the creative action. In this theory, critical thinking will also play a role not only in the individual who carries out the creative action, but in the validation of what constitutes creativity and what not. If creativity is, as understood by Csikszentmihalyi, "a post-hoc social attribution to new ideas and objects that find favor in the marketplace of ideas or of commodities" then critical thinking is important for creativity. In fields where the gatekeepers have limited critical thinking capacity, the acceptance of innovative ideas might be easier than in those where critical thinking is prominent. These aspects relate to the distinction between evaluation and valuation. Evaluation will mainly look at what is wrong with the options, while valuation will focus on the positive sides of the idea. These two (evaluation and valuation) are important in assessing whether a product can be regarded as creative or not. It is likely that valuation plays a major role in the determination of the originality of a product, while evaluation will be more important in determining its adequacy.

Critical Thinking in Education

Creativity and critical thinking are usually seen as cross-curricular competencies included explicitly in the syllabus or in the national curriculum. The promotion of both creativity and critical thinking has been made a political priority in many countries. However, it is less clear if creativity and critical thinking are actually being encouraged in education.

It seems reasonable to think that convergent thinking has an advantage over divergent thinking in educational settings. Group work might require conformity and convergence among individuals. The form of education still most prominent

usually involves a teacher giving a talk in front of the students and asking questions that have only one adequate answer. Traditional teaching has usually been done in a transmission manner, where teachers 'pass' knowledge to their students. In addition, convergent skill tasks are also easier to grade in a traditional manner, since they involve one correct answer. Within this traditional pedagogy, however, critical thinking has had a certain amount of support, probably more than creativity. From a philosophical tradition, the so-called Socratic system involves a series of questions and answers between the teacher and the student. Through the creation of a dialectic process between the teacher and the student, the latter can discover new knowledge as he or she is guided critically through his or her assumptions and structures of thought. In this way, students can learn to be critical thinkers.

However, some people maintain that increasing critical skills will be associated with a constraint in providing original ideas. As has been explained above, however, this is not necessarily the case. It is likely that critical and creative thinking are not independent, but it also seems likely that there is some interaction between the two, since the creative process most probably involves some aspects of critical thinking.

Conclusions

Critical thinking can be seen as part of the more general convergent thinking skills that involve the production of one correct answer. The relationship between creativity and critical thinking will depend on the different conceptualizations of the constructs and what aspects of each of the processes are taken into account. The stage model approach to creativity helps to resolve the apparent paradox between creativity involving both, critical thinking and divergent thinking. In different moments, the creative process involves different cognitive tools. Critical thinking might play a role, not only at the end but also during the creative process. Furthermore, critical thinking involves valuation and evaluation, which are necessary for problem identification and persuasion, as well as for determining the originality and usefulness of ideas.

See also: Divergent Thinking; Economic Perspectives on Creativity; Intelligence (as Related to Creativity).

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Relevant Websites

- <http://www.criticalthinking.org> – The Critical Thinking Community.
- <http://philosophy.hku.hk/think/> – Critical Thinking Web.
- <http://eduscapes.com/tap/topic69.htm> – Critical and Creative Thinking - Bloom's Taxonomy.
- <http://lateralaction.com/articles/critical-thinking/> – Why Critical Thinking Is Not a Creativity Killer.

Cross-Cultural Differences in Creativity

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Glossary

Cross-cultural Comparing, or dealing with, two or more different cultures.

Culture A group of people, usually living within one country or region, who have shared motives, values, beliefs, identities, and interpretations or meanings of significant events that result from common experiences of members of collectives and are transmitted across age generations.

Individualism – collectivism The strength and cohesion of bonds between people; in individualist societies people are

independent and take care of themselves, whereas in collectivist societies they are part of a larger group to which they are responsible.

Power distance The amount of independence individuals have in their society and the extent to which government or authority exerts a controlling influence.

Uncertainty avoidance The extent to which people feel uncomfortable in new or unknown situations.

Introduction

This article examines how creativity is defined by culture, in what ways different cultures encourage or discourage creativity, how some countries are working to develop creativity, and briefly considers the assessment of creativity cross-culturally. It includes a summary of the results of a number of research investigations into creativity and cross-cultural differences. For the purposes of the article, a small piece of research was also carried out in which a number of highly-respected creativity researchers were asked for their views about creativity in their own countries. Combined with existing research on creativity within and across various cultures, this article aims to present some of the key thinking about this issue in an accessible way. There are some common themes, findings, and experiences which transcend cultural boundaries, but also important differences as well.

The picture is complex and its interpretation is made more difficult both by gaps in the research data and sometimes by the use of research instruments designed for one culture and used in quite a different one. Indeed, Raina criticized the narrow *ethnocentric* boundaries of most creativity research and argued instead for a *garland making perspective on creativity and cultural diversity* - one which allows a diversity of approaches to flourish and which recognizes the complexity involved:

Be like a garland maker, O king: not like a charcoal burner.
(Mahabharata in Raina, 2004: 27)

As Raina explained, this famous metaphorical statement contrasts the creation of a garland of many flowers and colors against a charcoal burner burning all kinds of diverse wood into a homogeneous dead matter. He stressed the importance of building on the insights of both East and West:

... [considering] creativity as an infinite and endlessly diverse phenomenon which provides meaning and purpose to many in life and a sense of human purpose in relation to [the] cosmos ... [rather than] universalising a particular culture and inferiorising or ridiculing others' discoveries in various domains as only myths.
(Raina, 2004: 27)

In 2002, The Creativity Centre ran the international conference *Creativity and Cultural Diversity* in the United Kingdom, because a great deal of creativity research had been focusing primarily on a white Western approach, largely ignoring contributions from other cultures. Indeed, much cross-cultural research which had been carried out before this date tended either to use US testing methods or focus on a Western definition of creativity. This was something the conference organizers sought to address, and the publication following the conference, also entitled *Creativity and Cultural Diversity*, aimed to go some way toward addressing this imbalance in perspectives.

Since then however, it appears there has been a small increase in research published internationally which has been carried out from different cultural perspectives, and it does seem that many of those working in the field are now recognising that there is more than one approach to defining and assessing creativity.

Making Cross-Cultural Comparisons of Creativity

One of the difficulties to be faced when making cross-cultural comparisons of creativity is that it is often defined in different ways. This can happen both between cultures and even within cultures, for example, within subcultural groups or different classes in a society.

The Influence of Language on Creativity Definitions

In many languages there is more than one word to denote creativity. For example, in English there is often great confusion between *creativity* and *innovation* which have many overlapping features and tend to be used interchangeably. In Polish it seems there is a similar overlap between the words *twórczość* and *kreatywność*. According to Kwasniewska, *twórczość* is used in an artistic context, to describe the sum of one's creative work rather than one's potential. It is most often used to describe the fact that a person creates something. *In this meaning it is more important that something comes to life than the fact that this thing is*

unique or novel. For scientists however, *twórczość* always needs to be both novel and valuable.

Kreatywność is used in business contexts, to describe one's intellectual potential rather than one's work, as a feature of character. So in Polish you would say that a person, but not a picture, is *kreatywny*. The term *kreatywny* often means that someone is innovative and produces novel ideas (although these are not necessarily valuable).

According to Lubart, this was described a little differently by Necka, Groham, and Slabosz, who used *twórczość* to refer to eminent creativity works, whereas *kreatywność* refers more to everyday creativity, or a personal trait.

With regard to India, as India is a multilingual country, each language has its own word for creativity which may not exactly translate into an English meaning. As well as this, in India creativity tends to be viewed as a faculty which is distinct from intellect. In this context it is known as *pratibha* or intuitive creative power. In Hindi, the terms *srijanatmakata* and *sirksa* are used for creativity. The root *sri* means – to produce, to create, procreate, let go, let loose, and release. *Sirksa* means intending to eject, wishing to create and produce.

Even when the definitions are the same, there is often variation in how different elements are valued or prioritized over one another.

The Focus of Interest: Product Versus Process

Some cultures place most value on creative products, whereas others see creativity more as a process. In Western cultures much of the focus is on producing a novel or original product. Lubart contrasts this with an Eastern perspective “in which the key to creativity is the process more than the result. The creative process is cyclic, non-linear, and enlightenment-oriented.” This was reinforced by Fryer–Bolingbroke’s survey. For example according to Sharma-Sen, in India creativity is seen as self-actualization, self-fulfilment, and self-realization. In Indian creation mythology, “the creator lets flow out of himself a part of his substance which progressively evolves into the world and then enters his world as himself (atman).”

Jackson and Messick’s Creativity Criteria and Their Cross-Cultural Relevance

Although it has been widely accepted that it is useful to adopt some common criteria for defining creativity, even these pose challenges for a cross-cultural approach. For example, the four creativity criteria (*novelty*, *transformation*, *condensation*, and *appropriateness*) identified by Jackson and Messick have proved invaluable for creativity researchers, but these do not always translate well across cultures.

Novelty

In the West, novelty in some form is normally regarded as a necessary, if not sufficient, condition of creativity and it is the impact a novel product or process has which determines whether or not it is seen as creative.

To assess whether a creative product could be regarded as novel in a global sense would require a high level of specialist

knowledge. On the other hand it can be argued that a creative product is novel for the person who made it (for example a child doing something for the first time, with no knowledge of what has gone before).

Societies also vary in terms of the amount of novelty they will tolerate. To illustrate this Cropley gave the example of the sentencing of Galileo in 1633 for supporting the Copernican position that the earth orbits the sun.

According to Sharma, in India, among the traditional rural semi-urban people, creativity is perceived as the skill to create artefacts, which they believe need not be original every time. However, whether such artefacts can legitimately be called creative is a matter for debate and depends on who is qualified to judge. Sharma went on to say that “among the urban educated, the Western notion of creativity (implying novelty, originality) is accepted.”

Transformation

In Western cultures there is an assumption that a highly creative new product demonstrates a radical shift in approach. However this may not be the case in some Eastern cultures. Lubart described how Li compared Chinese ink-brush painting and modern Western painting:

Chinese ink brush painting was viewed as a “vertical” domain in which some elements are essential in each work, and certain aspects can be modified ... In contrast, modern Western painting is a horizontal domain with novelty allowed, supposedly, on all aspects. Thus, novelty can occur “in all directions” in modern Western painting, but only in certain directions in Chinese ink brush paintings. (Lubart, in press)

According to Lee, when Malaysian creativity researcher, Leonard Yong, studied the creativity of Japanese people in the early 1990s he concluded that, like other South East Asians, their main characteristic was elaboration, meaning they tended to improve on existing products rather than transforming them into completely new ones.

Condensation

Jackson and Messick described condensation as “the capacity to allow continued contemplation without exhausting meanings and implications.” This criterion seems more appropriate for great works of art, music or literature, rather than, for example, an invention. Perhaps this is the most culturally transferable of Jackson and Messick’s four criteria.

Appropriateness

This concerns the extent to which a product is appropriate to its context. Paletz and Peng used an implicit theory approach to explore the validity of *appropriateness* and *novelty* amongst over 400 students from Japan, China, and the United States. To do this they used repeated measured scenarios of cooking and textbook products. They concluded that appropriateness was more important for Americans and Japanese for evaluations of creativity and desire for products. They also concluded that whilst novelty was important for them all, the Chinese were more swayed than the Americans by the novelty manipulation with regard to their degree of desire for the product.

The Social Context of Creativity

The fact that creativity does not exist in a vacuum, but in a social context has long been stressed both by Stein and Cropley. Cropley (an Australian who spent much of his career working overseas) argued that society is ambivalent about creativity and that two opposing forces are operating: conserving forces which resist change and innovating forces that favor it. Importantly he noted that that not all conservation is reactionary or undesirable and not all innovation is beneficial. Furthermore, creativity can be achieved through evolutionary as well as revolutionary change.

Evidence that societal goals and cultural values influence the focus of creative endeavor was put forward by Razik who argued that economic needs and the political situation have tended to influence assumptions about creativity. He pointed out that in the United States even though the Progressive Education Movement, which focused attention on the creative qualities of children, was widespread as early as the 1930s, it was only after the Second World War "in the presence of the Russian threat, creativity could not be left to the chance occurrence of the genius . . . it had to be a property in many men . . ." Razik stated that it was when the need for creative individuals was great, that people began to entertain the possibility that perhaps anyone could be creative and that creativity was amenable to education. Cropley described how in the United States, the National Defence Education Act adopted a concept of creativity which went beyond its earlier aesthetic definition, to one in which creativity was seen as a key factor in society's prosperity and survival, thus launching the age of social creativity.

'Eastern' and 'Western' Perspectives on Creativity

Raina articulated what many literature reviews strongly suggest, that "theories of creativity derive from cultures' creation myths." The word *derive* seems important here since (if he is interpreted correctly) he was referring to the religious basis of creativity in each culture, whether Indian, Greek, or Judaic, for example. Hussain also emphasized how Islam laid the cultural and scientific foundations of the modern world.

It may, therefore, seem easy to simplify the cultural differences in creativity by grouping them into roughly Eastern and Western cultures, but this is not what Raina was arguing since he pointed out that: "creative thought in the Oriental traditions cannot be treated as a single, undifferentiated entity . . ."

So, whilst there are some significant differences between East and West in terms of creativity and culture, the situation is really more complex than this. This argument is also backed up by Kapur, Subramanyam, and Shah who drew attention to the similarities between Indian and Western scientists.

Furthermore, Hussain argued for the importance of understanding how people see creativity in order to help them improve and to do this it is important to understand the traditional bases for their creativity. He pointed out that Eastern philosophies like Buddhism and Taoism suggest that there is a need to loosen control and let the mind be free, because as soon as a person tries to create, 'to do,' they start controlling. Instead of forcing it they need to give it a chance to 'come,' although in his view this does not work for everyone.

According to Lee, in his controversial thesis *Why Asians are less creative than Westerners*, Singaporean Ng Aik Kwang described Asian society as hierarchical, tightly organized and collectivist. There is an emphasis on social order, harmony and gaining approval and a negative view of conflict in society. By contrast, he argued, Westerners are loosely organized with fewer social rules and norms to adhere to. They are individualistic and egalitarian, encouraging open and democratic exchange of ideas between individuals to develop creative potential. They are less negative about conflict in society. Therefore, he concluded, Asians are less creative. However, in her book, *Creative Malaysians*, Lee provided a series of examples of creative people in Malaysia and other countries in South East Asia. Therefore, she argued, it is too simplistic to assert that Asians are less creative than Westerners. Co-author Yong studied 16-year-old Malaysian students and found (not surprisingly) that their creative abilities were comparable to American students of similar age.

Yong believes that Southeast Asians also tend to display a similar type of creativity to Japanese people, who he argued are good at elaboration, or building on existing ideas. The idea of Southeast Asians as elaborators is also backed up, according to Lubart, by Westwood and Low who cited examples of creativity in a Hindu perspective, in which traditional truths are revealed in a new way, and classic Chinese visual art, in which a well-known topic represented with a certain style is explored in a new way.

According to Hussain, whereas the West relies on a scientific approach of hypothesis building and the search for evidence, the traditional Eastern system places great emphasis on building a solid foundation and then building up basic knowledge step by step. But he maintained the downside of this approach is an over-emphasis on the foundations and rote learning – something which he suggested has "robbed people of the initiative to make bold hypotheses about new situations and new problems." Another distinctive trait of Eastern culture he identified is humility in learning.

In Confucianist-influenced societies, such as China, Taiwan, Singapore, Malaysia, and to some extent Japan, the teacher is seen as the master of knowledge who must be respected, and challenging those views can be seen as inappropriate. According to Sharma, in India school children are expected to comply with authority, and follow their teachers' (gurus') instructions. The unwillingness to question the authority of teachers has emerged in a number of countries, although of course this is not universal within or across cultures.

Other researchers have drawn attention to features of Asian cultures which can foster creativity, including an emphasis on collectivism which can encourage working together for incremental innovations. They also highlighted the fact that Asian cultures often encourage long-term goal setting and perseverance which would be beneficial to creativity.

Hussain highlighted the incredible creativity and inventiveness of Chinese society as well as the outstanding works of great thinkers like Confucius. But despite all these achievements, he suggested that there have been no similar breakthroughs in the last 1000 years. He ascribed this change to a lengthy period of feudalism and the "rigid and deeply entrenched Imperial Examination System." He contrasted this

with a much shorter period of feudalism in Europe followed by the Renaissance, and later the Industrial Revolution. He concluded that the historical conditions in the West over the past few centuries have been very favorable to creativity and inventiveness, whereas in the East the historical conditions have been less favorable. But, he argued, the Western emphasis on individual achievement over collective effort also has its disadvantages: although it can spur people on to greater accomplishments, it results in self-centred individualism which indirectly affects creativity.

One of the ways researchers have tried to make sense of all these contrasting features of different cultures is by adopting categories such as those featured in Hofstede's study of IBM's international employees:

- Individualism–collectivism
- Power distance relationship
- Masculinity–femininity
- Uncertainty avoidance–uncertainty acceptance

According to Lubart, in studies of national inventiveness and innovation, it appears that societies which feature individualism, low power distance, and low levels of uncertainty avoidance are more likely to be inventive and innovative. However countries with high levels of individualism may struggle with idea implementation, as this stage often requires a team effort.

Obviously the picture is more complex and individual cultures cannot be classed as simply as Hofstede's criteria might suggest. Within every culture there will be pockets of creativity as well as sections of society who resist creativity. For example, citing Lau, Hui, and Ng, Lubart explained that "Chinese culture is complex and cannot be reduced to being simply 'collectivist'."

But as Hussain pointed out, both Eastern and Western cultures and civilizations have made outstanding contributions to the arts, mathematics, science, and technology which influence our thinking and our lives, alluding to the role religion has played in this, whether Buddhism, Christianity, Hinduism, or Islam.

But what Hussain stressed most strongly is the benefits to society of a synergy between Eastern and Western thinking and creativity:

[By drawing on] the essence of Eastern and Western cultures, and seeking a new direction amidst the clashes and contradictions, we can achieve a greater breakthrough in creativity for the mutual benefit of both East and West. (Hussain, 2004: 96)

Rasekoala, a Nigerian chemical engineer and champion of science education for young people, pointed to the way in which unfavorable conditions (in Africa) undermine creativity. This time Eurocentric values have, in her view, 'denied, undermined and marginalized' African perspectives on creativity and innovation which, she suggested comprise the:

crucial starting point in understanding the demise of advancement on the continent. Africans are still trying to come to terms with the trauma of the arrested development of their societies, through the often brutal interface of so-called Western civilisation. (Rasekoala, 2004: 11)

Their imposed values, she argued:

interrupted [Africa's] development path along cultural, spiritual and value systems that were uniquely theirs, having been handed down through generations. (Rasekoala, 2004: 11)

Such value systems, she suggested, had been the driving force for their creativity and innovation – in science, technology, and numeracy, for example.

Rasekoala provided examples of earlier African creativity, underpinned by their cultural and spiritual value systems, such as the Benin bronzes, the Ishango Bone and the Yoruba Number System. The driving force behind such achievements, she suggested, was the "cultural and spiritual need to pay homage to spirits and natural phenomena . . . deemed to be the powerful forces behind the creation and sustainability of the Earth such as the Sun, Moon, Stars, Thunder and Rain." But Christian missionary zeal, which converted many Africans to Christianity, labelled these cultural and spiritual systems as primitive and forms of paganism to be eradicated. This had a profoundly negative impact on the development and creativity of many Africans, she argued.

Paletz and Peng reached an important conclusion, which is to understand that:

Implicit theories of creativity may go beyond stereotypes about East – West differences . . . the nature of creativity is multifaceted: if we view it through the eyes of people across the world, we can better understand which aspects are universal and which are culture specific. (Paletz and Peng, 2008: 299)

Both Hussain and Rasekoala emigrated as children from their native countries (Pakistan and Nigeria respectively) to Britain. This in no way invalidates their perspectives, but the next section charts the views of indigenous creativity researchers about creativity in their own countries.

Perspectives of Indigenous Creativity Researchers

The famous researcher, Oppenheim, maintained that if you want to know something, sometimes the best way is simply to ask people. This is what has been done here, by contacting a number of creativity researchers around the world and asking them all the same questions. Not all were able to participate, but the answers of those who did are included below. This section includes snapshots of creativity and its development in eleven countries, Australia, Estonia, India, Japan, Malta, Poland, Portugal, Romania, Singapore, Spain, and the United Kingdom – personal views provided by distinguished creativity researchers from each country. Their perceptions could provide a valuable starting point for a more comprehensive comparative study since some interesting similarities and differences are revealed.

Please note that the summary from Estonia was based on students' views collected by their professor and the Japanese account was based on Fryer's experiences, in consultation with Japanese colleagues, together with the work of Torrance and Safter.

The questions asked were:

- How is creativity perceived in your country – what sort of definitions are used?

- What, if anything, is unique about creativity in your country?
- Is creativity valued in your country, if so why and if not why not?
- Is it valued only in particular contexts, for example, the arts, education, or at work?
- Have you undertaken any recent research which reveals more about the cultural approaches to creativity in your country?

Below is a summary of the responses received.

Australia – David Cropley

Australia has a strong tradition of invention and the cultural tradition of creativity is regarded as the first step in the process of innovation – something which probably links to early European settlers and those living in remote areas in modern times who had to invent out of necessity. However, most Australians would link creativity with art and culture rather than novelty.

In business and government, however, there is extensive interest in innovation, but rather than being seen as involving the generation and exploitation of new ideas and products, innovation tends to be seen as doing new business. So the focus seems to be mainly on the business and commercial aspect as opposed to things that are created and exploited or the characteristics of those involved in that. There is also a widely held belief that Australia is very good at coming up with novel products and processes but usually fails to exploit them, possibly because of a lack of scale and resources to do so.

Creativity is valued in an artistic sense and in schools. It is seen as enriching, and part of a diverse, mature, and healthy society. The Australian population is very diverse with a large proportion having been born overseas. The policy of multiculturalism, as opposed to integration, has enabled new immigrants to fit in whilst retaining their own cultural identities. But in a nonartistic sense creativity is undervalued because it is not well understood. This includes a weak understanding of how it leads to new products, processes and services and the factors that affect this.

Estonia – Eda Heinla

A recent survey of students' views on creativity revealed their perceptions about the extent to which they felt creativity had been supported in Estonia over the last decade. Results indicate that the regaining of independence of the Estonian Republic was considered most important for creativity. For example:

Responsibility for your life has become greater, since there is nobody any more directing you and telling you how to do things. People need to use their creativity in order to use their freedom.

Estonian society has moved in the direction where creativity is promoted at school and at work . . .

At the same time they also perceived inhibiting factors such as “state economic policy: insufficient funding in the areas of culture, education and leisure activities, as well as the use of networking out of self interest.”

Other enabling and inhibiting factors they perceived include an increase in self confidence amongst Estonian

people, independence in decision making countered by a tendency to be overly influenced by Western views and behaviors, and to become more materialistic – which was seen as “the most dangerous restraint on creative self-realization.” As one student put it:

In recent years there is much less of the experimenting spirit, open mind, looking for new opportunities in the Estonian cultural landscape. People do things that are guaranteed to bring in money. Has the comfort phase arrived?

At the same time, the students regarded Estonians as being “very flexible thinkers . . . open to unconventional solutions.” They attributed this to “historical quirks and cultural peculiarities of the Estonian nation.”

India – Rehka Sharma-Sen and Neerja Sharma

India is a highly multicultural society and every region has its traditional arts and crafts, quite often woven into people's everyday lives – in the clothes they wear, the motifs they draw on their walls, and so on. Thus, amongst the traditional rural, semi-urban people creativity is perceived as the skill to create artefacts which they believe need not always be original. But amongst the urban educated, the Western notion of creativity implying novelty and originality is accepted.

In India creativity is valued. What it means to people depends on their tribal/rural/urban residence, socio-economic status, and level of formal education. However, in the realm of formal education it is not valued over and above intelligence or wisdom. The uniqueness or need for autonomy of the creative person (as in the Western context) goes against the Indian cultural value for familism/collectivism. When creativity threatens group cohesiveness it is discouraged, as getting along with others is considered very important.

The school system generally does not support creative expression as it can only be nurtured in a democratic environment. In India, school is experienced as a space that commands compliance to authority and as a place for following teachers' (gurus') instructions. Within that, art, craft, music, and dance may be encouraged. But only the *best* ones are rewarded. Others do not see themselves as creative. It is not seen as a quality everyone can have.

At work, some of the modern institutions reward creative ideas – these may be in the fields of business, technology, education, or the arts.

Japan – Marilyn Fryer, in Consultation with Japanese Colleagues

The approach taken by the Japanese has much to offer the West. As well as their unique approach to creativity (outlined below) much value is placed on collaborative work. As is the case in many Asian countries there is some evidence of a reluctance to challenge the teacher's views. As far as artistic creativity is concerned, there is increasing interest in making this accessible to a wider population both in terms of the practice and appreciation of the arts.

According to Tatsuno, a Japanese author cited by Torrance and Safter, the Japanese can reach higher levels of creativity and invention by looking inward – grounding themselves in the

bedrock of Japanese tradition – instead of scouring the world for ideas and inspiration. He regarded the linear Western processes as being ill-suited to the Japanese, although those educated in the West take on Western characteristics. Tatsuno used the words ‘pathos’ and ‘logos’ to describe the differences between the way Japanese people and Westerners process information.

One method which illustrates the Japanese approach well is the KJ method. According to Susumu Kunifuji, this is very popular in Japan (more so than an alternative approach, the NM method, which is rather like Synectics). The KJ method was developed by Kawakita Jiro, an anthropologist, who used it as a means of organizing the vast amounts of data he collected during his explorations. Akira Onda reported in 2000 that a survey conducted by the Sanno College Creativity Development Group indicated that the KJ method was more popular in Japan than brainstorming, checklists, or Synectics. Brainstorming and checklist methods of idea generation had been popular in Japan in the 1960s.

The KJ method is a means of integrating data or ideas. It is a connection-making strategy that allows participants to create new meanings. They write a brief description of ideas or observations on cards. They can only put one piece of information on a card, so some ideas have to be cut up. Akira Onda described how this can help people change their views about others, since they have to separate positive statements about people from negative ones. It can also help people overcome fixed ideas.

The participants then spread the cards on a table and collate them according to similarity of information. This can serve as a memory aid. They give each group of cards a title and arrange them spatially. Giving groups of cards a title is seen as a way of consciously manipulating the data for future use.

Participants should gather the cards according to emotional feeling about the information or idea. There is no right way to group the data – it is personal and need not be hurried. Akira Onda suggested that if a spatial arrangement can be smoothly explained in words, then it is appropriate; if it is not an appropriate arrangement, it will not be easy to explain in words.

Malta – Shirley Pulis Xerxen

In an everyday sense, creativity is very much associated with the arts and this is the main focus of the St James Cavalier World Centre for Creativity. Edward de Bono is Maltese and his work is well known in Malta. State primary schools have a thinking skills program and at the University, the Edward de Bono Institute runs an annual Masters in Creativity and Innovation which attracts both local and international students.

Creativity has achieved a higher status over the years and it is particularly valued in the arts. In education there is greater emphasis on creativity and thinking skills than on rote and passive learning. Employers are also realizing that the *weightless economy* relies on employees who demonstrate a degree of independence of thought and creativity. This respondent’s 2006 survey of Maltese teachers’ perspectives on creativity in education revealed that, despite very many constraints, they value creativity as an educational goal and a student trait.

Poland – Joanna Kwasniewska

Historically, culture and creativity have been very important in Poland. During the time that Poland was not on a map, culture and creativity integrated the Polish nation.

There is a saying, *Polak potrafi*, which means that a Polish person can cope in every situation. When the shops were empty and life was hard, Polish people tried untypical methods to achieve what they wanted and they also had to be innovative in making things that they could not buy.

In Poland creativity is valued especially by educated people and in large cities, in the arts and by managers of large corporations, in which it is often a core value. However, it is not valued enough in everyday life (where it is associated with being insane, maladaptive, or antisocial), at school (where creativity is rarely a criterion for evaluating children’s work) or at work (in the lower levels of an organization).

Portugal – Fatima Morais

Ten years ago, the concept of creativity was almost unknown in every context in Portugal. Now, the situation is different, although there are still misunderstandings about the concepts of creativity and giftedness. Teachers and educators in general are more and more interested in creativity and strongly participate when events are organized. However, problems remain. For example, despite creativity being formally considered in the Portuguese education system, this is not supported financially by the government.

Universities are beginning to offer formal courses, for example, *Psychology of Creativity* and *Creativity and Innovation*, but there are few such courses. Instead creativity is included within other courses such as *Psychology of Intelligence* and *Cognition and Learning*. However, a Masters Degree *Creativity, Innovation and Human Development* will begin this year in a private college. At the same time, there are some major problems such as a lack of motivation and institutional acknowledgment in some universities with regard to the field of creativity and the small number of researchers working in this field.

Some research is also being done, mainly in the educational domain (creativity in different school levels and years; creativity and other variables like reasoning, self concept, academic achievement; teachers’ perceptions and practices; elaboration of some tests like insightful thinking, problem finding, pupils’ self evaluation; the beginning of Torrance Tests’ validation).

There are three professional Creativity Associations:

- AEDC – Association for Education and Development of Creativity – oriented to teachers
- Apgico – Association for Creativity and Innovation in Portugal – oriented to enterprises
- Torrance Center Portugal – (recently created) oriented to education in general.

These associations provide training sessions, organize conferences, and provide information about national and international events and publications. In addition, some enterprises invite creative problem solving trainers. There are also two national newsletters about creativity, but few academic publications.

Romania – Ana Stoica-Constantin

Creativity in Romania is still feeling its way as a social and individual phenomenon and as an area of study. Following a promising epoch, two world wars and the communist regime, psychologists today have not developed their own great theories and ideas, but they have maintained interest in creativity as a field of study. What they have done is to adapt and disseminate Western, mainly American, theories and research in Romania. They have also carried out their own empirical studies, whether original or replicating other research. And they have developed practical investigations and edited programmes for training in creativity as well as issuing practical guides for the development of creativity in education and business.

Creativity has been openly declared an *education* goal, and steps have been taken toward this aim despite problems in terms of incoherent legislation, poor endowment of schools and low motivation amongst some teachers. Generally, Romanian people tend to be individualistic – they hardly work in groups one reason for this could be the competitive nature of education. Presently, courses in creativity are held in at least four universities, creative groups of students are trained, and a large movement for promoting talented children is sustained by the association *RO-talent*.

In the *arts*, too, creators enjoy, and turn to good account, the liberty of expression and the access to information. In *business*, creativity is valued postfactum by successful entrepreneurs, and the fact that they make public the importance of creative thinking is beneficial to the others, and to the field of creativity. Having no previous experience, the managers have to create both their business, and their style of management, and that makes them more creative.

Two kinds of problems exist, which are not just evident in Romania. These include a certain inertness in attitudes and behavior in some quarters and the *brain drain* to highly developed Western countries along with the emigration of disadvantaged people.

Spain – Petra Perez and Neus Sandra Mefford

In Spain, creativity is understood as the ability to find solutions. Artistic creativity is also very important in Spain. Generally speaking, creativity is defined as *something new and valuable*.

In Spain creativity and the creative person are highly valued, perhaps because Spanish people are accustomed to improvise. Inflexibility is not valued. Creativity is particularly valued in the arts, advertising, business, and education, especially with regard to promotion.

Singapore – Henry Tio

In Singapore creativity is envisaged as *thinking outside the box*. As well as *creativity*, the terms used include *innovation, entrepreneurship, enterprize, invention, design, research, and development*. Creativity is usually approached from a practical, pragmatic point of view – to come up with useful, new products and services that can be produced and marketed in Singapore and exported. Creativity is frequently perceived as an economic activity in the sense that the outcome is beneficial

and has some tangible rewards – a return on the investment of time, money, talent and energy. It is best that it serves a purpose and creates value-added aspects for both the developer and the end user. But things are also changing in the sense that an element of fun, relaxation, enjoyment and personal enrichment are now also entertained, so there does not always have to be a monetary reward.

In Singapore there are diverse religions, cultures and value systems with people coming from all over the world to live and work. This provides a platform which makes people more open with one another and enables them to think differently. A lot of ingredients for innovation are in place. More money is being poured into science and technology. There are growing investments in creative industries, which have developed very well in recent years, and for designing centers of excellence around them. These include:

- Advertising
- Antiques and art dealership
- Architecture
- Broadcasting
- Computer software
- Design
- Digital entertainment
- Films
- Music
- Performing arts
- Publishing

Creativity is highly valued. The Singapore government has also been very supportive and proactive in promoting creativity and innovation as there are no natural resources and human capital is the country's only asset. Furthermore, there is a wish to attract foreign talent – for people to settle in Singapore with their families. The arts and entertainment scene has also been developed, so as to be a culturally vibrant city. Creativity is valued in many contexts as Singapore develops into a global city – a hub of excellence in many things with a very diverse, cosmopolitan population. In education both for young people and in higher education, creativity modules are included. The respondent teaches *Creativity and Applied Thinking Skills (CATS)* and this module is taken by all first year students. The aim is to help them develop a more open mindset and to take all kinds of possibilities into consideration. They are encouraged to use various brainstorming techniques, thinking tools and processes to solve real life challenges. They have to use both divergent and convergent thinking to come up with viable solutions.

United Kingdom – Marilyn Fryer

In the United Kingdom, creativity has traditionally been associated with the arts, but increasingly it is being recognized that people can be creative in other fields of endeavor. Creativity is now being taken very seriously across the whole school curriculum and increasingly in higher education the need for both staff to operate creatively and students to develop their creative skills is being made more explicit.

The situation was very different when Fryer began researching this area in the mid 1980s. At that time it was only really being addressed in some arts, management, and engineering courses. This is partly because in the 1960s creativity education had been wrongly regarded as synonymous with permissive education. In many instances this led to a *laissez-faire* approach to education and eventually to the demise of creative education until late into the 1990s, at least as far as government policy was

concerned. Between the 1960s and the 1990s, very few people were working in the area of creative education either formally in HE or informally in school. In the late 1980s there was great concern amongst teachers that the introduction of a National Curriculum and the *red tape* which accompanied it would make it even more difficult for them to enable their students to be creative. In fact many excellent teachers left the profession.

But by the late 1990s public opinion was changing and there was an increasing recognition that creativity education would be vital in the twenty-first century. This view was adopted by the then Secretary of State for Education – and later by the government as a whole. The publication of a government report, *All Our Futures: Creative and Cultural Education* was the catalyst for a whole series of initiatives and this report was hailed by the arts establishment as legitimizing arts education and its role in the development of creativity. In some quarters it was felt that the arts establishment had ‘hijacked’ creativity education, and this is still somewhat reflected in the government’s definition of *creative industries*. Despite this, the number of initiatives to promote or develop creativity and innovation in business, education, the arts, and the community as a whole has increased.

In Europe, the interest in creativity has been significantly boosted by the designation of 2009 as the *European Year of Creativity and Innovation*. But, as can be seen from the above extracts, although creativity is being increasingly encouraged in different cultures, there is also some ambivalence about it and this is the focus of the next section.

Why Some Cultures May Discourage Creativity

In some cultures creative people are viewed negatively, at least in certain contexts. According to Lubart, Lim and Plucker found that in Korea creative people are characterized by a set of deviant features – ‘indifferent to others’ opinions, headstrong, makes conflicts in working groups, is rude, is abnormal.’ He also cited a study of Chinese teachers by Chan and Chan which suggests that nonconformity, expressiveness, and assertiveness are seen as characteristics of creative students, but viewed negatively in terms of rebelliousness, being opinionated, and being self-centered.

But, as the snapshots in the previous section demonstrate, this phenomenon is not the prerogative of the East. Another example came from a Swedish study. Eriksson found that Swedish educators expressed ambivalent and negative attitudes toward the students they regarded as creative. They described them as a worrying element, wanting to do everything differently, unwilling to cooperate, adjusting badly to conventional tuition, troublesome in class, egocentric and egotistical, listless at the prospect of some subjects, cheeky, careless, coming up with strange ideas, and disobedient.

Similarly, Torrance’s classic cultural study of teachers’ attitudes to creative students revealed that, whilst all the cultures sampled had some values which supported creativity, teachers in the United States, Germany, Greece, India and the Philippines unduly valued characteristics associated with deference and making children easier to teach. Also employing Torrance’s Ideal Pupil checklist, Ohuche found that the Igbo teachers in Nigeria highly valued industry,

sincerity, obedience, consideration for others, and self confidence but neither nonconformity nor timidity. Using the same measure, Fryer, exploring over 1000 UK teachers’ views on creativity in the mid to late 1980s, found that no single personality characteristic was selected for particular encouragement by even half her sample. The most popular were *considerate* and *socially well-adjusted*, followed by three characteristics normally associated with creativity: *self confident*, *independent in thinking*, and *curious*. It is possible that both practical considerations and cultural factors have a role to play in coloring teachers’ views. Certainly a mistrust of imagination appears to have been deeply embedded in Western culture at least until the late eighteenth century. But as reported above, with the slimming down of the UK’s national curriculum, increasing autonomy for schools and a heightened interest in creativity, education for creativity is now formally required and assessed in state schools in England (www.qcda.gov.uk).

Cross-Cultural Assessment of Creativity

With regard to cross-cultural assessment of creativity, many of the measures used in the past have had their origins in the West, in particular the United States. Examination of the extent to which this biases the results of any testing of non-Western cultural groups has been woefully neglected, but is now being considered more seriously. As far as the East is concerned, it is important to be aware of the possible distorting effect that using Western measures of creativity may have on findings. Furthermore, Raina pointed out that “our concept and understanding of creativity may not have claims to universal legitimacy since our skewed discussions of the phenomenon are largely based on studies of societies which are homogeneous and uniform.” So it is important to be cautious when designing and conducting cross-cultural research and interpreting findings.

Conclusion

The subject of cross-cultural differences in creativity is very complex with many areas for debate, which this article has aimed to summarize briefly. The fact that creativity research appears to be becoming more cross-cultural is a good thing for the field, but it is essential that researchers do consider the effect of using measures devised in one country for conducting research in another. It is possible to loosely categorize features of cultures as supportive or not supportive of creativity, but the traditional distinction of grouping cultures as Eastern and Western is too simplistic and masks the vast number of differences between one culture and another. There are hints that colonial oppression, or a totalitarian regime, inhibits a culture’s creativity and this would tie in with the theory that countries with a small power distance would be less creative. But it is also true that sometimes these conditions can help creativity flourish, for example in Poland, where it became part of the national identity when the country was subsumed under communism. There is also evidence that the predominant features of creativity within a culture appear to tie in with that culture’s creation ‘mythology’ or stories. Internationally,

it appears that the interest in creativity from governments and business is increasing, which is helpful for its development, despite some resistance from those who see creativity as a threat to stability.

See also: Cultural Diversity and Creativity; East vs. West.

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Relevant Websites

- <http://www.get-thinking.co.uk/> – The creativity centre's online resource for creativity and innovation.
- www.qcda.gov.uk – Qualifications and Curriculum Development Agency.

Cultural Diversity and Creativity

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Glossary

Cognitive style The method in which an individual is able to process information, acquire knowledge, and evaluate experiences through mental activities, such as thinking, reasoning, and problem solving. There is a diverse array of cognitive styles as a result of individual differences, which are a product of genetic and environmental or cultural experiences.

Creativity A multifaceted human experience involving the interaction between predisposing genetic factors and environmental or sociocultural influences. All individuals have the potential for some form of creative expression. However, creativity is manifested in ways that are unique to the personality of the individual as well as consistent with his or her cultural context. Creativity may be studied in terms of personality characteristics, ways of processing, specific domains, and subjective outcomes and objective products. This article emphasizes the influence of culture on all of these aspects of creativity.

Culturally and linguistically diverse Individuals who are immigrants or who have attained varying degrees of acculturation, but whose traditional culture continues to exert an influence on their values and styles of thinking and behavior.

Culture Defined as the organization of values, ideas, and behaviors shared by a particular group of people. As a group, people use modal patterns for perceiving, interpreting, and relating to their environment.

Developmental stages Developmental stages identify behaviors at particular age levels and attempt to account for gradual changes of an individual's behaviors (cognitive, emotional, motor, and social) by describing a progress based on a specific theoretical framework.

Divergent thinking As defined by Guilford, divergent thinking is the generation of information from given information, where the emphasis is on the variety and quantity.

Diversity, cultural Factors (and related linguistic and cognitive style differences) that influence the development and manifestation of creative abilities in individuals.

Linguistic diversity proficiency In a language other than standard English. The various stages of language proficiency may move from monolingual dominance of native language to incipient second language learning and may advance into balanced dominance of both native and host country language (English). Linguistic diversity is related to differences in style of creative expression (e.g., content and nature of verbal humor). Balanced bilingualism has been associated with cognitive and creative advantages.

Multiple intelligences Gardner's theory of multiple intelligences is a multifaceted approach to describing intelligence. Gardner proposes that there are various types of intelligences including linguistic, logical–mathematical, spatial, musical, bodily kinesthetic, intrapersonal, and interpersonal.

Tests of creativity The main uses of creativity tests are for identifying creatively gifted individuals for specific enrichment programs, for research purposes, and for career counseling. Formal evaluations of creativity that have been cross-culturally validated include the Torrance Tests of Creative Thinking and Mary Meeker's Structure of Intellect (SOI), a measure based on Guilford's Model.

Creativity and Cultural Diversity

Culture has a significant impact on the conceptualization, definition, and identification of creativity. Although there are similarities across cultures in how creativity is conceived, measured, and developed, cultural values influence preferences for specific talents and abilities and how these are nurtured and expressed. For example, Westernized (e.g., European, Soviet-Russian) views of creativity are generally associated with novel and innovative ideas or products, while other cultures (e.g., German) value the creative process itself, and some emphasize the practical application of creative solutions to simple everyday life problems or complex societal problems (e.g., Latin Americans, Turks).

Understanding the origins of cultural diversity within the construct of creativity is complex. It is important to acknowledge the varying philosophical, religious, historical-political, psychological, and sociocultural factors that surround the concept of creativity within a particular society. For example, due to political instability and economic crises in Latin American countries, solving public health, educational, and poverty-related problems have been the focus of creative endeavors rather than conducting research in understanding the phenomenon of creativity. Furthermore, creative practices have also influenced cultural groups that have immigrated to a particular region. This is evident when examining the African influence in music of South America; bossa nova in jazz of Brazil and tango in Argentina.

Similarly, the daily lives of people impact how creativity is expressed in a culture. For example, in Turkey there is much poverty and oppression toward women. As a consequence of the arduous farm life experienced by Turkish women, artistic creativity is expressed in the form of embroideries, folk art, and song. Tales of happiness, love, and friendship are intricately interwoven into colorful embroidered traditional clothing, while tales of pain and sorrow are incorporated in their songs. In some East Asian countries such as India, creativity is highly associated with spirituality. Creativity is viewed as a personal journey of self-actualization and transformation of self which may not create a tangible visible product. Therefore, creativity is highly valued across cultures but differs in its manifestations.

Another important consideration that has been recently addressed in research (i.e., Runco, Sternberg) is implicit theory of psychological concepts. Implicit theories of creativity are beliefs and expectations held by parents, teachers, schools, and communities that determine whether a particular behavior or characteristic would be deemed as creative and therefore may elicit or inhibit certain creative behaviors. Implicit theories reflect cultural values, traditions, beliefs, and norms. Although implicit theories are hardly ever discussed, they significantly impact our daily lives. Parents will foster certain creative behaviors as well as teachers with their students. Accounting for implicit theories is very useful in understanding the commonalities and differences that exist in how creativity is perceived across diverse cultures and how individuals judge and assess whether traits or behaviors are considered creative. However, implicit theories are not stable and may change over time. Although there are general agreements about what characterizes creative traits across cultures, there are some differences. For example, some collectivist cultures value traits such as being courteous, orderly, and socially competent – traits that have been more associated with noncreative behaviors. Similarly, teachers also mistakenly characterize creative children as conforming and cooperative and fail to recognize creative children who are impulsive and nonconforming.

Although we have briefly touched on a small aspect of cross-cultural views of creativity, awareness and understanding of the cross-cultural literature on creativity facilitates our understanding of cultural diversity and creativity in the United States. The United States is a pluralistic and multicultural society where manifestations of creative endeavors vary and where implicit theories of creativity affect how we value, assess, identify, and encourage certain creative behaviors.

Research in the United States continues to remain limited in understanding creativity among culturally and linguistically diverse individuals. However, research is beginning to place more emphasis on examining bilingualism and linguistic and cognitive style diversity in relation to creativity. Some major developments in this area may be originally attributed to E. Paul Torrance whose pioneering work on cultural views of creativity led the way for future studies linking cultural diversity with creativity. Although creativity is manifestly a universal human experience, it is important to study how and to what extent culture influences its expression, without neglecting commonalities and within-group differences. An understanding of creativity from a multicultural perspective is critical, given the value that is placed on it and the desire to foster creativity among American youth in a democratic, pluralistic society.

Theoretical and Research Perspectives

Culture and Creativity

The critical role of culture on creative abilities went unrecognized prior to the 1960s. Before that time, creativity was closely identified with the study of high intelligence, which, in turn, was attributed primarily to hereditary factors. The work of Francis Galton, as reflected in *Hereditary Genius*, published in 1869, emphasized the genetic aspects of individual differences in intellectual functioning. Similarly, Lewis Terman's longitudinal study of gifted children, begun in the 1920s, was based on a definition of giftedness and creativity as high performance on standardized tests of intelligence. In 1926, Leta Stetter Hollingworth defined intelligence as the top 1% of intellectual ability, although she believed that giftedness manifested itself in a variety of ways such as in music, art, literacy, abstract reasoning, and mechanical aptitude. However, the beginning of a formal shift from a unidimensional to a multidimensional perspective of intelligence may be attributed to Louis Thurstone, who posited in 1938 that there were multiple talents or primary abilities that could not be measured by a single test of intelligence. Furthermore, J. P. Guilford's structure of intellect model in 1956, which included the concept of divergent thinking abilities, provided an important turning point for viewing creativity as distinct from intelligence. His model of creativity included flexibility, fluency, originality, and elaboration in divergent thinking, which was the major theoretical framework Torrance used in 1974 to develop a highly popular test adapted across many cultures – the Torrance Test of Creative Thinking.

The concept that creativity is a discrete construct was advanced by Getzels and Jackson in their 1962 landmark study. These researchers found that adolescents who were considered highly creative were not necessarily high academic achievers or the most intelligent. The role of nonintellectual factors on creative abilities, including sociocultural and environmental influences, continued to be studied in the 1960s by other researchers (e.g., Sato, Strang, Taylor). An often cited quotation from Torrance's writings, "What is honored in a culture will be cultivated there," concerns the influences of cultural differences on creativity. Torrance studied a number of diverse cultures and found differences in how creativity was defined, valued, and expressed. Based on his observations of economically disadvantaged African American (then referred to as Black) children, Torrance found that they exhibited unique creative characteristics. The creative positives of these children included the abilities to express feelings and emotions, improvise with commonplace materials, articulate effectively in role playing activities, engage in creative movement and dance, exhibit richness of imagery in language, figural fluency, and flexibility, and express enjoyment and skill in group problem solving.

Other researchers since the 1970s and today, such as Baldwin, Bernal, Chen and Goon, Kitano, and Maker and Schriever, have continued to focus their research on identifying gifted and creative characteristics among specific cultural groups. Among Hispanic Americans, gifted characteristics included rapid acquisition of the English language, leadership abilities in both dynamic-expressive and quiet influential ways, street-smarts, and risk-taking behaviors. For Native Americans, gifted and creative behaviors included valuing

traditions, heritage, and cultural beliefs; effective ability to communicate the collective idea of the tribe, creating stories and poems; generating original ideas and solutions; unusual sensitivity to expectations and feelings of others; and encouraging others to explore and develop their abilities. The ability to work diligently, demonstrate social competence, and excel in mathematics was regarded as characteristic of giftedness among Asian Americans. Furthermore, current research has indicated that bilingualism may have an advantage on creative abilities – cognitive flexibility that allows for multiple perspectives of problem solving. As demonstrated cross-culturally and within the pluralistic context of US society, cultural diversity in creativity comprises a variety of ways of expression and manifestations – from visible measurable outcomes to more subtle, but highly influential creative behaviors. Research on cultural diversity in creativity is of growing importance as analyses of gifted programs within the United States reveal an underrepresentation of culturally and linguistically diverse groups as members of programs in the public school system.

Additional theorists, such as Robert Sternberg, have emphasized the contextual components of intelligence and the role of sociocultural environments on the human expression of abilities, including creativity. Howard Gardner's theory of multiple intelligences (i.e., linguistic, logical and mathematical, visual and spatial, kinesthetic, interpersonal, and intrapersonal) also has enhanced the concept of sociocultural factors that contribute to determining the diverse manifestations of intelligence and creativity. Further, contemporary emphasis is placed on how creativity is expressed in various specific domains rather than on the absolute level of creative ability. Specific attention is being given to the diversity of talents, distinctly different styles of creative problem solving (e.g., Kirton, Feldhusen, Treffinger, and Selby), and specific forms of expression in culturally and linguistically diverse (CLD) populations (e.g., Bernal, Esquivel). Finally, it is important to consider the impact of individual diversity and culture, specifically in terms of language and cognitive style.

Although significant strides have been made in expanding the knowledge base on the impact of culture on creativity, the identification and assessment of creativity among culturally diverse populations continue to lag behind.

Bilingualism and Creativity

Research in the area of linguistic differences and bilingualism has taken a similar course in relation to the study of cultural factors on creativity. Studies prior to the 1930s tended to perpetuate the view that there were negative effects associated with bilingualism and cognitive and academic functioning. However, beginning in the 1960s, studies by Pearl and Lambert, and others, began to reflect the opposite of the deficit view of bilingualism. Bilingual students showed a number of cognitive and creative strengths. In 1970, Landry examined creativity in bilingual children and found that when a second language was learned at a critical age, performance on measures of figural and verbal fluency, flexibility, and originality was significantly better than for the monolingual group. In 1974, Carringer studied divergent thinking in bilingual children for whom Spanish was their first language and found similar results. Earlier studies failed to account for the different

degrees of bilingualism resulting in methodological flaws. Furthermore, early studies may have utilized measures of functioning that were internally biased against individuals whose second language was English. Recent research has continued to substantiate the fact that students who become 'balanced' bilinguals or proficient in more than one language show higher metacognitive awareness, originality, divergent thinking, cognitive flexibility, linguistic humor (e.g., in the form of puns), and other signs of creativity.

Simonton uses historical evidence to examine the association of bilingualism with creativity. He reported that higher incidences of creativity and creative geniuses were evident when civilizations were composed of bilingual or multilingual cultural groups (e.g., Golden Age of Greece) rather than having one official language. For example, higher probabilities of creativity were apparent when Japan opened its doors to foreigners such as Chinese Buddhist monks, Korean artists, and Christian missionaries. Other researchers have found a high percentage of famous creative geniuses who were first and second generation immigrants. Therefore, given the cultural and linguistic diversity of the United States, the potential for creativity to thrive in this country is significant, if recognized and nurtured.

Beyond the advantages of bilingualism, it is important to study the effects of linguistic style differences on creative expression. Catherine Collier suggested that some languages (e.g., Romance) lend themselves to greater embellishment and elaboration, whereas others (e.g., Germanic) are more precise and direct. These differences may manifest themselves in ways of processing verbal information and in the quality of creative products. For example, creative writing of Hispanic students may be characterized by ornamentation. Additionally, humor, a creative characteristic, may vary across cultures based on cultural meaning and semantic differences. In general, research in psycholinguistics (e.g., Cummins, Krashen) points to a strong link with affective, cognitive, and creative processes. The study of bilingualism is increasingly relevant as the numbers of bilingual and ethnically diverse students increase in US schools.

Cognitive Style and Creativity

Facets of diversity may also be examined through the interaction of culture and creativity in the area of cognitive styles. A cognitive style is the method in which an individual is able to process information, acquire knowledge, and evaluate experiences through mental activities such as thinking, reasoning, and problem solving. A cognitive style is a unique characteristic, or a personality trait that develops as a result of an individual's genetic inheritance and the experiences and interactions of the individual in the external environment and, more specifically, culture. Creativity is linked to cognitive style in the sense that creativity is an expression of the ways in which information in the environment is processed and manipulated. In *The Geography of Thought: How Asians and Westerners Think Differently ... and why?*, R. Nisbett provides convincing evidence of modal cultural patterns in cognitive style. Cognitive style among Asians is generally characterized by affective factors, interdependence, circularity, harmony, field dependence, and holistic conceptualization. Westerners tend to be more analytical, cause and effect, linear, and independent in thinking style.

Originally, the concept of cognitive style has roots in the cognitive-developmental theory of Jean Piaget. In the 1950s, Piaget's research focused specifically on mental intelligence and cognitive development. Piaget viewed development as a continuous process that begins when an individual enters the world and, thus, environment and culture have an impact on the ways in which individuals perceive the world and interact within society. Stemming from Piaget's work, further research began to examine the diversity of cognitive style and to define these styles primarily in terms of a bipolar continuum. Work exploring the polarity of cognitive styles began in 1958 with the work of Jerome Kagan. Kagan defined conceptual tempo as a specific cognitive style that was rooted in the notion of reflection (the tendency to reflect on alternative solutions) versus impulsivity (the tendency to respond impulsively without sufficient consideration of the problem). According to Kagan, it is conceptual tempo that can be considered a source of individual differences. Other work examining the polarity of individual differences in cognitive style continued throughout the 1960s and 1970s. In 1962, Herman Witkin and colleagues formulated the theory of field dependence versus field independence, which refers to how an individual utilizes the perceptual field in organizing information. Additional research by A. R. Luria in 1973, examined how information is processed either simultaneously or sequentially. In 1975, Das and Moll found how the selection of the cognitive process is dependent on not only the type of task involved but the individual's preference for informational processing and the range and variety of past experiences. This early literature has attempted to define cognitive style as the methods in which an individual processes information from a dichotomous perspective. Research in the 1980s and 1990s turned from evaluating cognitive style on a bipolar level to a multidimensional level, as cognitive processing began to be viewed as more complex in nature. Robert Sternberg's three facet model of creativity incorporates intelligence, cognition, and motivation. In 1988, Sternberg defined cognitive-learning style as a preferred way of utilizing abilities and not simply the possession of actual abilities. Preferences may be highly influenced by social learning and cultural differences.

Utilizing theories of individual differences within human cognition, research involving individuals of different cultures and ethnicity began to attempt to identify unique styles of cognition among culturally diverse populations. In Torrance's 1967 study comparing Anglo and African American children on divergent thinking, it was found that African American children scored higher than Anglo children on measures of figural fluency, flexibility, and originality. This study was further supported by Price-Williams and Ramirez in 1977. These researchers found that Mexican-American and African American males scored higher than Anglo males on fluency and flexibility measures.

The emerging sociocultural perspective of the research literature in the area of cognitive style is based on the notion that there is a relationship between society, culture, learning, and development. This perspective is translated into studies by Rita Dunn and her associates, which established that there are numerous cognitive and social variables that influence learning in diverse populations. In 1990, Dunn, Dunn, and Price developed the comprehensive Learning Style Inventory (LSI) as a tool for understanding diversity in learning and

cognitive style. According to Dunn and Dunn in 1993, cognitive style is composed of an individual's unique reactions to elements of instruction when learning information. These elements include the immediate environment, emotionality, sociological preferences, physiological traits, and cognitive-psychological inclination. In general, the construct of cognitive style has progressed from being viewed as a simple independent variable toward a conceptualization of style as part of a cultural process.

Research has been further stimulated by the high rate of academic underachievement among minorities in the United States and the assumption that culturally diverse populations learn differently. In 1990, Dunn and Griggs reported distinct cultural differences using the LSI in terms of preferred cognitive strategies. These researchers analyzed the learning styles of at-risk high school students and found that these students utilize a processing style and instructional strategies that differ significantly from those who are more successful academically. Overall, differences in learning style, specifically the patterns of used and preferred strategies, have been found in the form of modal patterns, although there may be more within-group than between-group differences. Additionally, creativity profiles across cultures have been found to be similar within a specific domain (e.g., science) and different across domains (e.g., music, mathematics, sports). Current research focuses on understanding distinct homework styles of creative behaviors in the classroom settings through the use of the Hong and Milgrams's The Homework Motivation and Preferences Questionnaire. Practical implications suggest that performance of creative behaviors can be supported by creating learning environments that are congruent with learning styles, thus reducing talent loss. The stability of learning styles has been debated, some arguing that learning changes according to developmental, environmental, and cultural factors.

Furthermore, according to Collier, cultures tend to reinforce certain learning styles through socialization. For example, in the educational system, rewards are given for analytic rather than relational forms of learning. Students who do not exhibit analytic style in their academic performance and have an alternative style that may contrast with the teacher's style will be at a distinct disadvantage in the classroom. Societal influences affect development of particular cognitive styles and preferences for methods of processing information. The role of culture also has been considered by Sternberg and Lubart, who believe that cognitive style is a component of creativity. Just as cognitive style may be influenced by socialization and environmental factors, so may creative style. Research by Darcy in 1989 focused specifically on the link between cognitive styles and creativity. In reference to Witkin's field dependence-independence theory, it was found that independent individuals were considered to be more creative, in that these individuals were better able to function independently of the perceptual field. This was further supported by a 2006 cross-cultural research by Hongli and Yulin in China among urban and rural high school students in liberal arts and science. Creative individuals have more cognitive flexibility in the ways in which they process information and solve problems.

Cultural blocks, such as rules, traditions and social norms, may hinder the expression of creativity and the development

of flexible cognitive style. Learning and cognitive style research is one approach to understanding individual differences and creativity.

Currently, research needs to continue to explore cognitive style because the concept is quite relevant to psychological constructs. In particular, it is important to consider cultural diversity and the degree to which an individual identifies with his or her ethnic background in considering the relationship of individual differences to cognitive style and creativity.

Identification

A central assumption in the identification of creativity in culturally and linguistically diverse (CLD) individuals is that environmental, sociological, cultural, and linguistic differences affect the way in which creativity is expressed. Consequently, when attempting to identify creative ability in CLD students, there is a need to use approaches that are capable of tapping into the unique creative strengths and into the ways in which creativity is manifested in diverse populations. These approaches, however, should be used with flexibility to avoid stereotyping individuals.

In general, CLD students, including African Americans, Hispanic Americans, Native Americans, and Asians Americans, particularly those of lower socioeconomic status, are underrepresented in programs for the creative and gifted. Reasons for this underrepresentation specifically include the narrow way in which creativity and giftedness have traditionally been defined, inappropriate methods and test procedures utilized, and the limited focus of the identification process itself. More and more researchers are advocating that the identification of creativity should be based on a broad definition of what it means to be creative. In terms of CLD individuals, special consideration needs to be given to cognitive style and cultural factors that affect the expression of creative abilities. In essence, all individuals possess diverse creative abilities. Therefore, the aim is not to 'identify' only the highly creative according to one set standard of what it means to be creative (e.g., high intelligence), but rather to assess in a suitable manner the diversity of creative abilities according to a variety of domains (e.g., visual and spatial, kinesthetic, mathematical).

Creativity within a multicultural perspective is more broadly defined as a multifaceted construct that may be exhibited through (a) diverse characteristics, (b) different ways of processing information and problem solving, (c) a variety of domains (e.g., music, dance, sports, or science), and (d) a wide range of subjective outcomes (e.g., sense of fulfillment, self-worth, spirituality, resilience) and objective products (e.g., a painting, musical score, or literary composition). Based on this definition, the assessment and identification process for CLD students will include multiple criteria, a variety of sources of nomination (e.g., bilingual and English as a Second Language (ESL) teachers, parents), and pluralistic assessment methods. There are numerous ways in which creative characteristics may be assessed in CLD students, including the use of culture-specific behavioral observations in various settings, anecdotal reports from a number of sources, biographical inventories, acculturation scales, and sociometric measures, including same-culture peers as raters. The assessment needs to be

accomplished with an understanding of the culture of the individual or group in question. For example, some cultures value personality characteristics of humor and cleverness in a social context over independent behaviors. Other cultures reinforce kinesthetic forms of expression (e.g., loud laughter, touching) that may be considered rude and disruptive, rather than creative channels, in mainstream culture.

Some cultures (e.g., Asians) show regard for quiet but influential leaders over assertive leadership styles. Current methods of identification could overlook these culturally different characteristics as signs of potential creativity. In reference to past literature and research studies in the field, creativity and the creative process have been assessed in terms of divergent thinking, problem solving, cognitive flexibility, critical thinking, ideation, fantasy, visual imagery, and other information-processing modes. The issue of preferences is also important to be considered in the realm of diversity and creativity. For example, some individuals are more creative (i.e., offer many ideas) in cooperative learning situations than in situations that are competitive in nature. Additionally, some individuals prefer to solve problems in a reflective and systematic manner, whereas others prefer a more intuitive and spontaneous approach. Learning style inventories may help determine the modalities of strength and the preferred cognitive styles and learning modes of the individual and of specific cultural groups; lending itself to creating learning environments that support diverse creative behaviors. Furthermore, tests that measure real-life problem solving (e.g., Creative Real Life Problem-Solving and Real World Divergent Thinking Test) may identify creativity of a practical nature.

Very few paper-and-pencil tests are relatively free from cultural bias. However, the Torrance Tests of Creative Thinking have been effective in identifying creativity in CLD students and have been translated into various languages; developed in 1966 with the most current version available in 2008. However, research has indicated mixed results with Hispanic Americans (e.g., Garcia) scoring better on nonverbal tasks, while others found no significant differences. It is important to account for bilingual language skills. Code switching, or shifting between two languages in various ways, has been said to reflect exceptionality in linguistic abilities. Bilingual administrations, untimed tests, and nonverbal forms of tests are useful for students with limited English proficiency. Use of Multiple Criteria Method such as the Bilingual Talent Portfolio (BTP) is a strength-based assessment approach that evaluates individual's interests, abilities, expression-style preferences, and potential talents in their primary language. In addition, level of acculturation must be accounted for given that less acculturated individuals often perform lower than highly acculturated individuals.

In addition, methods for assessing subjective outcomes and experiences may include personal and parental interviews and self-report measures. Self-reports of creative behaviors include the Creativity Achievement Questionnaire developed in 2005 by Carson, Peterson, and Higgins to assess various domains in drama, writing, humor, music, visual arts, dance, invention, science, culinary arts, and architecture. Ivcevic and Mayer used a method that examines both creative behaviors and personality to identify five types of creative individuals: conventional, everyday creative individuals, artists, scholars, and renaissance.

Again, it is important that this assessment be conducted with cultural sensitivity and understanding. Products, portfolios, and other objective outcomes in a variety of domains (e.g., art, creative writings, or science projects) may be reviewed and assessed by content experts who also have cultural expertise or by individuals with input from cultural consultants (individuals familiar with the culture in question). The Consensual Assessment Technique (CAT) is a method used by experts to rate creative products such as poems, stories, collages, and narratives. Kaufman, Plucker, and Baer indicate that this method can help identify creative talent that may be overlooked by traditional measures. Consideration needs to be given to culture-specific aspects of the content and quality of outcomes. For example, there may be sociocultural difference in materials used (e.g., commonplace versus expensive), aesthetic values (e.g., choice of colors), manner of expression (e.g., poetic versus analytical writing style), functional utility (e.g., for the common good versus the individual advantage), or emphasis on process versus product (e.g., value on subjective versus objective outcomes). Criteria for what is considered creative needs to incorporate cultural components as well as account for implicit theories of creativity. However, the intent is not to stereotype but to consider cultural factors with flexibility, showing respect for different levels of acculturation and individual differences.

In general, the identification process needs to be closely linked to intervention and implementation of enrichment programs. Caution needs to be taken in considering the role of diversity, particularly when implementing educational programs and identifying creativity in children. The main purpose of identification should be to provide students with opportunities for enhancing their creative development.

Educational Implications

The assumptions that all individuals have the potential for creativity, that creativity may be expressed in diverse ways, and that creative abilities may be enhanced have implications for more comprehensive educational approaches. Globally, creativity has been a fundamental mission in education, particularly in training creative thinking among students. Generally, educational initiatives in creativity have involved creative development through play, arts, direct instruction, and teacher training. Examples of educational programs include the 'Aprender para Crear' (Learning for Creating) and 'Aprender a Pensar' (Learning to Think) in South America. The 'Proyecto Inteligencia' (Intelligent Project) from Stanford University has been implemented internationally. Preschools in countries such as France and Germany have been successful in nurturing creative stimulation through storytelling, art, musical improvisation, and artistic expression. In India, drama is used to increase children's imagination, creativity, concentration, communication, self-expression, organizational skills, and disciplined behaviors.

Globally, training in creativity is incorporated in high schools, higher education, science, technology, engineering, art, and business organizations. Effective training programs are primarily based on the Creative Problem Solving or Osborn-Parnes Model which uses divergent thinking to

brainstorm a number of possible solutions to a problem. Treffinger et al. developed the VIEW which is a Problem Solving Style measure of creativity, with language translations, cross-culturation validation, and application for training in problem solving. Other related methods include brainstorming, the Art of Inquiry (method of questioning that allows the integration of disparate ideas), and Creative Synthesis (combining unrelated elements or subject matter into a cohesive whole). Innovative methods in business include using computer-based systems in industrial design tasks or cell phone applications. Phone application programs include tracking people or your position via GPS, listening to your own audio tour guide of London, or using your phone as a metro-nome as you practice a Rachmaninoff piano concerto.

In the United States, educational efforts are represented by such models as Joseph Renzulli's schoolwide enrichment triad model and John Feldhausen's talent identification and development in education model, both of which attempt to reach a greater number of students in order to enhance their areas of strength. Donald Treffinger has emphasized the need for educators to develop and support independent learning methods and for instructional environments in the regular classroom to be more responsive to the development of talent and creativity in all students. Similarly, Ernesto Bernal has suggested that CLD students be provided with in-class accommodations, and other diversified opportunities that are sensitive to their cultural and linguistic background. In addition, unique characteristics of learning style are found in the 'gifted' as well as in underachieving learners, students in special education, and others at risk for school failure. For students to achieve their potential, they should be taught in an environment and with the approaches that complement their specific talents, potentials, and learning styles.

There is limited research on creative development interventions specific to CLD students, but a number of researchers (e.g., Bernal, Castellano, Cummins, De Avila, or Ortiz) recommend pedagogical approaches that incorporate bilingual interaction, dual language instruction, a multicultural curriculum component, experiential methods, mentoring from cultural role models, special guidance, and parental involvement. Promoting partnerships between bilingual education and gifted and talented programs will broaden the experience of all students. Education in the United States should be sensitive to the linguistic and cultural differences of the students and be flexible to enable all students to develop their creativity potential.

In 2008, Hong and Milgram made the following educational recommendations to help reduce talent loss: use differentiated curriculum that focuses on a variety of creative abilities (e.g., political leadership, business, art, and drama); integrate technology with learning (e.g., television, computers, distance-learning, teleconferencing, email); individualize instruction tailored to diverse creative abilities; provide warm, nurturing, supportive, and creative school environments; emphasize teacher training in the areas of giftedness and creativity; and use mentors to guide the cognitive and social-emotional development of disadvantaged CLD students. The above researchers advocate technology integrated education to "eliminate the need for complex processes of identification and selection ... to no longer need expensive special education programs of all kinds ... offered to all levels, for all domains,

and for children of all ages in all schools.” Therefore, an open admissions policy is recommended to allow access to gifted and talented programs to reduce talent loss.

Conclusion

Cross-cultural research on creativity allows a greater multidimensional understanding of the concept of creativity which widens the cultural lens of the United States. Different cultures view creativity along a variety of dimensions. The value placed on creativity may be attributed to the reward system and socialization process of the particular culture. Although it has been supported that diversity in creativity and cognitive style exists between and among ethnic and cultural groups, research also suggests that there are as many within-group as between-group differences. Continuing research needs to focus on determining the universality of the creative process and the ways it is expressed in differing cultures and countries. In general, as the understanding of creativity continues to grow, it is important to consider the diverse manifestation of creativity, including the role that culture plays in its expression. In essence, attending to cultural diversity in creativity is another way of being sensitive to the uniqueness of each individual.

See also: Cognitive Style and Creativity; Consensual Assessment; Definitions of Creativity; Divergent Thinking; Implicit Theories; Intelligence (as Related to Creativity); Multiple Intelligences; Psycholinguistics; Testing/Measurement/Assessment.

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Relevant Websites

- <http://www.creativeeducationfoundation.org/> – Creative Foundation Education.
<http://nagc.org> – National Association for Gifted Children.
<http://gifted.unconn.edu/NRGCT.html> – National Research Center for Gifted and Talented.

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Marie Sklodowska Curie 1867–1934

Physicist

Awarded Nobel Prizes for Physics and Chemistry

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Marie Sklodowska Curie was one of the first woman scientists to win worldwide fame and one of the great scientists of this century. She had degrees in mathematics and physics. Winner of two Nobel prizes, she performed pioneering studies with radium and polonium and contributed profoundly to the understanding of radioactivity.

Perhaps the most eminent of all women scientists, Marie Sklodowska Curie is notable for her many firsts. She was first to use the term "radioactivity" for this phenomenon. In 1903, she became the first woman to win a Nobel Prize for Physics. She was also the first female lecturer and professor at the Sorbonne University in Paris (1906). In 1911, she won an unprecedented second Nobel prize (this time in chemistry) for her discovery and isolation of pure radium and radium components. She was the first mother–Nobel Prize Laureate of a daughter–Nobel Prize Laureate; her oldest daughter, Irene Joliot-Curie, also won a Nobel Prize for Chemistry (1935). She received 19 degrees, 15 gold medals, and many other honors.



Marie Curie. (Copyright WideWorld Photo.)

In 1995 Marie Curie's ashes were enshrined in the Pantheon in Paris; she was the first woman to receive this honor for her own achievements.

Background

Marie Sklodowska was born in 1867 in Poland, the fifth and youngest child of Bronsilawa Boguska, a pianist, singer, and teacher, and Wladyslaw Sklodowski, a professor of mathematics and physics. Descendants of Catholic landowners, her parents were intellectuals whose opportunities were restricted by the Russian domination of Poland. At age 10, Marie was left motherless.

Her father took boarders into his home; Marie helped with housework and became a governess for six years so that her sister Bronie might study in Paris and become a medical doctor. In 1891 Marie also went to Paris and after several years of spartan living and intense study she received a *licence*, or master's degrees, in physics and mathematics at the Sorbonne.

Marie was married to Pierre Curie, also a physicist, in a civil ceremony in 1895, followed by a honeymoon which was a three-week bicycle tour. Living near poverty they gave up social contacts and recreation for their dedication to research. Marie's first scientific work was on the magnetic properties of tempered steel (1893). Then, learning of Becquerel's discovery, she selected the radiation from uranium for her doctor's thesis. After observing that uranium ore (pitchblende) was several times more radioactive than uranium, the Curies came to believe that the ore contained a new element or elements more active than uranium.

Working under miserable conditions in a shed, the Curies carried out the chemical concentration of some 100 kg of uranium ore supplied by the Austrian government to obtain a specimen from which spectroscopic identification was made of a new element which they called "polonium." Marie later discovered a second element in pitchblende, which she named "radium."

By 1902, she had isolated 1 g of pure radium salt and had determined the atomic mass of radium as 225 (226 is now accepted). In 1903, Marie, her husband, and Henri Becquerel received the Nobel prize in physics for their work on radioactivity. It was not until 1910 that she finally obtained 1 g of the pure radium metal. The Curies also determined that the beta rays emitted by radium were negatively charged particles (electrons).

The birth of her two daughters, Irene and Eve, in 1897 and 1904 did not interrupt Marie's intensive scientific work. She was appointed lecturer in physics at the *École Normale*

Supérieure for girls in Sévres and introduced there a method of teaching based on experimental demonstrations. In 1904, Marie was finally named as Pierre's assistant at the *Faculté des Sciences* where she had long worked without pay.

Confident of medical and industrial applications, a French industrialist constructed a factory near Paris for the extraction of radium from pitchblende. The Curies took out no patents and claimed no royalties, thereby renouncing a fortune. The sudden death of Pierre Curie in a road accident in 1906 was a bitter blow to Marie Curie, but it was also a decisive turning point in her career. Marie's life became even more devoted to continuing her research and raising her daughters.

In 1906, the physics chair created for Pierre was bestowed on Marie and for the first time a woman taught at the Sorbonne. As had Pierre, Marie declined the recognition of the *Légion d'Honneur*, asking only for the means to work. Albert Einstein once said of her that "Marie Curie is, of all celebrated beings, the one whom fame has not corrupted." Five years after her husband's death, Marie received the 1911 Nobel prize, in recognition of her work in isolating radium in its pure metallic form and developing the first international standard for measuring the substance. She was nominated for the French Academy of Sciences that year, but was rejected by one vote after a slanderous campaign was waged against Marie by a competitor. Marie's supporters and co-workers were shocked by this defeat but she made no comment on her rejection.

In 1910, Marie worked with the Radiology Congress in Brussels to establish official standards for radium needed in therapy and research. The Congress defined the "curie" as the unit of radioactivity. During World War I, Marie, with the aid of private gifts, equipped ambulances (which she could drive) with portable x-ray equipment; she became head of radiological services for the Red Cross. Her wartime experience led her to write the book, *La Radiologie et la Guerre*.

In 1914 Marie Curie helped found the Radium Institute in Paris, and was the Institute's first director. Through the Radium Institute, the Curie Foundation, and her membership in the Academy of Medicine, Marie Curie pursued goals such as "curie therapy" and the establishment of safety standards for workers. Marie Curie has been honored more than any other scientist on the postage stamps of many nations; many picture the benefits of x-ray diagnosis, the use of radium in the treatment of cancer, and the gift of 1 g of radium to Madame Curie by grateful women of America.

Madame Curie's health declined partly due to the lethal effects of her prolonged exposure to nuclear radiations. She had cataract operations, and suffered from lesions on her fingers and from leukemia. She died in a sanatorium in the French Alps in 1934. After her death the Radium Institute was renamed the Curie Institute in her honor.

Creativity And Eminence

For decades, scholars have studied creativity by examining eminent individuals and those factors that appear to influence or be related to creativity. Marie Curie demonstrated many of the personality characteristics common to eminent individuals and she experienced many of the environmental and social factors frequently encountered by eminent individuals.

Personal Characteristics And Creativity

Scholars do not know whether personal qualities can be a direct cause of creativity, but it does seem clear that they are intimately involved in the process. Marie Curie demonstrated the following personality characteristics common to eminent individuals: propensity to persevere, intellectual competence, academic propensity, risk taking, force of character, and independence.

Marie Curie's perseverance, intellectual competence, and academic propensity are unquestioned. She spent six years as a governess so that her older sister Bronie might study in Paris and become a medical doctor, knowing that when Bronie obtained her licence, Marie would have the opportunity to attend university. Marie spent four years of spartan living and intense study so that she could receive a master's degree in physics and a year later, a master's degree in mathematics. From childhood, Marie was remarkable for her prodigious memory, and at the age of 16 she won a gold medal on completion of her secondary education at the Russian lycee. Her intellectual competence and academic propensity were also evident in her later academic accomplishments. Among those taking the *licence es sciences* exam Marie ranked first, and among those taking the *licence es mathématiques* exam she ranked second.

Marie Curie was not afraid to take risks and her forceful character led her to a level of independence unusual for her time. In France during this period, women, especially gifted women, were scorned. The Belle Epoque writer Octave Mirbeau wrote during this period that a woman "is not good for anything but love and motherhood. Some women, rare exceptions, have been able to give, either in art or literature, the illusion that they are creative. But they are either abnormal or simple reflections of men." When studying in Paris, Marie lived alone for almost three years. It was a life which, as she wrote later in *Autobiographical Notes*, gave her a sense of liberty and independence.

Later, Marie showed incredible strength of character when she foresaw the immense labor necessary in attempting to chemically concentrate uranium in order to study radium. Knowing the small means to accomplish this task at her disposal, she plunged into the adventure wholeheartedly.

Environmental Influences

Marie Curie was influenced by many of the environmental and social factors common to eminent individuals: she came from a culturally and intellectually advantaged family; she had the presence of many adults other than her parents; she was exposed to eminent adults during her formative years; and she experienced an early parental death.

Marie's family came from the peculiarly Polish form of landed gentry known as *szlachta*, nobles who in previous centuries had fought for the republic but who valued their independent authority and participated with equal voice in the parliament of the land. During Marie's time, both sides of her family had been reduced to the position of minor *szlachta*. Though very poor, the family, like many of the intelligentsia, viewed education as a powerful weapon, an unlimited resource which could fundamentally change and ennoble society.

Many members of Marie's family were teachers and the overall welfare of the children was primary.

"My father," Marie's brother remembers, "was concerned about our health, our physical development, our studies and even our free time, for which he tried to provide us with ideas and games." In the Sklodowski household, play was learning and learning was play. Although women were excluded from university in Poland, Marie and her sisters grew up assuming higher education was their right.

While growing up, Marie and her siblings had the presence of many adult role models, especially female role models. Marie Curie could look to her own family for examples of female independence. There had been her mother, the forceful headmistress, and there was Uncle Zdzislaw's wife, Marie Rogowska, the tall blonde who founded factories and ran the family estates, defying the rules of dress and decorum along the way. But the most pertinent example may well have been Aunt Wanda Sklodowska, "the most educated of all" the women, according to Marie's brother; she had attended university in Geneva and developed a "literary career." Later, Marie may have been influenced by another remarkable woman, Jadwiga Szczinska-Dawidowa. Dawidowa, responding to the yearnings of young Polish women for higher education, began to organize a clandestine academy for women. Marie was apparently involved in the secret academy almost from its inception.

Along with these adult role models, Marie was exposed to eminent adults during the formative years of her career. While at the Sorbonne in Paris she followed the lectures of Paul Appel, Gabriel Lippmann, and Edmond Bouty. There she became acquainted with other physicists who were well known—Jean Perrin, Charles Maurain, and Aimé Cotton.

Research suggests that the experience of an early death of a parent and/or an older sibling is not necessarily an impediment to the achievement of creative achievement and eminence. Such an event can be an opportunity and a challenge to healthy ego development. At age 7 Marie experienced the death of her cherished oldest sister Zofia from typhus, and that of her beloved mother at age 10 from tuberculosis. It may have been these premature deaths that in Marie evoked the agnosticism that would later bolster her faith in science.

See also: Collaboration; Albert Einstein 1879–1955; Eminence; Families and Creativity; Women and Creativity.

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Leonardo da Vinci 1452–1519

Painter, sculptor, architect, and engineer
Painted the *Mona Lisa*

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History is replete with geniuses. Their contributions to the advancement of knowledge and enhancement of the arts has greatly embellished the human adventure. There is, however, a division of genius. Those individuals who have contributed to the field of science have not made a comparable contribution to the field of art and vice versa. Only one individual—**LEONARDO DA VINCI**—in the entire historical record has been able to bridge the two fields of art and science and make Nobel-prize quality contributions to both. An examination of the unique way that Leonardo's brain was wired holds the clue to his genius.



Leonardo da Vinci, self-portrait. Used with permission from Alinari /Art Resource, NY.

Introduction

History is replete with remarkable men and women, but only once in the historical record has there appeared an individual who has no peer: such a one was Leonardo da Vinci. The quintessential Renaissance man, Leonardo made his mark as a theorist, an engineer, an artist, and a scientist. While there have been many famous thinkers, engineers, inventors, artists, and scientists whose work could be compared to Leonardo's, what makes Leonardo unique is that one would be hard pressed to find another thinker, engineer, inventor, artist, or scientist who also made significant contributions to the other fields mentioned. In terms of sheer creative intensity across the spectrum of human endeavor, Leonardo has no equal.

Historical Biography

Born in 1452, Leonardo was the illegitimate child of an illiterate peasant woman and a Florentine lawyer. He was

initially raised by his mother; then, before the age of five, he was separated from his mother and brought into the household of his father, a man of means who apparently did not care much for the young Leonardo. Leonardo had few friends during childhood and developed a highly sensitive, dreamy nature. Like many creative people he enjoyed his solitude.

As young man, Leonardo had a penchant for exotic practical jokes. Using a connecting tube, he once attached some bellows to the shriveled dried intestines of a bull and placed the guts in one room while he stood with the bellows in another. When people arrived in the room they barely noticed the prunelike coils, but were soon discomfited and then stupefied as a huge balloon suddenly started to fill the available space, crowding them against the opposite wall. Leonardo's fecund imagination poured forth a constant stream of discoveries, gadgets, engineering marvels, and far-sighted contrivances. He invented the helicopter, parachute, submarine, turn screw, and tank. Leonardo was extremely visual and expressed his ideas primarily through drawings. He made many contributions to science, both in theory and in application, but paradoxically he is principally studied in art history classes. He believed in pure mathematics as the highest expression of the human mind and stated, "There is no certainty where one can neither apply any of the mathematical sciences nor any of those which are based upon mathematical sciences." The subject of motion intrigued him and he made significant contributions to the field of mechanics. Leonardo's compelling studies of the muscular movements of men and horses, exemplified in his cartoons from his *Battle of Anghiari*, are the most detailed anatomical descriptions of men and animals in motion that have ever been produced. He published a book that still remains the definitive study of equine anatomy. His interest in the principles of movement carried him deep into the field of anatomy so that his contributions changed forever the way future students of this subject would be taught. The first modern medical textbook, Andreas Vesalius's *De humani corporis fabrica*, published in 1543, owes an enormous debt to Leonardo's earlier anatomical studies. Leonardo also attempted to understand the concept of inertia and came astonishingly close to the central clue that allowed Isaac Newton to elaborate his laws of motion two centuries later. Leonardo wrote, "All movement tends to maintenance, or rather all moved bodies continue to move as long as the impression of the force of their motors (original impetus) remains in them." The principle of inertia was called the Principle of Leonardo until Newton published his *Principia*.

Leonardo, the artist, analyzed the visual world with a scientist's eye. In a sampling of his precepts one finds,

When you have to draw from nature, stand three times as far away as the size of the object that you are drawing. . . . Every opaque object that is devoid of color partakes of the color of that which is opposite to it, as happens with a white wall. . . . The shadows cast by trees on which the sun is shining are as dark as that of the center of the tree. . . . The sun will appear greater in moving water or when the surface is broken into waves than it does in still water.

Leonardo was a pioneer in the study of light, and he revealed revolutionary insights about its nature. Leonardo understood that images were reversed upon the retina. He is generally credited with the invention of the camera obscura, upon which the principle of modern photography rests. He studied optical illusions and his explanations for them still apply today. He sketched an instrument to record the intensity of light that differed little from the one developed by Benjamin Thompson, an American, three centuries later. Leonardo was also fascinated by shadows and worked out the geometrical details of the umbra and penumbra that are still in use by present-day astronomers. He was familiar with eyeglasses and suggested in the 15th century the possibility of contact lenses. He investigated the phenomenon of the iridescence of peacock feathers and oil on water. He was the first person in the historical record to make the all-important surmise that light traveled through space and time. Extrapolating from water waves and sound waves he wrote, Just as a stone thrown into water becomes the center and cause of various circles, sound spreads in circles in the air. Thus everybody placed in the luminous air spreads out in circles and fills the surrounding space with finite likenesses of itself and appears all in all and all in every part.

Leonardo, the most visual of scientists, waxed poetic when describing the sense of sight by which we perceive light:

The eye, which is the window of the soul, is the chief organ whereby the understanding can have the most complete and magnificent view of the infinite works of nature. Now do you not see that the eye embraces the beauty of the whole world? . . . It counsels and corrects all the arts of mankind. . . . It is the prince of mathematics, and the sciences founded on it are absolutely certain. It has measured the distances and sizes of the stars; it has discovered the elements and their location. . . . It has given birth to architecture and to perspective and the divine art of painting.

Oh, excellent thing, superior to all others created by God! What praises can do justice to your nobility? What peoples, what tongues will fully describe your function? The eye is the window of the human body through which it feels its way and enjoys the beauty of the world. Owing to the eye the soul is content to stay in its bodily prison, for without it such bodily prison is torture. O marvelous, O stupendous necessity, thou with supreme reason compellest all effects to be the direct result of their causes; and by a supreme and irrevocable law every natural action obeys thee by the shortest process possible. Who would believe that so small a space could contain all the images of the universe. . . .

His most enduring contributions to our knowledge of light were not written in words, however, but rather they can be seen in his paintings. Leonardo was able to coax out of brush and paint a rare quality of light. No artist before or since has achieved the mysterious opalescence of the distant atmosphere. His ineffable vistas of faraway mountains, the wordless interplay of ethereal light upon a woman's smile, and the rippling fasciculations of a horse in motion, all are bathed in a light that at once is representative of the visual world and at

the same time contains a sfumato that gives his works an almost otherworldly quality.

Leonardo's technical innovations and scientific discoveries are insufficiently acknowledged by science historians because Leonardo was so ahead of his time. His imagination so far outstripped the technology of the 15th century that many of his most brilliant inventions and theories could not even be tested. Leonardo was also interested in the nature of abstract designs. In his *Treatise on Painting* (not published until 1651), he spoke of a method "of quickening the spirit of invention." He advised artists,

You should look at certain walls stained with damp, or at stones of uneven colour. If you have to invent some backgrounds you will be able to see in these the likeness of divine landscapes, adomed with mountains, ruins, rocks, woods, great plains, hills and valleys in great variety; and expressions of faces and clothes and an infinity of things which you will be able to reduce to their complete and proper forms. In such walls the same thing happens as in the sound of bells, in whose stroke you may find every named word which you can imagine.

Leonardo's interest in images without things led him to be the first European artist to draw a landscape. In so doing, he took the important step away from concrete and symbolic representation toward abstraction. Pure landscapes were utterly unimaginable to Greek, Roman, or Christian artists because they did not include the usual hierarchy of man-made things or people; instead they are the beginning of a recognition of patterns rather than objects. His interest in abstract pattern intensified until Leonardo became preoccupied with pure geometrical designs. His notebooks are filled with pictures that have no identifiable image. Later in Leonardo's life, he composed many drawings for his *Eruption of the Deluge* (1514), that second coming of the flood that would purify the sins of humankind with water. In these drawings, the complex shapes of massive walls of falling water achieve a level of art-without-an-image that anticipated by 400 years the abstract works of Wassily Kandinsky, Kazimir Malevich, and Piet Mondrian. Although Leonardo never published a single book, his writings were extensive. The scattered and disarranged pages of notes he left behind have been indexed somewhat haphazardly over the ensuing centuries, resulting in the *Codex Atlanticus*, which contains 1222 pages bundled together, evidently not in the order Leonardo wrote them. In these pages are some of the astonishing revelations of the Renaissance's most incisive mind. In one line Leonardo states with conviction, "The sun does not move," thereby anticipating both Copernicus and Galileo. The many pages of notes include an astonishing array of drawings of aerial maps, swirling water, plants, grand irrigation schemes, anatomical studies, and the ever-present profiles of faces of every physiognomic variation.

Rivalry with Michaelangelo

Like most historical geniuses, Leonardo had to contend with a rival artist, Michelangelo, who also excelled at engineering but cannot compare to Leonardo in the scientific endeavors. The living presence of an artist who could challenge Leonardo led to an inevitable confrontation. According to the Renaissance

art historian Vasari, Leonardo and Michelangelo disliked each other intensely. Leonardo, who enjoyed wearing the latest fashions, had frequently made belittling comments about the coarse and peasant-like appearance Michelangelo presented in his sculptor's working clothes and his ever-present pale patina of marble dust. Leonardo's remarks made their way back to Michelangelo and they did not endear the painter to him. When Michelangelo learned that the Duke of Sforza, the ruler of Milan, had commissioned Leonardo to cast an equestrian statue, he sneered contemptuously, believing that the diletante painter could never complete such a project. Leonardo, of course, was up to the task. There had been many man-on-a-horse monuments and Leonardo was determined to create something the likes of which the world had never seen. He set out to create an object not only of great beauty, but also the largest, most daring equestrian statue ever conceived.

When Leonardo finished making a model in plaster, it was so magnificent the townspeople urged him to place it outside in the piazza for all to behold in the sunshine. Meanwhile the artist busied himself with the engineering details of the proposed casting and informed his patron, Sforza, he would need 200,000 pounds of bronze. Sforza dutifully began to accumulate such a large quantity of the expensive metal, but not without a nagging doubt about the wisdom of commissioning such a large and expensive statue. Shortly thereafter Sforza found himself pressed by the armies of the French at his gate. He directed the bronze he had put aside for Leonardo's statue to be cast into cannons instead. Depressed, Leonardo departed for Florence. The horse suffered the fate of the martyrdom of St. Sebastian. When the French mercenaries forced the gates, they were confronted by a piazza deserted save for a towering clay horse, which must have appeared to them as a Trojan horse in reverse. In the victory celebration that followed, drunken soldiers began shooting arrows at the vulnerable *cavello*, and continued to do so into the night. In the morning, the arrows were removed and the mortally wounded horse was exposed to the elements. Rainwater seeped into the arrow tracks, and within a few months the erosive effect caused the horse to disintegrate.

One day soon after in Florence, Leonardo passed a group of young men in the piazza who were discussing Dante's *Inferno*. They asked Leonardo for his interpretation just as Michelangelo, who was also living in Florence, deep in thought, rounded the corner. Michelangelo was known to have studied Dante zealously. Leonardo, in a gentlemanly fashion, said, "Here is Michelangelo; let us ask him as he will know." Michelangelo, however, misunderstood and thought Leonardo was making fun of him. Michelangelo exploded: "Explain them yourselves! You made a design for a horse to be cast in bronze, and, unable to cast it, you have in your shame abandoned it. And to think that those Milanese capons believed you!" Leonardo flushed deeply but made no reply, turned on his heels, and strode away. These two titans never spoke to each other again, but Leonardo, as best we know, never again spoke or wrote ill of Michelangelo.

Paradox Of his Personality

Leonardo had a penchant for secrecy and loved to decode and write in cryptograms, and he enjoyed trying to decipher occult

messages from the past. In Leonardo's voluminous writings, personal statements are curiously absent. Upon learning of his father's death, for example, Leonardo made the following dispassionate entry in his journal:

On the ninth of July 1504, Wednesday at seven o'clock, died Sen Piero da Vinci, notary at the palace of the Podesta, my father, at seven o'clock. He was 80 years old, left ten sons and two daughters.

Despite his personal reserve, Leonardo was the exemplary Renaissance man. By reputation, he was gentle and generous, and he was an accomplished musician and a pleasant, witty conversationalist. Leonardo developed a philosophy akin to St. Francis of Assisi's early in his life. He had a reverence for all living things and frequently bought caged birds just so he could set them free. He became a vegetarian because he did not believe one should ever kill a living creature. It is a paradox that Leonardo, who was reputed to be unable to harm a fly, nevertheless expended considerable amounts of his genius designing engines of war. In the course of his career, he invented some of the most gruesome devices to grind and rend the flesh of enemy soldiers. Without the faintest moral compunction, he solicited employment from the infamous Cesare Borgia and left his post as Borgia's military engineer only when he discovered that a fellow worker of his, also in Borgia's employ, had been strangled to death for some unknown reason by their mutual patron.

How Leonardowas Unique

To highlight the fact that Leonardo stands alone, imagine that in every year of human history a Nobel prize committee had granted an award for the outstanding artistic achievement as well as for the most meritorious scientific one. To be fair, let us broaden the scope of the word "scientist" to include everyone whoever pondered the nature of "nature," including Pythagoras, Plato, St. Augustine, Aquinas, Kant, Dalton, Darwin, and Freud.

Despite the numerous artistic titans and the many giants of science, the fact that leaps out of the historical record is how rarely anyone would have ever qualified for *both* awards. While there have been artists who dabbled in science and scientists who displayed an artistic bent, there is almost no one who was able to make an outstanding contribution to both fields. Brunelleschi and Alberti would certainly be nominated. In the realm of art, Michelangelo, Voltaire, Goethe, and Wagner spring to mind, but their scientific contributions would not be considered Nobel prize material. Correspondingly, not a single artistic creation of Nobel prize caliber has ever issued forth from any of the men or women who applied their talents primarily to solve the problems posed by science. How odd that in all of recorded civilization only one person could lay clear-cut claims to both prizes. It speaks to the sharp divisions in our culture between art and science that we have produced only this one indisputable exemplar of the total integration of creativity's dual aspects at such high levels. The existence of even this one individual, however, points the way to the possibility and the importance of healing the artificial rift between these two sides. Somehow Leonardo

merged the processes of seeing and thinking, and the profusion of images and insights that emerged from that cross-fertilization was cornucopian.

Left Brain–Right Brain Split

To better understand this amazing Italian's creativity, we must take a short excursion and examine how the human brain processes information. All vertebrates from fish onward have a bilobed brain, that is, a right hemisphere and a left hemisphere. In all animals with this configuration, each side of the brain performs in a mirror image fashion the same tasks as its opposite side. Only humans have sharply diverged from this arrangement. While each side of the human brain is similar in appearance to each other and resembles the configuration of other animals, each lobe of a human's brain performs functionally different tasks. This specialization is called hemispheric lateralization. (Some other higher mammals and birds exhibit brain lateralization but none approach the extent to which this feature is present in humans.) The evolutionary reason for this arrangement is nature's decision to dedicate one hemisphere primarily for language. This then became the left hemisphere in right-handed people. Slightly over 90% of the population is right handed and 90% of their language centers reside in their left hemisphere. (The arrangement is not so lopsided in women, homosexual men, and lefthanded people of both sexes.) The other hemisphere, the right side, then became the primary location for functions that used to reside in both lobes, but because of space requirements now had to be squeezed into the right lobe. Since language is processed one word at a time, one sentence at a time, and one paragraph at a time, the left hemisphere functions primarily in time. All of the other human abilities and concepts that are time dependent, such as arithmetic, causality, determinism, logic, and rationality, require a well developed linear sequential time sense.

The left hemisphere controls the act of willing through its agent the right hand, which carries out the commands of this hemisphere. The right hand is the agent of action and aggression. In battle or the hunt, the right hand swings the club or sword, throws the spear, and pulls the trigger. It is the right hand that hammers the nail while the left one steadies the nail. As such it is more dominant than the left hand. The four cardinal abilities of the left hemisphere are language, numeracy, abstract thinking, and doing. All the human abilities that depend on holism and simultaneity, such as the recognition of spatial relationships, were crowded into the remaining right hemisphere. Pattern recognition, identifying faces, manipulating three-dimensional objects in space, appreciating a 70-piece orchestra, or deciphering inner emotional states through a person's expressions or gestures fall under the purview of the right brain. The left hand, controlled by the right brain, is often the one that cradles a baby, carries what the right hand has gathered, and wards off blows. Its function is more protective and nurturing. The four cardinal features of the right hemisphere are perceiving patterns, recognizing faces, synthesizing music, and creating the existential state of being. Immanuel Kant proposed that human beings have two innate dimensions built into their brains which they use to construct their

perception of reality. Kant imagined these two parameters as time and space. In many ways, the hemispheric lateralization scheme recently elucidated by neuroscientists seems to confirm Kant's speculation. The right hemisphere is predominantly a spatial hemisphere. Driving, dancing, skiing, and seeing the relationships of the parts to the whole are better handled by this hemisphere. On the left, every function that takes place there is time dependent. One could almost say that the left hemisphere is a new sense organ designed by evolution to perceive time. It differs from our other conventional sense organs in that it does not have an opening to the outside world through skin or skull.

Because the loss of speech results in a catastrophic effect on human communication, the left hemisphere has been commonly referred to as the "dominant" hemisphere and the right hemisphere is called the "nondominant" one. Researchers have identified the right hemisphere as the side best suited to process novel information; the left side is better at organizing and retrieving information that has already been learned. One could say that creativity is more a right brained function than a left one.

While not scientifically proven, it is also fair to say that the right hemisphere has those attributes that are commonly associated with the feminine and the left has those that are traditionally thought of as being masculine. Intuition, holism, synthesis, simultaneity, and emotions have been traits we usually associate with the feminine. Linearity, sequence, reductionism, analysis, and duality are concepts traditionally associated with the masculine. In a similar duality, science is traditionally associated with the left hemisphere and the masculine, and art is traditionally associated with the right hemisphere and the feminine.

This background discussion of right–left brain dichotomies is necessary to understand the unique creativity of Leonardo. To integrate so seamlessly the two hemispheric functions, Leonardo must have been born with some very peculiar wiring in his brain. We know several startling things about his mental faculties, the most striking of which was that he was ambidextrous and could write with equal facility forward and backward (mirror writing). Some of these features are found in people with dyslexia, a gender cognitive syndrome (affecting boys over girls 9:1) in which the letters "b" and "d," and "p" and "q" are frequently transposed. Many neuroscientists theorize that dyslexia may be due to a failure of brain dominance. In the dyslexic child, both hemispheres have nearly equal responsibility for the generation and understanding of speech, written language, and hand dominance, instead of the conventional arrangement in which hand preference and the preponderance of speech centers lie in the dominant lobe. Although today dyslexia is generally considered a learning disability, it did not hinder Leonardo. Perhaps his near equilibrium between his lobes allowed him to range back and forth between two different mental processes, one rooted in space and the other in time. In this way he achieved a depth of understanding about this world that has rarely, if ever, been equaled. The equality of Leonardo's hemispheres enabled this dual man to perceive space and time differently from any artist or scientist before him. Spatially, Leonardo elevated the artistic practice of sfumato to its apogee. It was his vision of deep space and the way atmospheric conditions changed distant light that revealed the

subtleties of depth to all viewers of his art. This feature of reality had gone unnoticed by previous artists. In the most famous painting in the world, his *Mona Lisa*, Leonardo imbued this obscure young woman with an eternal aura of mystery. A significant part of her inscrutable countenance lies just at the edges of the viewer's perception, for on either side of her head Leonardo created different distant landscapes that do not coincide: One is painted in a perspective that makes it closer than the other. While few people are consciously aware of this slight difference in the third dimension of depth, it is not unperceived by the viewer's eye, and this paradox of space heightens the enigmatic quality of the *Mona Lisa's* smile.

Leonardo's ability to perceive time was also *sui generis*. He observed and recorded in his drawings the complex sequence of pigeons' wings fluttering in flight, as well as the patterns made by fast-flowing water. It was not until time-lapse photography was invented 300 years after he worked that anyone else could slow down these visual blurs, and then the studies photographers made confirmed what Leonardo had seen. He alone, among all the world's artists, was able to see time in slow motion, and in the case of his flowing water drawings he was able to transfix time so that it stopped. He worked out a bird's wing's sequence of flight and the still frame pattern of rivulets capturing the motionless complex whorls and eddies. Perhaps the nondominance of his hemispheres allowed Leonardo to envision time as an "all-at-once" phenomenon, rather than perceive it in the conventional "one-at-a-time" sequence. Further evidence that Leonardo's time sense was different from other people's is his reputation for procrastination. In one case, Leonardo set an all-time record for time elapsed between accepting a commission and delivering the finished painting—23 years! In another, Pope Leo X commissioned Leonardo to paint any subject he wished. Absorbed as always in technical matters, Leonardo started to compound a special varnish for the finish of the unpainted picture. The pope, checking on the progress of his commission, threw up his hands in disgust and exploded, "This man will never accomplish anything! He thinks about finishing the work before he even starts it!" If Leonardo did not envision time as a linear sequence running from beginning to end, perhaps for him the end was the same as the beginning. Aware of his unusual ability to see time all-at-once, he once remarked, "We know well that sight, through rapid observation, discovers in one glance an infinity of forms; nonetheless, it can only take in one thing at a time." In ancient mythology the wisest figures were hermaphrodites. For example, Tiresias, the hermaphroditic blind seer in many Greek dramas, was the one character who could see the clearest. On the continuum of masculine to feminine, homosexuality falls somewhere in the middle. If the left hemisphere represents the masculine in both men and women, and the right hemisphere represents the feminine in both men and women, then someone who had a near equilibrium between the two cortical sides would likely be homosexual. Besides his ambidexterity, Leonard's homosexuality was well recorded. In his case, considering his genius and ability to see into the future, perhaps it would be more appropriate to think of Leonardo's balanced brain as the factor that made him one of history's nonfictional hermaphrodites. Although he lived more than 400 years ago, the achievements of Leonardo continue to fascinate a populace that still operates

primarily out of either one or the other side of the psyche. In *The Innocent Eye*, Roger Shattuck reports that for a stretch of 50 years— from 1869 to 1919—a time characterized by a burst of artistic and scientific creativity in the West, there was an average of one full-length book per year published on the subject of Leonardo—more than about any other individual. This literary outpouring came from such diverse authors as Bernard Berenson, Jakob Burckhardt, Sigmund Freud, and Paul Valéry, to mention but a few. The number of books still being published about the life and work of this phenomenal artist / scientist suggests that his combination of artistic humanism and scientific curiosity attests to the public's continuing awe of Leonardo. If Leonardo could integrate the two halves of his divided psyche, then how might the rest of us learn to do so? Perhaps the left hemisphere, the language lobe, has been given too much weight in Western culture. Perhaps dependence on left brained thinking and a denigration of right hemispheric thinking prevents us from being more creative. Clearly, Leonardo's brain differed from the ordinary in that he had a more balanced outlook. The following analogy will help to illustrate why the full integration of the attributes from each hemisphere will enhance a new way to see and think, which in turn is the essence of creativity.

Nature of Integrated Paired Sense of Sight and Hearing

One of the most compelling features of our sensory apparatus occurs as the result of the quirk of overlapping fields. When a paired sense such as vision or hearing appreciates the same perception from two slightly different positions in space, something unique emerges. For instance, since both our eyes face forward, we see essentially the same picture with each eye at any given moment, but because the distance between the skeletal orbits of the two eyeballs is minimal, each retina registers its impression from a slightly offset point of view. When we view an object with one eye, we perceive only two vectors of space: perpendicular height and horizontal length. However, when we open our second eye, we provide our brain with information from a slightly different angle. Somewhere within the matrix of the visual cortex, the brain overlaps the information from these two angles to create, almost magically, the third dimension of depth.

Our brains operate in the same sort of way with our hearing. Each of our ears listens to the same sounds; however, each takes in auditory information from a different point in space. Again, this distance between our ears, though small, is enough to create a third dimension of sound that we perceive as depth. Everyone knows this who has listened to music through a pair of stereophonic earphones and heard the sound as if it emanated from a point directly above the head. This occurs even though the listener *knows* that the sound from each speaker is entering each ear on the head's opposite sides. We can also discover a new dimension when we attempt to understand art and science in terms of each other. Our language certainly recognizes this, which is why, when we say a person is "well rounded," or that he "has depth," we commonly mean he can see the world through the different lenses of art and science and, by integrating these perspectives, arrive at a deeper understanding of reality. These colloquial

expressions indicate that, unconsciously, we realize that someone who has the ability to knit together two basically different hemispheric points of view is richer for it. We refer to them in words evocative of depth— “multifaceted” or “multidimensional.” The right and left hemispheres offer overlapping viewpoints of the same thing. Using both hemispheres allows us to see it in the full glory of three dimensions and understand its existence in an extended “now.” The synthesis will produce a heightened awareness and appreciation of the world we live in, two preconditions for creativity. Meister Eckhardt, the medieval mystic, wrote, “When is a man in mere understanding?” I answer, “When he sees one thing separate from another.” And when is a man above mere understanding? That I can tell you: “When a man sees All in all, then a man stands beyond mere understanding.”

Conclusion

Using both brush and pen, Leonardo changed the way we see the world, and this subtle shift in mind-set prepared people to

be receptive to the changes in perception that were destined to bring forth the modern world. This extraordinary individual was arguably the most creative individual in history. He created the sobriquet “Renaissance man” because of the outstanding contributions he made not to just one field but across a spectrum of fields, beginning with art at one end and science at the other.

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Dance and Creativity

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Glossary

Aesthetics From the Greek root word, aisthese; applied to something that incorporates perception, feelings, and sensation; usually manifested in art, culture, and nature.

Chi Kung Also known as Qigong; Chinese term applied to all forms of exercise which works with one's chi (chi is vital energy or breath and kung is to work with or to train); simply translates as breathe work that incorporates active and passive training.

Classical dance Ballet – theatrical classical Western school of dance that has evolved over six centuries and is known for its codified movement vocabulary.

Classical dance kathak Classical dance of India known for its brilliant rhythms, fast turns, and foot work that combines Hindu and Muslim influences in perfect harmony.

Convergent and divergent thinking Convergent thinking is a process that moves toward one point; whereas, divergent thinking is a process that moves away from one point.

Cortical The outer layer of the brain, also considered the higher regions of the brain.

Flow state To move freely and effortlessly; a state that is achieved when the challenges of the task match the skills of the performer.

Phenomenology Philosophical and qualitative research study that examines 'the thing itself.'

Phylogenetic The history of the evolution of a species as opposed to ontogeny which is the history of the development of an individual organism.

Reasoning Inductive reasoning is a process of separating, bringing together and reaching a conclusion versus deductive reasoning is a process of taking away to reach a conclusion, moving from the general to the particular.

Shaman A priest of Shamanism; found in any religion that believes gods and spirits work only through the shamans who provide healing and wisdom to the tribe members.

Dance and Embodiment

Jose Limon, dancer and choreographer, once observed that dancers are fortunate because their instrument is the most eloquent and miraculous of all instruments, it is the human body. Dance is an ancient and enduring practice, a nonverbal act of expression that embodies imaginative feeling and being. It is a mind–body experience that expresses and reveals the archetypal themes of humanity. Performed by dancers and viscerally experienced by viewers, dance springs from and resides within movement that exists in an immediate interpersonal time–space continuum.

Dance sits at the center of human expression, indeed, according to Hindu legend, Shiva, the Lord of the Dance, created heaven and earth when he performed his Dance of Creation. Curt Sachs claimed that dance is the mother of the arts since the creator and the thing created, the artist and the work, remain one and the same thing. Humans are able to use their bodies in dance to create rhythmical patterns through movement in time, to engage a flexible sense of space, and to evoke vivid representations of a world seen and imagined. The dancing body was the first medium of expression; later, substances such as stone, paint, musical instruments, and spoken and written language were utilized to

enhance expression. Dance continues to be a vehicle for the ecstatic practices of spiritual rituals, for the exhilarating liberation of imagination, visions and repressed emotions, and for the delight of sharing social events. Ancient civilizations regarded dance as sacred, primal, and essential.

Dance was and continues to be an activity that involves rhythmic motions and gestures that recreate things seen and heard, giving form and substance to intangible and irrational perceptions, and expressing the divine and the mundane. From the beginning it was believed that dance represented cosmic harmony; it remains a dynamic activity that resides completely within the present-moment. Though dance could easily be mistaken for any movement, including the everyday actions of work and play, it exists as something separate. What differentiates dance from other forms of movement is its singular intention towards an aesthetic that reveals itself through itself. It is immediately recognized by the youngest child and by anyone who visits a foreign culture. Dance, in its immediate visceral potency, breaks down the distinctions of body and soul, social norms and individual expression, and emotion and intellect. Dance is defined as the rhythmic pattern of movement but it is much more – it is an aesthetic experience that moves easily from the domain of spiritual practices and social celebrations to artistic forms.

Dance Forms

The origin of dance is almost impossible to determine with accuracy; however, ancient paintings and writings do provide clues. We can surmise that dance was deeply integrated into all aspects of communal living. It was part of ceremonial practices, story-telling, and spiritual rituals. Dance and acting were indivisible in the beginning, although early in dance evolution it separated as a unique and different form of expression. Movement patterns performed by individuals were orchestrated into group choral dances, organized around rhythmic structures and spatial patterns such as rounds, chains, serpentines, and squares. Over time dance became more codified and with these stylized demands dancers required formal training and protracted periods of practice. Regardless of region or continent, dance developed along several tracks: (a) social celebrations and ecstatic expressions of pleasure, (b) religious rites, (c) healing and shaman practices, (d) folk dance, also known as world dance, (e) ballroom, (f) dance as theatrical or operatic interludes, (g) concert dance forms such as jazz, contemporary and tap, (f) classical dance such as ballet or Kathak.

Although dance forms change and develop over time, original dances are maintained with great authenticity. Historical dance societies and performing groups operate as living museums in which dances are preserved through a practice of examining (a) original music, (b) art work or photos from the time period, (c) dance notations, and (d) written critical reviews of the dances. Further, the long tradition of dancers handing down dance steps from one generation to the next, although not an authentic documentation, does keep indigenous and classical dance alive. These organizations, companies and groups are dedicated to preserving the authenticity of dance, while in less formal settings small communities and tribes retain and regularly practice their dances at family gatherings and community celebrations. The preservation of dance tradition is counterbalanced by the passion and commitment of dancers and choreographers who strive to push the boundaries of physical limits and the constraints inherent in any dance form. The advancement of dance forms evolved within many settings such as the courts of royalty, where all classical dance forms around the world developed, or in small cafes, urban streets or small studios, where social dance, tap, jazz, modern, stepping, folk dances or urban street dances emerged as a way to express the socio-political world of the people. Many dance crazes, started by small groups of individuals, preceded larger socio-political shifts in behaviors and values. For example, Argentine tango grew in the barrios and cantinas of South America. It expressed the passions, tensions, and struggles of a community and even when it was outlawed it persisted. Soon dancers in other parts of the world adopted the tango. Rather than being quelled it progressed into formal theatrical companies that toured the world. Similar dance crazes have unfolded within folk dance traditions and classical dance. This was certainly the origins of Modern Dance, a dance form that rejected classical ballet and celebrated the struggles of the human spirit, including the unrelenting pull of gravity on all movement. Today world dance traditions are both preserved to ensure authenticity and fused into new forms that can express the diversity of our world. They can be readily viewed on the internet (YouTube or the Dance Channel), television and

film, in the traditional settings of theatres, studios, site-specific spaces, dance halls, restaurants, casinos, cultural community centers or in the school halls and even on city sidewalks.

Choreography

The word choreography is a compound word of Greek origin, literally meaning dance and write. The practice of choreography and the leadership provided by a choreographer (those who create new dances) seems to have evolved concurrently with dance development. Although dance notation only existed since the early fourteenth century, choreographers began by designing their compositions on the actual dancers who performed the work, and this practice continues today. The choreographer's function is to conceive and make dances. They (1) select the music, dancers, and other performers that may be involved in the work; (2) establish the style and specific steps of the dance; (3) determine the design elements such as sets, props, lighting, and costumes; and (4) they share in the responsibility of producing the dance (where it will be performed, promotion and advertising of the performance, and managing budgets and revenues). The choreographer may be the dominant figure in a theatrical event, especially if they are also the artistic director of a dance company, or they may be part of a creative team when a theatrical work includes dance such as in musical theatre, opera or dramatic plays. Choreographers also work in large and small productions that are not dance-specific, for example, half time shows during games, opening and closing ceremonies of sporting events, fashion shows, circuses, or cultural festivals. Choreographers work in film, television, and other electronic media whether for the purpose of creating advertising, adding dramatic or physical variety to a work, or as the major focus of the show.

Choreographers are first trained as dancers, although most express an interest in making dances as well as performing dance early in their career. Today there are choreographic training programs offered in conservatories, universities, and professional dance companies; however, many choreographers still learn to create dances by witnessing others in the process. Unlike composers and playwrights, choreographers generally do not write a score or a text, although some choreographers will have their dances notated after the work is set. The majority of choreographers compose new works on the mobile bodies of dancers who will then share in maintaining the memory of the new work. Since this process is collaborative, dancers frequently join in the creation of the dance. The quality of how they move, the technical skills that they possess, and their unique physical appearance all influence the creation of a dance work; most choreographers will cast dancers with these elements in mind. The dancer is the choreographer's instrument and may even be the inspiration for a new work. Like the other performing arts, dance requires daily practice to maintain the skills essential to give life to the dynamic expression of the work and since a dancer's instrument is the embodied imagination they must cultivate both physical skills and a vivid imagination. Choreographers who share in this same training practice expect dancers to provide these ingredients. The dancer and choreographer are completely interdependent; they bring an aesthetic understanding that springs from

their collective kinesthetic imagination and they give present-moment life to the artistic expression inherent in dance.

Dance and Healing Practices

Although dance is primarily regarded as an aesthetic art form, there is a long tradition in the healing arts and spiritual practices to include it. For example, ancient shaman practices incorporated dance as a means to communicate with spirits and to activate transformative energy necessary to excise unwanted spirits. Formal spiritual practices frequently require specific physical postures to be assumed during meditation or prayer, the same postures that are repeatedly found in dance forms around the world. Many ancient healing traditions such as yoga and chi kung have clearly prescribed sequences of dance-like movements that are practiced in a state of mindful awareness. Since around 3000 BCE until today, these ancient movement arts offer relief to human suffering by activating physiological and psychological energetic release, and by providing hope to those seeking enlightenment and wisdom. As Western medicine began to depart from these ancient practices, dance and movement were devalued and gradually disappeared from medical treatment. However, in the United States in 1940, dance therapy became a distinct profession and in 1966 the American Dance Therapy Association was founded. Not surprisingly, dance therapists in the West reintroduced practices similar to those of the shamanistic, tribal, and Eastern traditions. They asserted that the body and mind were interrelated and that psychotherapy could use movement to further emotional, cognitive, physical, and social integration of the individual. With increased Western cultural awareness of ancient healing traditions, native tribal rituals were once again given credence and in some communities these healing practices were reinstated. For example, the Northern Canadian Inuit communities are now treating their depressed and addicted members with ancient healing practices; practices that incorporate movement and dance. Many treatment centers that offer an integration of Western and Alternative medicines prescribe some form of dance or movement therapy such as in the rehabilitation of patients suffering strokes, neurological disorders, or heart disease. Dance as a healing art continues to be incorporated into programs that treat babies, children, adolescents, adults, and geriatric populations. Many experienced dancers are actively working in the healing arts and conducting research in this field of study.

Creativity and Neurobiology

It can be readily argued that dance and creativity have co-existed since the beginning, even though the product (dance) disappears as rapidly as it appears. Given this transient quality, any study of creativity and dance must focus on process as much as product. Traditionally, creativity is defined as a process in which original or meaningful new ideas, forms, interpretations, or methods transcend traditional ideas, rules, patterns, or relationships that results in a product that is unique and original. An older term, imagination, is defined as the faculty of forming memories, mental images or concepts of what is not actually present to the senses. The merging of

these two terms, creative and imagination, has come to mean not only the memory of actual events but the transformation of these memories into something that has never existed before. In neurobiological terms, the retrieval of memories is a process which reconfigures images that were previously consolidated and stored in multiple regions of the brain. Memory retrieval is a form of imagination but what distinguishes any imaginative memory from creative imagination is how we use these images.

The brain is dynamic and continually generates neural maps, neural networks, and neural systems to support life. When we engage our creative imagination, neural activity is even more complex. According to neuroscientist, Walter Freeman, creative activities require the most chaotic and unstable brain activations and yet this chaos is organized and balanced by high levels of global cooperativity in the brain. This cooperativity is managed in multiple association areas located throughout the higher and lower cortical and subcortical structures of the brain. Antonio Damasio, a neuroscientist, states in his book, *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*, that there are two levels of neurobiological description, one for the mind and one for the brain. This separation is not intended to be reductionist but rather reflects different degrees of complexity in neural activation and patterning. Damasio places the body and emotion at the apex of making unconscious material conscious. Like choreographers and dancers, he claims that the body and emotion express our inner feelings and intentions. He posits that the mind, a much more complex term, captures the mystery of the imagination; whereas, the brain, a physical organ, opens up the discussion of where, and to some degree, how the imagination and creativity operate. Although creative individuals have long known the power of the creative imagination, today scientists are attempting to understand its neurological process.

There are many theories that describe the creative process but one of the most applicable to today's neurobiological findings is a biphasic model of creativity. The biphasic model is a recursive model in which global imaginings are detailed and elaborated. This biphasic activation pattern can occur with high global cooperativity that regulates chaotic neurological patterns or it can work with less flexibility, ease, and regulation. The poet, Samuel Taylor Coleridge, described his notion of a biphasic model and named the two phases, primary and secondary imagination. He believed that primary imagination was the most direct living power and prime agent for all human perception. As a creative process, primary imagination worked as the instant act of organizing global images into meaningful patterns. Coleridge's secondary imagination, an echo of primary imagination, was not a spontaneous process but coexisted with conscious will and analytic thought. With the effort required to employ his secondary imagination he noticed that his images tended to dissolve or become diffuse. Their primacy dissipated with the effort to create them. Although different in kind, both primary and secondary imagination processes inevitably operate in any creative enterprise.

Primary and secondary imagination activations employ different cognitive and affective strategies. Often primary imagination is comprised of divergent thinking, inductive reasoning and broad global focus. These cognitive strategies allow artists to make remote associations (drawing material that may seem unrelated and bringing them together). In order to

facilitate this form of reasoning and focus, less frontal brain activation occurs as is evidenced by increased theta wave rhythms, a rhythm state that is associated with deep reverie. Decreased frontal cortical brain activity facilitates disinhibition of the sub-cortical (deeper and lower regions) of the brain which then releases more emotional and sensory information during the creative process. Furthermore, during primary imagination the usual pragmatic daily activities that demand more language-centered left hemispheric dominance are reduced, thus both hemispheres interplay. When the left hemisphere is no longer dominating right hemispheric activations diverse and bountiful associational information is detailed and elaborated. Secondary imagination consists of convergent thinking, deductive reasoning, and focused attention. These cognitive activities are critical for detailed selection and engage more prefrontal and frontal cortical activation. With the activation of higher cortical regions there is greater inhibition of sub-cortical regions and thus less emotional interference occurs. Literature on right and left hemispheric specialization supports and adds to our understanding about creative integration. For example, the right hemisphere generally holds autobiographical memory as well as an ability to contextualize events through a process of balance, focus, self awareness, self-reflection, and self-monitoring, while the left hemisphere applies learned rules, specificity, complexity, and reason. Perhaps Coleridge's ideas contained an intuitive knowledge about how primary imagination resembled right hemispheric processes while his secondary imagination paralleled the activities of left hemispheric activations. The creative imagination flexibly engages both the right and left hemispheres to create content and form that shapes creative meaning.

For the dance artist it is helpful to recognize and understand these recursive biphasic states. To engage more primary imagination it is necessary for the artist to reduce external stimulus in order to enter a state of deeper receptivity, a state that facilitates internally generated remote associations. This occurs as a result of reduced cortical activation. Further, it is helpful to recognize that when the frontal cortical regions are quieter, there is less inhibition of the lower brain regions that store more intense emotional memories. Since the higher cortical regions regulate the intensity of emotional responses, when these regions are quieter more unbidden memories and sensations emerge, an experience that may be quite unsettling for artists if they do not have the skills to tolerate and regulate them. During secondary imagination, the detailed complexity of higher cortical regions, especially from the left hemisphere, operates in a more sequential linear progression, a process that is much slower than global right hemispheric activations. Artists must also learn to tolerate and regulate this slower process since it can heighten anxiety and doubt. The more artists learn how to recognize, activate, and fluidly shift between primary and secondary imagination, the more they experience a sense of control and security. Twyla Tharp stated in her book, *The Creative Habit*, that what is most important for any dance artist is to repeatedly engage in the act of creating and dancing; it is a daily practice, a habit that is maintained throughout a dance artist's career. Knowing how to activate and respond to primary and secondary imagination is a learned skill that requires trust and patience. With practice a dance artist learns to experience a sense of creative efficacy and

with it comes an abiding faith that the creative imagination can be activated, tolerated, and regulated.

Dance and Neurobiology

We have gained some knowledge about the neurobiological processes operating during creativity and great understanding about how movement is organized. We know that our brain is biased to respond to sensory stimuli, especially sensing motion in others, whether it is a baby responding to the loving smile of a mother, a child imitating the actions of older children, adults empathically engaging with others, or members of a social gathering swaying and rocking to music. These responses are classified as fixed action patterns; they are phylogenetically innate neural network patterns of behavior that integrate movement and emotional activation. When we participate in movement sequences that are intrinsically congruent with the outside world we experience a knowing that is personal and individual. The sensori-motor-emotional associational regions of our brain and body are designed to resonate with the actions of others. We engage in mind-body experiences that are always immediate and visceral and when aesthetic intention is added to movement, dance emerges.

Science now confirms that we have multiple neural maps of our body that react in real time while anticipating future actions and intentions. Sandra and Matthew Blakeslee, in their book, *The Body has a Mind of Its Own*, clearly describe how our brain maintains body-maps that extend and blend into space. In short, our self does not end where our flesh ends, but extends and blends with the world, including other beings. They describe this as peripersonal space, a flexible elastic aura-like space that expands and contracts to meet our goals and needs. Our perceptions of our body expand while driving a car, holding an object, in an embrace, or dancing with another. Our profoundly plastic body-maps are located throughout our body (skin surfaces, joints, and muscles) and our brain (central, autonomic, and peripheral nervous systems). This allows for complex dynamic engagement with the world and an embodied sense of agency and meaning.

Our body schema (a felt sense based on physical properties of our body) is ideally matched with our body image (learned attitudes about our body). In dance this is one of the most delicate convergences because many trained dancers acquire great skill at managing body schema activations; however, their body image may become distorted by the ideal notion of what a dancer's body is to resemble. Body schemas operate almost entirely outside of our conscious awareness. For example: (a) proprioception (meaning perception of one's own) provides a sense of body motion, (b) the vestibular system provides a spatial awareness while we are moving, (c) our senses of touch, sight, sound, and smell provide further information, and (d) muscle memory (procedural memory) facilitates an organized and coherent motor action. Multiple regions within our brain coordinate our body schemas and organize and mobilize conscious and unconscious intentional actions. What is most intriguing is that our perceptions of the world and our actions are primarily predictive. Our brain is constantly creating models of our body and the world, continually updating these models as new information is received and

extrapolating and predicting action intentions so that we can effectively respond. For great dancers and athletes this predictive power is what gives them a decided advantage over those with less neurologically dynamic body schema facility. In fact, research studies have shown that physical practice maintains and may even improve cognitive ability. According to Glenna Batson, a dance scientist and physical therapist, through dance training, accuracy of proprioceptive inputs are strengthened. This suggests that dancers develop an augmented inner body sense compared to nondancers. Research findings also demonstrate that when greater technical skill level is attained, brain activation is more efficient and precise. As a result of long hours of training, the modifications to body schemas are rapid and require less metabolic energy. These findings explain why beginners may get discouraged; they employ more brain activation and achieve less accurate body schema feedback. Only with practice does this improve. The brain manages the learning of new skills much differently than the activation of old skills. This is precisely why Twyla Tharp claimed that creativity must be a habit and why dancers around the world know that they must dance regularly if they wish to dance with ease.

The discovery of mirror neurons is one of the most intriguing neuroscientific findings, especially when applied to our growing understanding about how dance engages others. These specialized neurons, located in major cortical regions of the brain, allow us to mimic an action that is performed in front of us. They rapidly link perception, action, and intention in order to facilitate the acquisition of new motor behaviors. Not only do these mirror neurons help us learn new skills but they also form strong neural circuits as we practice and witness these skills. Perhaps this is why members of an audience who have danced gain greater pleasure when watching others dance and why they are less kinesthetically involved when they watch football players. Mirror neurons help us learn and they improve with practice. Along with mirror neurons we are also neurobiologically biased to empathically sense the emotional state of others. Even in newborn infants this ability is evident. When one baby cries in the nursery a contagion effect results and soon all will be crying. The limbic regions in the brain detect the emotional states of others and mobilize actions and intentions that are congruent. This is why we can laugh with another and why we feel sad when someone else is crying. Further, as we respond emotionally, our interoceptive awareness activates visceral sensations. We can feel light-hearted or sick to our stomach when we experience emotional states. The insula, a region situated between the prefrontal cortex, the limbic system, and other subcortical regions, integrates emotional, motor and somatic signals allowing us the capacity to fully feel what is happening around us. Our body schemas blend with our interoceptive and emotional sensations and they all give us appropriate feedback so that we can engage effectively. These felt exchanges occur between dancers and between dancers and their audiences.

Our brains are wired so that we can effectively interact with our environment. Dance, as an activity and as an art form, engages these social neurobiological systems. For the dance creator these complex neurobiological processes are embedded within the tapestry of the creative imagination. Howard Gardner suggested that dance artists may have greater kinesthetic intelligence. This may be in part because they have

trained and refined their body schema systems, systems that include mirror neurons and interoception. Neurobiological processes that operate during the creative moments of dance are rich resources that are enhanced by training, and heightened by flexible and fluid state shifts that adapt and respond to the demands of the creative moment.

Dance, Creativity, and Research

Dance research falls into several large groupings. The majority is theoretical and qualitative: (a) anthropological studies of world culture and indigenous dance practices; (b) descriptions of historical trends within specific dance genres such as ballet, tap, modern, African, or ballroom; (c) historical-biographical accounts that investigate individuals, how they were influenced by their socio-political environments and how they shaped dance; and (d) critical inquiry studies that analyze the shifting patterns of dance. Although important and rigorous scholarship has been produced, within the historical-biographical genre, a pattern of idealizing and glamorizing dance artists prevails. Despite this tendency many excellent biographical books, such as those written on Serge Diaghilev, Vaslav Nijinsky, Martha Graham, Fred Astaire, or Tatsumi Hijikata, inform the reader of the unique creative gifts inherent in the artist and the specific contributions they made to the field of dance.

More anthropological-based and critical inquiry subjects on dance are included in essays found in dance journals. One of the major journals dedicated to such topics is the *Dance Research Journal*. It offers essays on issues such as transnational migration patterns in the arts, especially theories and methods for understanding patterns of individual and mass human movements across world stages and the social-cultural experiences that such movement migrations engender. In this journal topics are examined with great care and detail. For example, writings suggest that the effects of human migration on dance in particular, and the arts in general, help researchers investigate issues such as citizenship and statelessness, labor refugeeism, border wars, religious and political occupations, and environmental displacement. Anthropological fieldwork studies document how dance is integrated into religious and ritual traditions and how these traditions inevitably influence subsequent dance practices. This line of research provides contextual insight into today's urban street dance practices such as hip hop, popping and locking, house dance, capoeira, krumping, and break dancing. Critical studies, a field of study within aesthetics, provide a format to critically investigate new approaches to understand and interpret interdisciplinary dance performances. They claim that collaboration and cross-fertilization between forms of dance, theatre, visual art, film, and technology are growing. Researchers in critical studies suggest that increasing multi-layered performances demand new approaches to critically analyze dance and to frame new works in ways that will enhance awareness, understanding, and enlightenment in audiences, researchers, and performers.

Empirical and anecdotal research in dance therapy presents findings on treatment outcomes such as how dance contributes to (a) elevated mood in geriatric treatment centers, (b) promotes appropriate adolescent emotional expression in juvenile delinquent homes, and (c) augments physical therapy

treatment practices in patients with neurological disorders such as Parkinson's disease and related movement disorders. Scientific dance research investigates the implications of dance training and dance styles on the type, degree, and rate of injuries, as well as the psychological make-up of dancers working in this frequently brief and stressful profession. These investigations also examine the specific biomechanics and motor learning employed during the execution of dance skills. Research topics that remain at the forefront include investigations on the distinction between perfectionism and neurotic perfectionism; denial of pain and exhaustion that frequently cause career ending injuries; and body image and eating disorders, especially in the adolescent dancer who is vulnerable to disruptions in normal hormonal and bone development. Researchers such as Donna Krasnow, Linda Mainwaring, and Gretchen Kerr have demonstrated a clear link between excessive perfectionism and dance injuries and multiple articles address the need for dancers to maintain adequate nutrition to achieve optimal physical and psychological balance. The topic of effectively treating dancers as a population with unique needs and specific treatment approaches is another major focus of investigation. Dance practitioners, dance educators, and dance scientists all share similar concerns regarding the need for trained practitioners in performance psychology and dance medicine. They claim that effective treatments will only be developed with specific understanding about the physical and psychological demands of dance and how dancers respond to treatment interventions as compared to other patient populations.

A topic that has received robust research is the application of imagery and mental practice to improve performance. Consistent findings suggest that elite dance artists tend to use more elaborate images to improve the quality of their performances. When images are effectively used performance improves, in particular, when motivational mastery imagery is employed self-confidence is enhanced. Cognitive-specific imagery significantly predicts the direction of somatic and cognitive anxiety symptoms. According to Eva Monsma and Lynnette Overby, motivation-specific and motivation-general imagery improves performance. They recommend that motivation-general imagery practices should be avoided when linked to cognitive arousal images but not when linked with somatic arousal imagery. Other studies suggest that more elite dancers have more frequent experiences of working with teachers who offer metaphorical images. Although it is unknown whether imagery is the major factor for improving performance these dancers are able to engage in movement with more complexity, control, structure, deliberation, and sensory involvement. Further, findings suggest that dancers tend to be skilled and talented in a range of mental imagery strategies, hence they frequently engage in imagery as part of their training (to avoid overuse injuries) and for healing when injured.

Dance research is a strong international field of study but most dance artists and dance educators have minimal contact with these findings. One area that does have cross-over influence is the popular work on flow states. Findings suggest that dancers actually have more flow experiences in part because they have enhanced autotelic abilities (Greek word meaning something that is an end unto itself); dancers are able to

become absorbed in the present-moment of dancing where autotelic experiences reside. They are also able to maintain an optimal balance between skill level and performance challenge. Achieving flow states is pleasurable and desired and most dancers, whether in professional, spiritual or recreational settings, seek and embrace them.

Research that specifically examines creativity in dance remains scant, although this is gradually changing. One of the challenges in studying creativity is determining the criteria that constitute a creative product and a creative individual. One way to manage this dilemma is to select artists or scientists that have been designated as creative on the basis of their level of achievement and success and then to compare them to individuals who have not worked or trained in these domains and who have not demonstrated any creative productivity. This approach has provided rich information about creative personalities, findings that can be generalized to some degree. What makes dance a challenge to investigate is that it is both an individual and group process. Hence, creativity in dance must be examined through a model that includes individual and contextual factors. Mihaly Csikszentmihalyi and Howard Gardner proposed such a model, an interactive model on creativity, in which three elements or nodes are regarded as central in any consideration of creativity: (1) the individual artist; (2) the domain or discipline in which the individual is working; and (3) the surrounding field that judges the quality of individuals and products. They argue that creativity is best viewed as a dialectical or interactive process in which all three of these elements participate. Keith Sawyer claims that an integration of two approaches, contextualist (sociological, cultural, and historical elements) and individualist (personality, cognitive psychology, biology, and computational approaches) best explains the nature of creativity. Certainly, in the domain of dance, all approaches must be considered in order to acquire a deeper understanding about this art form. Any individual artist, either dancer or choreographer, operates within a dynamic group setting, which includes interactions with their audience. Perhaps because of the communal nature of dance, more contextual writings currently exist, especially in the disciplines of dance history, dance criticism, world-dance, dance computer notation systems, and dance education. Less is known within the individualist approach that examines the dance artist's personality, cognition and biology, although case study and phenomenological papers have attempted to capture the ephemeral nature of dance.

Although more limited in number, many studies do lend greater understanding about the creativity of dance artists and how they are influenced by the environments that surround them. Gregory Feist, a major figure in the creativity research field, noted that dancers, as well as other performing artists, scored significantly higher than control subjects on anxiety, guilt, and hypochondriasis, and that dancers were more achievement-oriented. Jane Piirto suggested that dancers tend to suffer physical injuries and psychological disorders, such as eating disorders, low self-esteem, and self-image distortions and that their personalities were more akin to those of athletes (discipline, high-standards, perfectionism kinesthetic, and emotional intelligence). Paula Thomson, E. B. Keehn, and Thomas Gumpel found that dancers and choreographers were

similar in their level of fantasy proneness, a finding that reinforces the belief that dancers and choreographers are generally cocreators in any new dance work. This research team also found that dancers employed more dissociative absorption states, perhaps as a cognitive and somatic strategy to engage in heightened kinesthetic awareness, and that dance artists had elevated levels of pathological dissociation as compared to nonperforming artists. This finding supports the theory that performing artists are vulnerable to psychological disorders but the research team also found that dancers were significantly better able to tolerate and regulate intense emotions.

The diverse range, scope and volume of research in dance makes it an easy field to gather information but one of the major problems is a lack of integration within and between research fields and a fundamental lack of interest by the actual practitioners working within dance. In order to spread these rich research findings to the dancers and their audiences, research practitioners must explore new ways to engage wider audiences. Perhaps electronic media formats are doing just that. More viewers are now able to see dance and maybe they will read more articles if they are listed as links provided within the websites.

Dance Artists Communicate: Writings and New Media Tools

Despite the fact that dancers remain suspicious of more academic approaches, as a group, they seem to gravitate toward writing about the actual creative process. Maybe because dance is so difficult to capture in words these same artists are drawn to articulate their process in writings or interviews. Further, dance remains frustratingly illusive to capture on camera, in part because the human eye is able to maintain complex focal patterning that far exceeds the limited range of the camera lens and editing choices. Perhaps dancers write about their process as a way to preserve the meaning, significance, and beauty of their works – dances that may have been seen by only a small audience during a brief performance season. Regardless of the intent, what is striking and inspiring is the magnitude of writing on this topic and the force of these accounts. Writings by dance artists such as Martha Graham (*Blood Memory*), Doris Humphrey (*An Artist First*), and Paul Taylor (*Private Domain*) provide insight into the brilliant creativity of dancers. Dancers write about their professional experiences including the technical training regimes that were practiced; dance educators provide books on pedagogical concepts for effectively training young dancers in school and community settings; dance therapists recount effective treatment practices for specific patient populations; and dance specialists offer books on specific genres such as flamenco, folk dance, ballroom dance, classical ballet, or Kathak dances of India. Dancers also write about their struggles as they transition from a career in dance to a new profession. Whether as a result of injury or age, the inevitable transition from dance is a topic that is shared through personal memoirs and interviews. Yes, dance is a nonverbal art form but much has been written on this topic and certainly more will be generated.

With technological advancements most of these works will include DVD documentaries to support the written texts. Electronic media carriers are offering even more documentation about the creative process in dance and the personal journeys of dance artists.

Conclusion

Dancers love to dance and they display this passion early in development. As young children they respond kinesthetically; they move when music is played and they express their emotions through movement. This desire to move, and to move within a rhythmic pattern, is one of the intrinsic motivating factors that drew them to dance. As Twyla Tharp stated, dance is a habit. Dancers embrace the demands of daily classes, long rehearsals, and public performances. Although their careers tend to be short they self-identify as dancers long after they have left the profession. For those who never had the opportunity to formally study dance, their intrinsic desire to dance can be seen whenever an opportunity presents itself. Family celebrations, cultural events, and clubs are all places and times where dance can be experienced. Dancers relish the kinesthetic pleasure of expressing ideas through movement. Dance, whether performed in clubs, streets, studios, film sets, or theatres, is a dynamic and immediate form of expression. It lives in the present moment of the embodied dancer and is viscerally experienced by the viewer. A preeminent choreographer and dance artist, Martha Graham, claimed that dancers offer a blood memory, an archetypal presence that far exceeds any single dancer. Since dance and creativity are intrinsically tied to embodied expression the dance artist must give kinesthetic life to any creative idea. The process, according to Martha Graham, is a blessed unrest that keeps dancers moving and exploring. This kinesthetic manifestation of the creative imagination is demanding and compelling.

Dance is regarded as an ephemeral art form; it exists within the present moment and then disappears, but the immediacy of expression is palpable and tangible. Dance was present at the dawn of civilization and remains today. Regardless of political upheaval, religious persecution, or social restriction, dance endures and prevails. The impulse to give expression and find meaning through movement is a fundamental human response that persists – this is where dance lives.

See also: Acting; The Beatles; Music; Theater.

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Relevant Websites

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- www.dancemagazine.com – Dance Magazine.
- www.loc.gov/performingarts/ – Performing arts encyclopedia.
- www.historyworld.net – History World - histories and timelines.
- www.sdhs.org – Society of Dance History Scholars.

The Dark Side of Creativity

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Glossary

Aesthetic Creativity Creativity in which the focus is primarily on the generation of novelty.

Benevolent Creativity Creativity intended to result in positive and/or self-actualizing outcomes.

Disruptive Innovation The exploitation of unprecedented, effective, and novel ideas.

Functional Creativity Creativity in which the primary concern is the generation of effective, useful novelty.

Incremental Innovation The exploitation of relatively small, but effective and novel, changes to existing artefacts.

Malevolent Creativity Creativity intended to result in deliberate harm or damage of others.

Negative Creativity Bad or undesirable outcomes resulting from creative processes.

Positive Creativity Good and desirable outcomes resulting from creative processes.

Introduction

In psychological research Mel Rhodes introduced the four Ps approach to creativity, looking at it from the point of view of Person, Product, Process, and Press (environmental support). Typically, discussions have regarded all four facets of creativity in a positive light. For instance in the case of Person creativity is typically associated with positive properties of the individual such as openness, courage, or high ego strength, and with favourable psychological development such as achievement of a high level of self-actualization, personal fulfilment, or improved mental health. The creative Process involves procedures like seeing the known in a new light, combining the disparate, producing multiple answers, shifting perspective, transforming the known, generating alternative or multiple solutions, initiating new lines of attack, giving surprising answers, or opening up new possibilities, all thought to be highly beneficial for achieving peace and prosperity at both local and global level. Where outcomes (Product) were discussed, the main interest was usually in artistic, literary, musical or other aesthetic products, in discoveries in science or medicine or in innovations in technology, manufacturing, or business systems. All of these are usually regarded as inherently good.

The essence of creativity is going against the crowd. In the case of Person this involves "creating" an individual self and a unique identity. This process is also at the core of normal personality development, which can thus itself be seen as a creative process. However, as James Averill has pointed out, at some point, in some cases, the process can go awry. The positive, desirable "creation" of a unique personality can cross the line and become pathological or antisocial, manifesting itself in, for instance, personal maladjustment and neurosis, or in crime. Various writers such as Nancy Andreasen and David Schulberg have demonstrated the existence of a link between creativity and both mood disturbance and also cognitive disorders. In a recent review, Dean Keith Simonton examined this relationship and concluded that there is some truth to the idea that creativity is connected with mental illness. However, there is no simple, linear causal relationship.

While it is true that processes such as combining the disparate may in themselves be neither good nor evil, it is clear that

under certain circumstances these processes, usually referred to as "divergent," can have a dark side. In the school classroom, to take a single example, they have the potential to lead to disruption of order and to introduce intolerable levels of uncertainty. A striking example is that of the French mathematician, Evariste Galois, who was expelled from secondary school despite being a brilliant and, as is now known, highly creative mathematics student who was keenly interested in learning and greatly admired his mathematics teacher. He was simply too disruptive to be tolerated. In business or industry too, divergence can go too far, for example, if a new product or process is simply too divergent for customers and consumers to accept. Clayton Christensen points out that disruptive technologies – in other words, those that embody high degrees of divergence – can actually prove fatal, even, or perhaps, especially to well-managed, mature companies. The Sinclair C5 electric vehicle, launched in the United Kingdom in January 1985, embodied many novel ideas, including technological breakthroughs in motor design, aerodynamic performance, chassis and body design, and also anticipated a move to hybrid vehicles, and yet led to the bankruptcy of Sinclair Vehicles less than one year after launch, due to poor sales volume. Similarly the famous DeLorean DMC12, launched in 1981, exemplified divergence in automobile design, with novel materials, body and chassis design, industry-leading use of electronic fuel injection and advanced safety features, but, like the Sinclair C5, sales were poor and the company folded in 1983.

More recently, some writers have turned their attention to Product, the results of creativity, rather than the processes or the personal properties that foster the processes. Such products include aesthetic creations such as artworks or literary or musical compositions, but they also encompass structures, machines and devices, production, distribution or marketing techniques, and complex systems. It does not require much effort, however, to see that creativity – in the sense of the generation of effective, or useful, novelty, whether aesthetic or concretely useful – can also be used for purposes that, to some people at least, might be considered undesirable, for instance to obtain undeserved benefits, discomfort or harm other people, or get away with crimes, that is, the outcomes (products) of creativity can also have a dark side.

This dark side of creativity is found in a wide variety of domains, some obvious, and some less so. In the fields of advertising, marketing, politics, technology, agriculture, entertainment, literature, and even art, it is possible to identify manifestations of the dark side of creativity. For example, creative advertising campaigns encouraged people to smoke cigarettes despite the adverse health effects of smoking. In Australia, agricultural innovations that have facilitated the development of highly efficient and intensive farming in areas lacking in sufficient natural rainfall have also now led to the breakdown of the country's Murray–Darling river system. The impact of irrigation, drawing water out of the river system in upstream parts of the country, has resulted in excessive salinity, acidification of soil, and toxic algal blooms in downstream regions that may yet result in the complete breakdown of the ecosystem in these areas. The beneficial effects of creative approaches to irrigation in some areas are driving farmers off the land in other areas and literally rendering some farmland unusable.

Defining Creativity: Novelty and Usefulness

If one accepts the widely used definitions of creativity (see elsewhere in this volume) that regard novelty and usefulness as its core criteria, then one must first ask the question: "Useful for what and for whom?" The term implies that creativity is undertaken with some particular purpose in mind. This purpose is often captured through the idea of problem-solving. Indeed "creative problem-solving" is a common phrase and is associated with the application of techniques for the generation of novel ideas. Well known examples of these include *Brainstorming* devised by Alex Osborn in the early 1950s and *Synectics*, formulated by William Gordon in the same decade. The problems that people seek to solve through the application of these techniques and methods may be conceptualized more generally as *needs*. In a conventional sense the need might, for example, be that of a motorist for a more economical automobile, or the need of a doctor for a means to "see" inside a patient's body. The solutions to these needs, in the former case an electronic fuel-injector, and in the latter case a Magnetic Resonance Imaging (MRI) machine, would, when first introduced, have been seen as novel – that is to say original and new – and continue to be seen as useful and/or effective in addressing the need today.

Creativity and Business

It is also a widely held belief nowadays that creativity, along with its offspring innovation, is an essential ingredient of competitive businesses. Whether this innovation takes the form of small improvements to what already exists (typically referred to as *incremental innovation*) or of radical changes to the *status quo* (usually called *disruptive innovation*) there can be no doubt that recognizing and responding to the needs of customers, in the sense of solving their problems through the generation of effective, novel solutions, is a key activity for businesses. Those organizations that are good at this activity prosper, while those that are not may stagnate or perish. In 2002, the *Economist Technology Quarterly* reinforced this fact by

pointing out that, at the turn of the twenty-first century, more than half of economic growth is accounted for by creative products. Paul Pilzer has described the concept of *economic alchemy* whereby novel technologies continue to override the limitations of finite resources. Creativity and innovation in the automotive industry continue to improve the fuel efficiency of automobiles, for example, and in so doing reduce dependence on oil. This has the effect of extending the life of that finite resource. Pilzer argues that humans are not constrained by finite resources, provided that technological creativity and innovation continue to drive businesses.

Creativity and Competition

Does this competitive model apply only to businesses? "Competition" can be conceived of more broadly by recognizing that opposing armies, for example, are engaged in a form of competition. Similarly, opposing sporting teams are competing in a more readily recognizable way. It is also possible to think of doctors as competing with diseases, in this case for the health of people, or even law enforcement agencies as competing with criminals.

These latter examples, however, open up a somewhat different perspective on creativity and competition. To understand this it is necessary to return to the notion that creativity embodies novelty and usefulness. It is easy to see, in a business context – for example, two rival manufacturers competing to sell washing machines – that usefulness means the same thing for both parties. Usefulness is about providing customers with clean clothes. It is about performing a function. If a novel idea, for example, using an electric motor to agitate a container full of clothes, rather than manual labor, is also useful (in this case the task is performed more effectively by a motor than by a human) then this creative idea is both new and useful and offers a competitive advantage. Both rival manufacturers wish to provide their customers with a machine that helps in the process of washing clothing, and both seek to do this effectively, efficiently, and at an affordable cost. The one that can do so *most* efficiently, and *most* effectively, and at the *lowest* cost, will typically capture the lion's share of the market.

Competition in a Broader Sense

What about the case of a law enforcement agency *competing* with criminals? In this case the competition is of a fundamentally different nature. One party, the police, is seeking to do something that most people would have no hesitation in categorizing as laudable, desirable, and good, while the other party, the criminals, is seeking to do something that most would regard as undesirable, or indeed, illegal and overtly bad. In this example it is now no longer the case that the two competitors share the same basic, benevolent objective (i.e., to satisfy a customer need). Rather, one competitor is doing something regarded as good, or benevolent, while the other is doing something bad, or malevolent. Whether this latter example is labelled "negative" creativity, in contrast to the positive, benevolent creativity embodied in the example of the competing businesses, or "malevolent" creativity, one

must examine and seek to understand what it is that makes the process and the outcomes of some creative activity desirable and good, of other kinds of activity bad.

A Dark Side to Creativity

A good starting point is to return to the key criteria of creativity – novelty and usefulness. Novelty presents fewer problems. It is widely agreed that novelty captures the notion that something is original and new. More colloquially it might be said that a novel solution to a problem has “never been seen before”, in contrast to a solution that is already well-known. This is not to say that an established solution is not desirable. One may speak of *routine* solutions, whose primary criterion is that they are effective – they solve the problem – even if they lack novelty. Creative solutions, namely those that are both novel and effective, may elicit a reaction of surprise from an observer. “Why didn’t I think of that!” or “What a neat idea!” are phrases that are often heard in response to creative – that is surprising and effective – solutions.

Effectiveness, or usefulness, however presents a moral dilemma that manifests itself in some of the examples cited earlier. If one moves from the idea of rival businesses competing with each other to meet a customer need, and returns to the idea of law enforcement agencies *competing with* criminals, or even security forces competing with terrorists, the problem is more obvious. While it might casually be said that “most people” would regard the idea of hijacking a plane and crashing it into a building as bad, if not overtly evil, and therefore not at all useful or effective, it cannot be denied that there are some people who would see this situation differently. There is no doubt that the 9/11 hijackers believed that what they were doing served some noble purpose, and that, in the light of what actually happened, it was highly useful and effective. That their method of attack on that day was also, by definition, surprising and therefore highly novel – commercial airliners had not previously been hijacked and crashed into buildings – is not in question.

Similarly, the conman who devises a new method for defrauding an organization, or the thief who finds a new way to defeat a security system, may develop solutions that exhibit high degrees of novelty, and presumably they do these things because they solve a problem that the criminal has – in this case, the desire to obtain more money.

This leads to a situation in which it seems that the current lexicon of creativity is not fully equipped to describe these situations, and that the lack of a term to classify these cases – where the goal of the creative process is to achieve harmful, illegal, or immoral ends – hinders one’s ability to analyze them and take action against them. This is one aspect of the Dark Side of creativity – the use of creativity deliberately to damage or harm others.

Characterizing the Dark Side of Creativity

Two pairs of concepts have already been articulated in the field of creativity and help make sense of this dark side of creativity. Keith James and his colleagues Karla Clark and Russell Cropanzano have been using the term *negative creativity*, in

contrast to *positive creativity*, to describe the undesirable, or indeed harmful, consequences of creativity since the late 1990s. These terms provide a more general classification of creativity with respect to the nature of the outcome, or product. Good products and outcomes, in other words those that are beneficial and affirming, are labeled “positive.” Those that are undesirable, harmful and/or damaging are negative.

A more differentiated classification of product and outcome is yielded by the pair of terms *malevolent* and *benevolent* creativity. Coming into use more recently than *positive* and *negative* creativity, these terms provide a secondary, more explicit and more precise level of classification. In contrast to negative creativity, the critical factor that differentiates malevolent creativity from negative creativity is the *intent* of the actor. Malevolent creativity *must* involve not only a harmful or damaging outcome or product, but also a *deliberate intent* to cause harm or damage. Negative creativity, by way of contrast, may feature no deliberate intent. In the case of negative creativity, the harmful or damaging outcomes may be merely an unfortunate by-product that results in unintended consequences such as the discovery of microorganisms leading to germ warfare. Benevolent creativity, in comparison to positive creativity, involves both a positive outcome and positive intent.

The Many Faces of the Dark Side of Creativity

Negative Creativity

At least two factors can therefore be said to contribute to the dark side of creativity. The first is the product or outcome of the activity. This is typically the generation of an effective or useful, novel solution to a problem. The second is the intent of the actor – that is, the individual, or possibly the organization, generating the effective novelty.

Robert McLaren’s seminal work on the dark side of creativity contains many instructive examples of negative products and outcomes that may be differentiated from malevolent creativity through the absence of intent. It seems unlikely that medieval clergy, for example, set out to impoverish the laity by commissioning elaborately decorated, expensive, and undoubtedly artistically creative, cathedrals. And yet there is no denying that the money and resources lavished on these religious monuments might, as McLaren points out, instead have been used to satisfy more earthly needs. Thus the products of artistic creativity embodied in these structures were, as McLaren describes them “merely aesthetic exercises in self-indulgence,” and although they constitute an example of negative creativity, since they harmed many people, they cannot be regarded as malevolent. **Table 1** identifies the primary differentiator for the dark side of creativity. In straightforward terms, bad outcomes/products arising from the process of generation of effective

Table 1 Negative–positive creativity and product

<i>Product/outcome</i>	<i>Primary label</i>
Bad	Negative
Good	Positive

novelty are labeled “negative creativity” and good outcomes/products are labeled “positive creativity.”

The changes, cited by McLaren, to the way that the function of art was perceived, during the age of Enlightenment and beyond, also help distinguish between different aspects of the dark side of creativity. Whether art, as a form of creativity, becomes “a substitute for reality,” or a rival “to faith,” or indeed that it leads “nowhere except to the aggrandizement of the isolated artist and his will” these arguably negative outcomes are difficult to see as intentionally damaging or harmful. The dark side of creativity thus manifests itself again as an undesirable or bad outcome/product, but not one that is malevolent. The preceding example also once again highlights a difficulty posed by the dark side of creativity – namely, how to decide what is bad and what is good. Some might see artistic works that call religious faith into question as liberating and progressive, in the same way that some see acts of terror as vital steps on the path to freedom.

Technology is also not free of examples of the dark side of creativity. Deborah Cadbury described examples of technological and scientific creativity that gave rise to an explosion of new products, processes, systems, and services from the late eighteenth century onwards. The changes wrought by the industrial revolution, however, created as many problems as they solved. The advent of steam locomotion, for example, resulted in the need to build tunnels to facilitate the development of rail networks. Often these tunnels were pressurized during construction to prevent flooding. This elegant solution – tunnellers could continue to work unaffected by water leaking into the works – resulted in the cases of the “bends.” A similar problem occurred in the construction of the foundation of large bridges which used pressurized caissons to allow workers to dig foundations and pour concrete on the beds of rivers. When workers finished their shifts and returned to the external environment they began to suffer the effects of nitrogen bubbles released in their bloodstream. It took some years and a number of deaths before the problem was understood and a solution found. Once again, it is impossible to ascribe any evil intent to the engineers who devised the creative procedure of using pressurized air to facilitate this kind of work. Their solution to the problem of digging bridge foundations and tunnels was both effective and novel, and yet it also resulted in a harmful outcome. It was negative, at least with regard to the health of the workers, but it was not malevolent.

Malevolent Creativity

Introducing the concept of malevolent and benevolent creativity expands the available classifications of creativity, including those representative of the dark side, from two categories to four. This serves a purpose that is more than merely technical. In particular it makes it possible to turn attention from the output of the creative process or activity to its *inputs*, and indeed, to the process itself. **Table 2** adds the *intent* of the actor in the creative process, to the nature of the product or outcome of **Table 1**. This permits more precise differentiation than is possible when using the labels “positive” and “negative.” When a creative process, for example, the development of a novel form of terrorist attack (like the attacks on 9/11 previously mentioned), results in an outcome that is undeniably negative, it

Table 2 Outcome and intent – malevolent creativity

<i>Product/outcome</i>	<i>Intent</i>	<i>Secondary label</i>
Bad	Malevolent	Conscious malevolence
Good	Malevolent	Failed malevolence
Bad	Benevolent	Failed benevolence
Good	Benevolent	Conscious benevolence

can now be further examined and an attempt made to understand the intent of the actor(s). Where the intent is deliberately to cause harm to others, as was the case on 9/11, the label “negative” creativity is replaced with *consciously malevolent creativity*. The terrorists in question set out to create a novel “solution” to their problem that would, if successful (i.e., effective and useful), undeniably and without any shadow of doubt, result in the deaths of many innocent people and the widespread destruction of property. This negative outcome was not the result of an accidental set of circumstances, nor was it an unfortunate by-product of some other activity, both of which might cause us to label it as *failed benevolence* (good intent, bad outcome). Because it was both novel and effective, it was creative, and because of the nature of the intent it was not merely negative creativity, but *consciously malevolent creativity*.

Similarly, when benevolent intent results in a positive outcome or product, then the label positive creativity is replaced with *consciously benevolent creativity*. However, addition of the factor *intent* also now acknowledges the possibility that malevolent intent may, serendipitously, result in a positive outcome. In this latter case one can now use the label *failed malevolence*. In other words, in comparison to **Table 1**, there are two possible situations in which the result is positive, and two possible cases where the result is negative. **Table 2** allows us to express these cases with greater precision.

Table 2 illustrates the value to be gained in the more differentiated understanding that results from an analysis of the dark side of creativity. At a primary level, negative creativity recognizes that the product of the creative process *may be* bad. Thus the invention of the internal combustion engine, leading as it has to pollution and many deaths in automobile accidents (and notwithstanding the many positive aspects that have also resulted from its invention and that of the automobile), is an example of negative creativity, but not malevolent creativity. It seems certain that Karl Benz, who designed and built the first four-stroke engine, did not do so with the intent of polluting the environment or killing people. Indeed, it is almost certain that he envisioned only positive outcomes for society, including massive improvements to economic prosperity, mobility, and development. In a more differentiated analysis, an appropriate secondary label for this invention, at least with respect to the polluting/safety aspects of the engine, would be *failed benevolence*. The negative aspects of the invention are unintended, and unforeseen, consequences of the primary problem which the device was created to solve.

The Four Ps of Creativity and the Dark Side

The addition of the factor intent has enriched the understanding of the dark side of creativity. Negative outcomes may be

deliberate, but they may also happen, as it were, accidentally. The literature of creativity, however, points to other factors that could enhance this understanding further, and lead to a more highly differentiated model of creativity. The traditional model of creativity in psychology is the 4Ps approach: The social/psychological factors involved in creativity are the Person, the Process, the Product, and the influence of the surrounding environment (the Press). These factors were originally proposed by Mel Rhodes in the 1960s. Although Person covers a range of factors including motivation, feelings, and other personal properties, such as willingness to take risks, it is sufficient for present purposes to use this factor to address intent. The factor Product is what has already been labeled under the same name, or alternatively the outcome. If Process and Press are now added to the table of factors leading to creativity, the categorizations available grows from four (Table 2) to eight (Table 3).

For the purpose of differentiating the dark side more precisely, I will treat Process and Press together as representative of those factors that influence what happens between the formation of intent, and the realization of the end product. These will be categorized again using two poles. Either the Process and Press act to *support* the activity for which a useful, novel product is the output, or they act to *undermine* it. The former will be labelled *supportive*, and the latter *obstructive*.

Table 3 introduces four new categorizations that are distinct from those discussed in the previous section. In Table 2, on the dark side of the creativity ledger, *conscious malevolence* and *failed benevolence* arise where the outcome, or product, is negative, but where the intent is, respectively, malevolent and benevolent. In Table 3, the addition of Process/Press now distinguishes between creative activities that take place in circumstances that are either supportive of the intent, or that attempt to act against the intent.

Thus, while intent may be malevolent, and a negative outcome may result, one can conceive of two pathways to this result. One arises from a situation where both the Process and the Press act in concert with the intent, whereas the other arises from a situation where Process and Press act in opposition to the intent. Put more plainly, malevolent intent that achieves a negative outcome *in spite of* the process and press is *resilient malevolence*, in contrast to *conscious malevolence* that succeeds *because of* the process and press. The terrorist attacks on 9/11 again assist us in understanding the different forms of the dark side of creativity. It can be argued that the hijackers of the aircraft involved in the Twin Towers attacks, and the Pentagon attack, succeeded *in spite of* an *obstructive* press. In other words, the normal security measures that were part of the

environment in which those attacks were made failed to prevent them. The creativity of the attacks was therefore not only intentionally harmful, but it was resilient enough not to be deterred. It is interesting, however, to note that the attack on United Airlines Flight 93 did not possess the same resilience. It may be argued that the reason for this “failure” of the terrorist attack was that it was no longer novel (and therefore no longer creative to the same degree as the other attacks). There is evidence from phone conversations with some of the UA93 passengers that they were aware of the other attacks that had taken place. This means that the novelty of the attack on UA93 was already different, and lower, than that on the other flights. The starkly different reaction of the UA93 passengers to the hijacking was almost certainly a direct consequence of this decline in novelty. In other words, they were not taken by surprise in the way that the passengers on the other flights seem to have been. When the passengers on UA93 fought back, this obstructive environment turned the resilient malevolence of the terrorist attack into *frustrated* malevolence. In this case, one has to admit that there is a degree of relativity in this discussion. The terrorist attack was still successful, particularly for the people on board the flight, but it was clearly not nearly as successful as is generally believed was the intent. Thanks to the bravery of the people on board, the UA93 attack did not succeed to the degree that it might have.

The discoveries of Jenner and Pasteur in the field of immunology can be used to illustrate different combinations of Product, Person, Process, and Press. There is no doubt that both scientists set out with the intention of treating harmful diseases and alleviating illness and suffering. In both cases they developed “products” consistent with their intent. Thus the intent was unequivocally benevolent, and the product good. If undertaking these activities in an environment that supported their goals, and using a process that positively aided in their achievement, then we can label the outcome as *conscious benevolence*. Even if the process and/or press was obstructive in some way, for example, they may have struggled to obtain financial support, or they may have been undermined by jealous competitors, the positive outcome and good intent simply means that the resulting benevolent creativity was *resilient* and able to succeed in spite of some adverse factors.

The same example, however, can also be used to illustrate a combination of factors leading to negative outcomes. Maria Zaitseva writes about the activities of scientists in the Soviet Union who participated in the development of biological weapons. She argues that some of the scientists may have deliberately blinded themselves to the dark side of their

Table 3 Product, Person, Process, and Press – types of malevolent creativity

<i>Product</i>	<i>Person (intent)</i>	<i>Process/Press</i>	<i>Secondary label</i>
Bad	Malevolent	Supportive	Conscious Malevolence
Good	Malevolent	Supportive	Failed Malevolence
Bad	Benevolent	Supportive	Failed Benevolence
Good	Benevolent	Supportive	Conscious Benevolence
Bad	Malevolent	Obstructive	Resilient Malevolence
Good	Malevolent	Obstructive	Frustrated Malevolence
Bad	Benevolent	Obstructive	Frustrated Benevolence
Good	Benevolent	Obstructive	Resilient Benevolence

work, either through a fascination with their work, or as a result of unquestioning political obedience, or even through deliberate deception or coercion by the state. Thus, under the right set of deceptive and coercive circumstances, the same apparent positive intent and supportive environment, instead of leading to cures, could lead to harmful biological weapons, changing *conscious* benevolence to either *failed* or *frustrated benevolence*.

Dealing with the Dark Side

The latter examples pave the way for a final question. That question is “so what”? Why is it necessary, important and/or useful to develop a more precise, more highly differentiated model of the dark side of creativity? Is it not sufficient to recognize that creativity – the generation of effective or useful novelty – can sometimes lead to bad outcomes? There are two answers to these questions. First, it is entirely consistent with the progress of science to seek to understand a phenomenon in progressively greater detail. The contrast between negative and positive creativity opens our eyes to the fact that creativity does not have to be only about beneficial, desirable self-actualization. Creativity is an ingredient of competitive success, and it does not have to be confined only to those activities that are inherently good.

Second, the more precise, and more highly differentiated, the model of the dark side of creativity, the more likely one is to find ways to counteract it. In the same way that the positive aspects of creativity are highly valued, for example, in business – a great deal of time and effort is spent trying to enhance the creativity of individuals and organizations – one needs to invest time and effort in learning how to minimize the impact of the dark side. Whether this is used to prevent terrorist attacks, or to prevent criminal acts, or simply to guard against the accidental negative consequences of a new technology, a detailed model is the first step in equipping society to deal with the dark side of creativity.

The three factors that characterize the dark side of creativity – Product, Person, and Process/Press – allow researchers to formulate approaches to counteracting the dark side of creativity. The example of the 9/11 attacks highlights the potentially disruptive impact that an obstructive Press can play with regard to frustrating malevolent creativity. By the same token, strategies that attempt to disrupt the Person (including their intent) or the Process may offer opportunities to turn a negative outcome into a positive one.

Concluding Remarks

The concept of a dark side to creativity, at least explicitly stated, is fairly new. It arises when attention is turned from studies of creativity based on outcome measures that focus on positive ideas, solutions, products, and outcomes, to outcome measures that focus on negatives. Acts of terrorism, as well as fraud, theft, and deceit bring into focus the fact that creativity is by no means limited to the production of useful or effective novelty for universally positive purposes. James et al. resolve the qualitative dilemma this poses by recognizing that while

the decision of what is good or bad requires a subjective judgment, where a creative product achieves an outcome that is good for some, but bad for many, it is not unreasonable to label this as negative. Negative outcomes, or products in a general sense, that result from creativity give us the starting point for studying the dark side of creativity. If one adds to that the *intent* of the actor then it is possible to differentiate more precisely on the nature and kind of dark side creativity involved. Once other social and psychological factors are added to this model – simplistically the Person and the Press – then additional categorizations of the dark side of creativity are possible.

Thus the dark side of creativity is first characterized by the nature of the outcome. Bad outcomes, at least those that are bad for the majority, resulting from the generation of effective or useful novelty give rise to negative creativity. If the nature of the intent of the actor is added to the model, then one may speak of malevolent creativity resulting from intentionally harmful effective novelty. Where the intent was positive, but the outcome was negative, one can now distinguish creativity that is unintentionally (or perhaps accidentally) malevolent and call this failed benevolence. If one adds a dimension to capture the nature of the process and press that support the generation of effective novelty, then one arrives at the most differentiated model of the dark side of creativity. In this case a supportive environment reinforces the deliberate production of harmful, effective novelty. There may be cases, however, where intentionally harmful effective novelty succeeds in spite of attempts to frustrate it. In this obstructive environment, one may speak of resilient malevolence.

Thus creativity has two basic sides – the bright and the dark. The three dimensions discussed result in eight specific manifestations of creativity. Four of these can lead to negative, undesirable and/or harmful outcomes and give us the dark side of creativity. Each of these four instances of the dark side, however, occurs through a different combination of factors, meaning that some of the negative outcomes are deliberate and some are accidental. Understanding these four faces of the dark side of creativity offers insight into how these negative consequences of the generation of effective novelty might be overcome.

See also: Innovation; Mental Health: Affective Disorders.

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Charles Robert Darwin 1809–1882

Naturalist

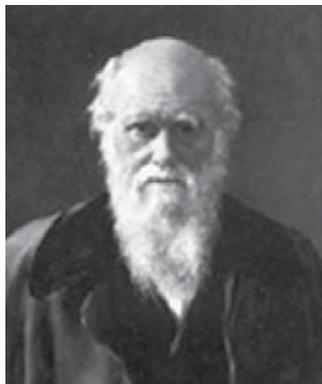
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CHARLES DARWIN was an English naturalist who proposed the theory of natural selection to explain the evolution of life on earth. Darwin constructed this theory in a series of notebooks that he kept during the 2 years following the nearly 5-year circumnavigation of the globe aboard H.M.S. Beagle. Although he had his basic insight into the mechanism of natural selection in 1838, 20 years passed before his theory of evolution was made public. In 1859, Darwin published *On the Origin of Species*. Though Darwin did not explicitly state in *Origin* that humans had evolved in the same manner as all life on earth, the implication was clear. This aspect of the book sparked lively debate in scientific, cultural, and religious circles as it challenged traditional views on the nature of humanity. In 1871, Darwin explicitly discussed his views on human evolution in *Descent of Man*, further fueling the controversy. In addition to the pivotal role Darwin played in the establishment of evolutionary theory, he also made substantial contributions to the fields of geology, zoology, psychology, botany, ecology, and other related fields in natural history. More than a century after his death, Darwin's ideas remain central to the biological and social sciences and continue to energize debates about human nature in cultural and religious contexts. Charles Darwin was born on February 12, 1809, in Shrewsbury, England, the fifth of six children. Charles' paternal grandfather was Erasmus Darwin, a highly regarded physician, a poet, a proponent of evolution, and a founder of the Birmingham Lunar Society, which brought together some of the most original thinkers in science and technology of the time. Charles' maternal grandfather was Josiah Wedgwood, a successful entrepreneur and innovator in ceramics technology, and a member of the Lunar Society. Charles' father, Robert Waring Darwin, was a well-respected physician in the Shrewsbury area and his mother, Susannah Wedgwood, was an intelligent woman and a knowledgeable pigeon fancier. Charles was baptized in the Anglican faith despite the tradition of free-thinking agnosticism in the Darwin line and Unitarianism in the Wedgwood line.



Charles Darwin.

Childhood and Early Adolescence: Discovering the Wonders of Natural History

The life of Charles Darwin supports a concept of creativity in which hard work plays the central role, not some special type of thinking such as divergent or primary process thinking. Interests that arose as hobbies in childhood and adolescence were gradually extended and refined to become the work of science in adulthood. As Howard Gruber has written, Darwin is best understood as an evolving system. Darwin had to organize and reorganize his knowledge, his purposes, and his emotions in such a manner as to enable him to carry on work over a long period of time. This period of long work was necessary for Darwin to construct a new point of view about nature, which was his great accomplishment. Darwin was not a child prodigy. He seems to have been a typical boy of his age, well placed by geography, social fashions, and social standing to acquire an interest in the natural world of plants, fish, birds, insects, and rocks. As a young boy, Charles' education took place at home. At age 8 he was sent to a day school. Charles' mother died when he was 8 years old. This loss has been used by psychoanalytically oriented writers to explain Charles' creativity. They propose that Charles was motivated to search for order in nature the rest of his life in response to this abrupt change in the domestic order. While no doubt a tragic event, Charles' everyday routine may not have significantly changed as a result of his mother's death. Through a combination of conventions of Charles' social class and Susannah's frequent illnesses, Charles had relatively little direct contact with his mother. Upon her death, Charles' three older sisters took charge of running the household and caring for the three younger children. Stability was also underpinned by staff members and a nanny named Nancy who were part of the household staff for years before and after Susannah's death. Charles' father, a gentle man, became rigid, depressed, and overbearing at times following his wife's death. Though a certain measure of tension existed in their relationship until Charles established himself in adulthood, Charles greatly loved and admired his father. Charles' formal education continued in 1818 at the Shrewsbury School. The education at this school was classical—study of Greek and Latin, some ancient geography and history, Shakespeare, and an emphasis on memorization, making up verses, and recitation. In his *Autobiography* Charles wrote of this school, "The school as a means of education to me was simply a blank." This statement is typical of Charles' attitude toward learning in the classroom throughout his years of schooling. Outside the classroom Charles showed zeal in pursuing his hobbies. He became an avid collector of minerals and insects, an enthusiastic birdwatcher and hunter

of birds, and an accomplished horseman. During this time, Charles also gained an appreciation for experimental science. With brother Erasmus in a homemade laboratory, the two conducted chemical experiments. This activity earned him the nickname “Gas” at school.

At age 16, Charles went to Edinburgh University where he joined his brother in the study of medicine. Charles largely dismissed the value of his classes at Edinburgh, although a course he took with Professor Robert Jameson taught him skills in how to collect, preserve, and transport specimens and provided him with field experience in geology. Charles also had access to the very fine natural history collection at the museum in Edinburgh and the university library. Charles spent 2 years in Edinburgh. During the first year, his brother Erasmus was with him. In the first year, Charles witnessed two operations, in the years before general anesthesia, one of which was on a child.

He left the operating room before they were completed and wrote in his *Autobiography* that “the two cases fairly haunted me for many a long year.” Neither Darwin brother was genuinely interested in medicine, but they plumbed the library for books on natural history and walked together to the Firth of Forth, an estuary that was rich with invertebrate fauna. After Erasmus left in March of 1826, Charles continued to walk these beaches, collect specimens, and record them in a pocket diary. He made the acquaintance of other students who had an interest in natural history and met Dr. Robert Grant, a zoologist who would become very influential during Charles’ second year at Edinburgh. Charles began taking taxidermy lessons from a freed slave, John Edmonstone, during this period, and had almost daily contact with him for a period of 2 months. John likely spoke to Charles of his life as a slave in South America and his travels with his master through the South American rain forest, and must have sowed the seeds for Charles’ later desire to travel to exotic places in pursuit of natural history.

Late Adolescence: A Turning Point

Upon his return to Edinburgh in November 1826 without Erasmus to rely on for companionship, Darwin sought the company of other students who shared his interests. Charles immediately joined the Plinian Society, a club for students and faculty interested in natural history. Darwin began accompanying the zoologist Dr. Robert Grant on walks to the Firth of Forth. Charles even went out on trawlers to collect live specimens of marine invertebrates for Dr. Grant, becoming, in effect, a research assistant. Grant became Charles’ first important mentor outside the family. The Plinian Society was the forum for two formative events in Charles’ life that second year in Edinburgh. In March 1827 a student named William Browne presented a paper supporting a thoroughly materialistic view of consciousness and mind as nothing more than the physiological activity of the brain; no spiritual agency needed to be invoked to explain mental phenomena. The minutes of Browne’s talk were stricken from the record. This censorship of a materialist view of life alerted Darwin to the dangers of proposing a materialistic explanation of nature.

At that same meeting, 18-year-old Charles made his first public presentation of discoveries he had made in natural history—that the eggs of one marine invertebrate were capable of locomotion and that the black globules contained in old oyster shells were, in fact, leech eggs. Charles had done the private work of collecting, observing, and analyzing his specimens, and he had reviewed scholarly publications to make sure no one else had made these discoveries. With this presentation, he was for the first time making his work public, a prerequisite for a life in science. Edinburgh provided an environment that nurtured Charles’ real interests in his later teenage years. The importance of the person–environment fit in the later teen years remains an underexamined question in the literature on creative thinking. Cases such as Charles Darwin in Edinburgh and Albert Einstein at Aarau suggest that it is a matter of great importance for the individual in the later teenage years to find an environment in which one can independently pursue one’s own interests in accordance with one’s own style of learning, supported by knowledgeable adults.

Taking stock of Charles as an evolving system as he left Edinburgh, his sense of purpose for a life in science had undergone significant transformation in his 2 years there, as evidenced by his presentation at the Plinian Society. His affect had changed as his love of nature and his love of science coalesced. His knowledge of natural history had been greatly expanded, especially as a result of his interaction with Dr. Grant. He left Edinburgh a very different person from when he first arrived there. In the summer of 1827, Charles and his father agreed that medicine would not be Charles’ career. Instead, Charles would attend Christ’s College at Cambridge University in order to prepare for a career as a clergyman in the Anglican church. Religious zeal was not the motivation on either Darwin’s part. For Robert Darwin, this career path held the prospect of providing respectability and a steady income for his son. For Charles, it held the prospect of a lifestyle he could enjoy. As a country parson he would have ample time for hunting, fishing, and collecting.

Darwin went to Cambridge in January 1828. There, he reconstructed a number of the circumstances that he had found helpful in the pursuit of his real interests in Edinburgh. Creativity requires the construction of a milieu in which sustained learning and work can proceed, and Charles was a good craftsman in this regard. Edinburgh had provided the natural environment and the personal support to engage in the serious study of marine invertebrates, in the form of the Firth of Forth and Dr. Robert Grant. Cambridge provided the natural environment and personal support to engage in the serious study of entomology, in the form of the Cambridge fens and the Reverend John Stevens Henslow, professor of mineralogy and later botany. Darwin formed a very close relationship with the young professor. Beetle collecting became a passion during Charles’ years at Cambridge. As he had employed trawlermen working in the Firth of Forth to collect marine invertebrates, he employed bargemen to collect beetles in the wetlands surrounding Cambridge. Charles continued this pattern of enlisting the help of others in his researches in natural history throughout his lifetime. Having successfully completed his final exams, Darwin accompanied the Cambridge geologist Adam Sedgwick on

a short geological expedition through North Wales, a trip arranged by Henslow. Henslow believed that Charles would greatly benefit from doing fieldwork with Sedgwick. Returning home from Wales at the end of August 1831, Charles read a letter from Henslow informing him that the captain of H.M.S. *Beagle*, Robert FitzRoy, was seeking a well-bred man to serve as a companion and naturalist on a voyage to survey the southern coasts of South America and Tierra del Fuego and then circumnavigate the globe. The voyage was expected to take 2 years and Charles would not receive a salary. Despite his father's initial objection, on December 27, 1831, Charles sailed from Plymouth, England, on a voyage that would last almost 5 years.

The Voyage of the *Beagle*: First Theory

The voyage of the *Beagle* should be viewed as both a remarkable personal journey for Charles Darwin and as one more journey in a tradition now known as the "voyages of discovery." These sailing expeditions were carried out for military, commercial, and scientific purposes, and include the fabled voyages of Captain Cook, the mutiny on the *Bounty*, the efforts to discover whether there was a great southern continent (Antarctica), and the search for a northwest passage from the Atlantic to Pacific through Canada. There was an established role for a naturalist on these journeys.

Darwin was now on his own. Mentors such as Robert Grant and John Henslow had played an important role in the formation of Darwin's views on nature. Deprived of easy and frequent contact with these men, Darwin adopted a new mentor, the geologist Charles Lyell. Darwin would not meet and become personal friends with Lyell until after the *Beagle* voyage, so this mentorship took place not through direct contact but through Lyell's comprehensive, three-volume, roughly 1400-page *Principles of Geology* in which the uniformitarian view of geology was explained. The crux of this point of view was that the geological forces at work in the present, at their current intensities, were the same as those that acted in the past. Lyell rejected the popular notion that great and unique cataclysms in the past could account for the present geological features of the earth. The "gradualism" in this theory—that great changes could occur through a series of small changes that continued and accumulated over long periods of time—had a profound effect on Darwin.

Darwin's letters during the voyage reveal the rapid effect that Lyell's views had on him. The power of the *Beagle* voyage on the formation of Darwin's view of nature stems from the co-occurrence of his absorbing a new point of view at the same time the raw material of nature was being directly experienced. For example, following a devastating earthquake in Chile, Charles assessed the amount of land elevation that had taken place. He found it to be several feet. Darwin saw this effect as supporting Lyell's idea that mountain ranges could be formed by gradual but continual uplift of the land on the order of inches and feet.

After spending over three and a half years in and around the southern portion of South America, the *Beagle* arrived in the Galapagos Islands. While Charles was there, he had no great insight into evolution, but his experiences in these

islands would later inform his thinking on this issue. It was during the three and a half weeks sailing from Tahiti to New Zealand that Charles made his first major creative contribution to science: a theory of coral reef formation. Gruber keenly noted in 1981 that this theory "bears a striking formal resemblance to his later work on organic evolution". It was a thoroughly gradualist theory, based in Lyell's own theory of coral reefs, but it was an improvement on Lyell's theory. Charles was able to explain different types of coral formations (fringing reefs, atolls, and islands) as structures representing different phases of a single gradual process of formation. The gradual accumulation of very small changes, the deposition of coral skeletons, over extremely long time periods created something significant in nature that had not previously existed.

The Fruitful use of Analogy: Conceiving of Natural Selection

The 2-year period following the return of the *Beagle* to England in October of 1836 marked a time of intense and productive work for Charles. By March of 1837 he was convinced that evolution had occurred and provided the best explanation for why there were different species in the natural world. This belief in evolution preceded his understanding of how it might occur and put him at odds with the great majority of scientists at the time, including Charles Lyell.

In July of 1837, Darwin opened the first notebook in what would become a series of notebooks devoted to thinking through a theory of evolution. These notebooks provide one of the best records of creative thinking in process. They show Darwin's assembling of a huge amount of information in natural history, mixing his personal observations with those of others who wrote in this field, comparing his ideas with the largely discarded views of the earlier French evolutionist Jean Baptiste Lamarck, coming to perceive the problem of explaining how species change as uniquely his own problem to solve, and eventually sketching out a series of theories of evolution only to discard them as too deeply flawed. Some of these notebooks were especially devoted to exploring issues that Darwin knew were potentially explosive, issues such as extending the theory of evolution to human beings, thereby accounting for human intellect, existence, and morality through a natural and thoroughly materialistic mechanism without invoking the concept of a Divine origin.

Within this 2-year period, Darwin also presented a paper on how topsoil was created through the action of earthworms eating, digesting, and then excreting castings of fine particles of organic material at the openings of their burrows. The analogy with the coral reef theory is clear—so-called "lowly" organisms could build large and significant features of the surface of the earth through the accumulation of tiny changes over immense periods of time.

An entry in one of the notebooks of this period, the one known as the C notebook, raises an important question for those who wish to understand creativity: What role does meta-cognition play in creative thinking? For Charles Darwin, the answer is that it played a significant role. In thinking about human evolution, Darwin wrote on page 74 of this notebook,

“The believing that monkey would breed (if mankind destroyed) some intellectual being though not MAN,—is as difficult to understand as Lyell’s doctrine of slow movements.” Here is explicit recognition of the analogy between the uniformitarian view of geology and Darwin’s emerging theory of evolution—new things can be created through the slow accumulation of small changes. He then goes on to write on page 75, “This multiplication of little means & bringing the mind to grapple with great effect produced is a most laborious & painful effort of the mind.” Darwin recognized the value of this gradualism as a strategy for problem solving. He had already used it productively in explaining the formation of coral reefs and topsoil, but he implies in this quotation that others may have difficulty in accepting this approach to explaining the natural world.

The culmination of this 2-year period of intense work came on September 28, 1838, when Darwin, writing in the D notebook, had his great insight into the mechanism of natural selection. The context for this insight was Darwin’s reading of Thomas Robert Malthus’ *Essay of Population*. This essay led Darwin to realize that the tendency toward overpopulation in human population that Malthus clearly outlined must also apply to the rest of nature, and that competition and struggle for scarce resources was the inevitable result of this situation. Combined with his understanding of hereditary principles that the traits of parents are likely to be passed to offspring and his crucial move to accept that variation was ubiquitous in nature *without* understanding or having to explain the mechanism that produced this variation (he attributed variation to “chance,” a word indicating his inability to explain the source of variation, not a belief that it was a truly random process), Darwin put it all together. Organisms which by chance had a variation that was adaptive, that is, one that helped in the struggle for scarce resources, would survive and pass this trait to offspring. Over enormous periods of time, the accumulation of these new adaptive traits would result in an organism so different from its ancestor that it would constitute a new species. It is characteristic of Darwin’s style of thought that in the same passage in which this crucial insight occurs, he uses a metaphor to capture the essence of the idea. He compares nature to “a force like a hundred thousand wedges,” some wedges forcing their way into the economy of nature and some wedges being forced out. This metaphor highlights the idea of struggle and extinction. Other metaphors Darwin used at other times include the “tree” image to capture the branching structure of nature and the “entangled bank” metaphor to emphasize the fullness and diversity of nature. Use of metaphor was an important part of Darwin’s creativity. For the next 20 years, Darwin refrained from making his theory public. Much has been written on this delay. Stomach maladies plagued him throughout his lifetime following the voyage of the *Beagle*. Explanations of Darwin’s illness and delay have ranged from psychosomatic causes stemming from fear of the reaction his theory would provoke, to hyperventilation syndrome, to a tropical disorder he picked up while on the *Beagle* voyage, to the felt need to do more work on the theory to solve problems remaining with it and to inoculate it from the criticism it would almost certainly engender. In this 20-year period, Darwin worked assiduously for 8 years to understand and

explain variation in just one group of marine invertebrates, barnacles. He also had major insights into how natural selection could work at the level of the group instead of just at the level of the individual, and how natural selection would lead to the multiplication of species (Darwin’s principle of divergence) since a local environment can support more life-forms if organisms divide resources rather than compete for the same resources.

Darwin’s long public silence on his theory of evolution came to an end in 1858 when he was set into motion by a letter he received from a young naturalist working in the Malay Archipelago, Alfred Russel Wallace. In addition to this common experience of archipelagos, Wallace also had read Malthus. In this communication Wallace outlined a theory of evolution so similar to the one Darwin had worked out over the preceding 20 years that it stunned Darwin. Darwin recognized that he could not simply go ahead and publish his own views after receipt of this letter, but a clever solution was worked out by two friends who knew Darwin’s ideas on evolution, Joseph Hooker and Charles Lyell. Darwin had formed a friendship with Hooker in 1843 and had enlisted his help in gathering information on botanical subjects. The solution consisted of having portions of an essay on natural selection Darwin had written in 1844 and part of a letter Darwin had written to American botanist Asa Gray of Harvard in 1857 explaining his views on evolution read in addition to Wallace’s paper at the July 1, 1858, meeting of the Linnean Society by the society’s secretary.

At the time Darwin received Wallace’s letter, he had completed 10 chapters in a work known as *Natural Selection*, a manuscript of over a quarter of a million words and estimated to be a bit over half completed from what Darwin intended. In light of the absence of any significant reaction to the joint presentation of his and Wallace’s views at the Linnean Society, Darwin saw a need and an opportunity to further explain his views. He set to writing an “abstract” of *Natural Selection* and the result was the approximately 500-page *Origin of Species*, one of the most important publications in the history of science and the work that reveals Darwin as a creative thinker of the first rank.

After *Origin*: Concluding a Creative Life

The publication of *Origin* when Darwin was age 50 was the signal achievement of his career. However, Darwin continued to produce important and innovative scientific books and papers, a striking example of sustained creative output throughout a full adult life. Over the final two decades of his life, Darwin’s most creative work occurred in botany, guided by the principle of natural selection. He wrote books and papers describing remarkable structures and behaviors in plants and brought a genuinely ecological approach to his analyses by focusing on insect–plant interactions. In addition to these botanical works, he published important books on variation in domesticated animals and plants and human evolution, and in the year before his death, a book length treatment of a subject he addressed over 40 years earlier, how earthworms form topsoil, reaffirming the gradualism that had worked

so well for him over his lifetime. Charles Darwin died on April 19, 1882, and was laid to rest 1 week later in Westminster Abbey amid the graves of other great creators in British arts and sciences.

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Definitions of Creativity

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Glossary

Creativity paradox The simultaneous coexistence in creativity of psychological elements that seem logically to be mutually contradictory.

Divergent thinking Thinking that yields original or unexpected ideas (contrast with 'convergent' thinking).

Effective novelty Novelty that successfully achieves some purpose or realizes some end.

Intelligence threshold An IQ score beyond which creativity is thought to become independent of intelligence.

Malevolent creativity Creativity that deliberately seeks to do harm.

Moral creativity Creativity that serves the common good.

Negative creativity Creativity leading to bad ends, whether intentionally or not.

Phases of creativity Stages in the production of a creative product.

Pseudocreativity Stereotypical behavior that is thought to involve creativity, although it does not (contrast with 'genuine' creativity).

Secondary creativity Creativity involving novel application of the already known (contrast with 'primary' creativity).

Serendipity Discovering something genuinely valuable by accident.

Sociocultural validation The acknowledgment by the social environment that a product is creative.

Sublime creativity Creativity leading to great works, major discoveries, etc. (contrast with 'ordinary' or 'everyday' creativity).

The Changing Understanding of Creativity

In his *Ion*, Plato discussed the contribution of creative artists to society, albeit in a rather sarcastic and uncomplimentary way. Over the centuries since, painters, sculptors, poets, musicians, writers, actors, and other workers in the creative arts, as well as critics and scholars, have frequently discussed creativity from an esthetic point of view, mainly focusing on works of art. The Chinese Emperor, Han Wudi, who reigned until 87 BCE, emphasized a different aspect. He saw innovative administration as a force for improving his people's well-being, and was intensely interested in giving creative thinkers high rank in the civil service, reforming the method of selection of mandarins to achieve this. Both Francis Bacon and René Descartes, two of the early seventeenth century founders of modern science, saw scientific creativity as involving the harnessing of the forces of nature for the betterment of the human condition.

Creativity has also been seen as the only uniquely 'human' characteristic, a bastion of human dignity in an age where machines, especially computers, seem to be taking over routine skilled activities and everyday thinking. It is also regarded by some writers as a force of nature that lies behind all growth and development. An extension of this point of view is to see creativity as an element of mental health: Through its perceived connection with flexibility, openness, courage, and the like – properties of personality that are seen as both prerequisites for and results of a healthy personality – creativity is thought to foster positive adjustment to life, while there is also evidence of a link between creativity and mental illness.

In a semantic sense, the term 'creativity' is used in three ways: it refers to a set of processes, a cluster of personal characteristic, and to results (e.g., a 'creative' product). Thus, creativity is treated as both a cause (creative processes give rise to

products; peoples' creative personality causes them to behave in certain ways) and also as an effect (creative products are the result of special processes and personal properties). This is the 'classic' 3 Ps approach (person, process, and product), which was soon expanded to incorporate a fourth P – 'press' (i.e., the pressure of the environment, which can either facilitate or block creativity).

However, applied discussions in the modern creativity era, which started in 1950 with the publication of J. P. Guilford's 1949 presidential address to the American Psychological Association and was strengthened by the 'Sputnik shock' of 1957, were strongly shaped by ideas from psychometrics and personality, as well as from education, largely thanks to Paul Torrance. More conceptual discussions came to be dominated by humanistic writers such as Carl Rogers, Abraham Maslow, or Rollo May, who saw its value as lying in its perceived beneficial effects on individual well-being. The result was that discussions of creativity in applied settings such as schools came to be dominated by questions of recognizing, measuring and fostering creative thinking (i.e., process), and the purpose of fostering creativity came to be seen not as production of sublime artistic works, but as promoting processes and personal properties related to creativity. The role of educators and managers was then seen as providing an appropriate environment (i.e., press). In the case of schoolchildren, because of the focus on creative thinking and creative personal properties, insistence on high quality products came to be seen as unimportant or even as inimical to creativity (see below).

Immediately after Sputnik, emphasis shifted more strongly to areas like physical science and engineering, and creativity began to be seen as a way of keeping up with the competition (especially with the then Soviet Union in the space race). The understanding of creativity was no longer largely confined to

fine art, literature, performing arts, music, and similar artistic/esthetic domains, but also included fields such as business, manufacturing, technology, medicine, administration, education, even defense, anti-terrorism, and law enforcement. Its products are sometimes abstract and essentially psychological, such as communication of a feeling, arousal of esthetic admiration, provocation of a new way of looking at such things, or development of new understandings of experience or existence (mainly artistic/esthetic or philosophical). However, they may also be concrete such as the making of works of beauty or imagination on the one hand, or on the other the design and construction of novel devices, machines, or structures, processes or systems for producing them, operating procedures, even enhancement of profits or preservation of national security. This interest has been fuelled by the perceived role of creativity in promoting social growth and justice, economic advancement, social stability, health and welfare, and peace and security.

Recent thinking thus gives more emphasis to products, especially 'functional' products (practical and useful objects and processes), which can be contrasted with esthetic products ('spiritual,' esthetically pleasing objects and processes). Although they are sometimes seen as mutually exclusive – for instance, in the foreword to his own novel, *Mademoiselle de Maupin*, Theophile Gautier argued that to be beautiful something must be useless – esthetic and practical aspects of effectiveness need not contradict each other. It is possible for a book to be commercially successful and at the same time written in elegant, even beautiful language, or for a novel technological product to look beautiful while successfully carrying out some useful practical function in a new way. Many everyday-use objects or structures such as furniture or motor vehicles or buildings seek to achieve both practical usefulness and beauty at the same time, and advertising often lays claim to both. Architecture is an outstanding example of a discipline where both beauty and practical usefulness are demanded.

Discussion of creativity has recently also become prominent in business, with an emphasis on beating the competition for markets and market shares. Research in this domain focused at first on invention of new products and production processes, for instance through studies of patent-holders. More recently there has been considerable emphasis on creative management, that is, on the fourth P of Press, especially creative leadership and the management of innovation, with research focusing on productivity, effectiveness, and the like. There has also recently been considerable discussion of the fostering of creativity in areas where it would scarcely have been regarded as relevant 25 years ago – for instance in management, technology education, sport, even counter-terrorism.

Basic Theoretical Issues

Is It Enough Simply to be Different?

Shortly after the Second World War, researchers concluded that the only constant factor in virtually all discussions of creativity is *novelty*. Novelty was later defined by Jerome Bruner in a more psychological way as the achieving of 'surprise' in the beholder. However, subsequent discussions made the important point that surprisingness alone is not sufficient for creativity.

It is possible to speak of 'pseudocreativity,' which is novel only in the sense of nonconformity, lack of discipline, blind rejection of what already exists and simply letting oneself go. These properties may be observed in many genuinely creative people, and thus be confused with creativity, but they are not actually an inherent part of it. It is also possible to distinguish what can be called 'quasicreativity.' This has many of the elements of genuine creativity – such as a high level of fantasy – but its connection with reality is tenuous. An example would be the 'creativity' of daydreams.

Genuine creativity requires two further elements over and above mere novelty. A product or response must be *relevant* to the issue at stake and must offer some kind of genuine solution, that is, it must be *effective*. Otherwise every farfetched, outrageous or preposterous idea or every act of nonconformity would, by virtue of being surprising, be creative. Thus, creativity is nowadays widely defined as the *production of relevant and effective novelty*. What is meant by 'effective' may differ from, let us say, fine art to engineering to business. In the former case, criteria such as beauty may play a decisive role (i.e., form predominates). By contrast, an engineering product – let us say a bridge built to conduct traffic across a river – must be capable of doing its job (i.e., function is paramount): no matter how esthetically pleasing its design, few people would acclaim the Tacoma Narrows Bridge as a triumph of engineering creativity even though it was beautiful to look at – it fell down in 1940, causing enormous expense and major disruption to traffic. In the case of business, increased profit provides an indicator of effectiveness, and introduction of novelty that destroyed a company's viability, as in examples given by Clayton Christensen, would not typically be regarded as creative business practice, despite its novelty. Thus, simple deviation from the usual is not enough on its own.

Can Everybody be Creative?

Creativity involves something new, different, and effective. However, this raises the question for whom a product, process or idea should be new: for all human beings throughout history, for the society or the era of the creator, or for the creator alone? Requiring that products be new in all human history would mean that a person would not be regarded as creative if someone else somewhere else had had the same idea at some time or other, even though the first person knew nothing of this. On the other hand, defining creativity in terms of the point of view of the person in question only would mean that total ignorance would guarantee creativity, since every idea would be new for someone who knew nothing! In fact, the word 'creativity' is used to refer to products ranging from being novel only in the sense that they have recently come into existence, regardless of relevance and effectiveness – such as is the case with a child's drawing on what was until a few minutes before a blank piece of paper – all the way to great works that are widely hailed as enlarging human perspectives in some way not previously seen in all history. The former involves 'ordinary' creativity, the latter 'sublime' creativity.

This distinction between the creativity of say a Leonardo da Vinci or a Johann Sebastian Bach, which changed the paradigm in an area and inspired other people to follow new pathways, versus that of, let us say, a home cook who varied the

ingredients of a well-known dish and produced an effectively novel taste effect that, however, never became known outside the family and was soon forgotten even there, is sometimes referred to in a picturesque way as involving 'big C' versus 'little c' creativity. Even in the case of sublime or big C creativity, it is possible to distinguish between two ways of producing effective surprise: by means of new applications of existing principles or by development of new principles. Some writers have contrasted 'secondary' (a different application of the already known) and 'primary' creativity (development of new principles). Other authors have distinguished between 'minor' creativity (extending the known) and 'major' creativity (going beyond the known).

A more differentiated approach in this connection is the distinction among 'levels' of creativity made by Irving Taylor: 'Expressive spontaneity' requires only the free production of ideas, without regard to their effectiveness or relevance. This has a role in some creativity training procedures such as brainstorming, and may well be helpful in the production of novelty, but may often lead to pseudo- or quasi-creativity and is not sufficient by itself for sublime creativity. 'Technical creativity' requires unusually high levels of special skills or techniques, for instance with words or paints or a musical instrument or other tools. Despite its importance in some creative activities (such as painting or playing music), technical skill is not sufficient as a universal definition of creativity. 'Inventive creativity' involves applying the already known in new ways, 'innovative creativity' requires expanding known principles, while 'emergent creativity' encompasses the development of new principles. As a general but not universal rule, children often show expressive spontaneity, but lack knowledge of a field or skill with tools or special techniques. In this sense they can be said to display creativity, but only in the form of expressive spontaneity.

About 40 years ago the idea of creativity in the person who will never achieve anything creative was introduced into the discussion by John Nichols. More recently, there has been a considerable amount of research on 'everyday' creativity. Although they may not produce innovative or emergent creativity, a high proportion of adults engage in the production of (at least for them) new ideas or products, for instance in the course of 'creative' hobbies, or simply in everyday life, as in the example of the cook given above. Thus, it is certainly possible, in the sense of everyday, minor, humble, small c creativity, to speak of creativity as a widely distributed characteristic seen in large numbers of people, although to a greater degree in some than in others.

Is a Unified Definition of Creativity Possible?

In recent writings, authors have disagreed about whether creativity can be defined in a general way or only in specific areas such as fine arts or science. There is no doubt that in specific fields special processes or personal qualifications based on, for instance, special abilities such as discrimination among tones, relevant specialized knowledge, skill in using special tools, or skill in specific techniques are important. Such abilities, knowledge, skills and techniques play a role in all fields of creativity, although the relative importance of particular factors is greater in some domains than in others – knowledge is perhaps

relatively more important in science, technique in music, to take an example. The specific contents of these elements also vary according to the particular field or activity in question: the specific knowledge required for designing and building bridges may not be very relevant for creative research in, let us say, botany, but both require a knowledge base. Both mathematical creativity and creative writing require mastery of a set of abstract symbols for representing ideas, although the two symbol systems may be quite different. Thus, there is specificity in creativity, but a general approach is also possible.

What is the Role of Products in Studying Creativity?

The role of a physical product is particularly obvious in fine art or performing arts (where specific works or performances are judged by specialized critics as well as interested members of the public), science (where peer judgment of published discoveries is of great importance), engineering, architecture and the like (where creative work usually leads to concrete products that are sometimes the source of public and professional controversy), or in business, where a concrete product is the usual result of creativity, but the 'wrong' product may spell ruin. On the other hand, in some areas, most obviously mathematics or philosophy, immaterial products such as novel *concepts* or *symbol systems* may well be the usual result of creativity. The two kinds of product are possible in all fields of creativity, and both may be identifiable in more or less all creative achievements, concrete objects being more prominent or dominant in some situations, symbol systems in others.

Although products are of great interest to both artists and business people, engineers, scientists, designers, and architects, to give some examples (i.e., products are important in both esthetic and functional creativity), they present problems for a psychological discussion. Artistic products in particular are often the subject of great controversy, with serious differences of opinion about their degree of novelty and especially their effectiveness: criteria vary from beholder to beholder (for instance art, literature or theatre critics) and from epoch to epoch. The perceived creativity of paintings has been shown by researchers to vary according to the viewers' beliefs about the identity of the painter or the amount of time they believed was expended on completing the work. In the case of business, acceptance by the market or positive effect on the bottom line is paramount. Various writers have thus suggested that psychological discussion should concentrate on process, person and press (social environment). However, from almost the beginning of the modern era some writers emphasized the importance of products. Donald MacKinnon concluded that they are "the bedrock of all studies of creativity." Sharon Bailin labeled efforts to study creativity without reference to products as 'misleading' and 'dangerous.'

Can Creativity Occur by Chance?

There are many examples of apparently lucky combinations of events that led to acknowledged creative solutions: for instance James Austin refers to many famous creators who described chance events that led to breakthroughs. Just what is meant by chance can be divided into four sets of circumstances: blind

chance (the individual creator plays no role except that of being there at the relevant moment; serendipity (a person active in a field hits upon something novel and effective without actually looking for it); the luck of the diligent (a hardworking person eventually stumbles onto something); self-induced luck (special qualifications of a person – such as knowledge, close attention to detail, or willingness to work long hours – create the circumstances for a lucky breakthrough). Case studies suggest that genuinely creative results require a combination of all four kinds of luck, which raises the question of whether it is a matter of luck at all!

An example of the complexity of the way chance works is to be seen in the case study of the Latvian/German veterinary pathologist Eugen Semmer. In 1870, he published a paper in the German-language scientific journal, *Virchows Archiv* (which still exists today), reporting on the strange return to health of two horses that had been admitted to the clinic where he worked suffering from what we would now call 'infections.' Moved by the personal property of curiosity he carefully examined the now-recovered horses (whose corpses he had expected to be dissecting), and applied his specialized knowledge and research skills to discover that they had unintentionally been exposed to spores of the fungus *Penicillium notatum*, which happened by chance to be growing unnoticed in dark corners of the lab. In his article he explained how he had carefully cleaned out his laboratory and had succeeded in eliminating the troublesome mold: No more sick horses would be recovering by accident in his clinic! Chance had presented Semmer with the opportunity for a momentous piece of creativity – he had accidentally discovered antibiotics – but because of other factors such as his inability to re-define the problem he was working on, medicine had to wait another 70 years for Alexander Fleming to discover penicillin, also more or less by accident. Blind chance alone is not enough (see also the discussions in the next section).

What is the Role of Hard Work and Knowledge in Creativity?

Although early studies of creativity supported the view that it frequently results from bursts of sudden inspiration, apparently out of the blue, opinion is divided among contemporary researchers. In some case studies, acknowledged creators have reported that their 'inventive,' 'innovative,' or 'emergent' creativity came from nowhere. In 1881, as he was about to enter a coach for a sightseeing trip during a conference, the mathematician Henri Poincaré was not thinking about mathematics at all when the Fuchsian functions (nowadays known as 'automorphic functions') suddenly came unexpectedly into his head. The poet, A. E. Houseman, described how the lines of his poems simply appeared in his head. Wolfgang Amadeus Mozart reported that he never revised his work, but wrote down complete music that occurred to him in its final form. Such reports have encouraged the idea that hard work and knowledge are unnecessary for creativity, or even that the two are incompatible, and has led to conclusions such as that simply relaxing or letting ideas flow will lead to creativity. However, Poincaré had been working on his problem for many years, and possessed a vast amount of relevant knowledge accumulated by hard work. Houseman's descriptions of his effortless production of poetry go on to recount how after

the first free flow of six or eight lines the next one or two took hours to emerge, and Mozart's account is inconsistent with the fact that corrected early versions of his music have been found.

In fact, a number of researchers have confirmed the role of knowledge in creativity: The Canadian Intellectual Property Office reported in 2007 that no less than 90% of new patents are improvements of existing patents. In explaining his own generation of effective novelty Edwin Land, the inventor of the Polaroid camera, expressly emphasized knowledge. He argued that he had had a purpose – the invention of a camera that developed its own pictures on the spot – and that all the necessary knowledge already existed. His achievement was to become familiar with this knowledge and work his way logically through it to the almost inevitable result, the Polaroid camera. It seems appropriate to adopt a modified version of an aphorism uttered by Thomas Alva Edison, which was printed in *Harper's Monthly* in 1932: "[Creativity] ... is 1% inspiration, 99% perspiration." Apparent serendipity may, in fact, be 'quasiserendipity,' as Cora Díaz de Chumaceiro put it, that is, 'accidentally' finding something you were searching for.

Although some theorists maintain that creativity is so novel that it has nothing to do with anything that already exists, the idea that creativity draws from the wellspring of conventional knowledge was already well established prior to the modern era. For instance, studies of inventors early in the twentieth century concluded that they work with existing knowledge gained via past experience. More recent writers have concluded that novelty always arises out of what already exists. John Feldhusen and Donald Treffinger summarized this view by referring to the 'knowledge base' of creativity. In general, an apprenticeship of 10–15 years seems to be necessary for acquiring the necessary fund of knowledge and skills, even in the case of famous youthful prodigies such as Mozart, who, it is true, produced creative music in his teens, but started his interaction with music by playing at the age of four. There is evidence that scientific and technological creativity may benefit more from knowledge than artistic creativity.

It should be borne in mind, however, that knowledge is a two-edged sword. Some recent research has looked at the problem that, although working successfully in a field over a long period of time (i.e., acquiring a great deal of knowledge) can provide a knowledge base that can be manipulated to yield effective novelty, it can also produce a kind of tunnel vision that narrows thinking and restricts it to the conventional – the Semmer case study is an example. In the absence of appropriate personal properties such as openness to the spark of inspiration, flexibility, or courage to try the new, expertise can inhibit the production of novelty. Great knowledge is thus both the friend and also the foe of creativity. Colin Martindale described the relationship as curvilinear: Too little knowledge is bad for creativity, but so is too much. In order to achieve effective surprise, experts need to be thoroughly familiar with the contents of their field but capable of seeing them in a new light. Creative experts often show a freshness and openness that is more typical of beginners: This has been referred to as the 'novice effect.' I once attended a lecture by the then 58 year old Hans Selye, nominated for the Nobel Prize no fewer than ten times, who apologized for being in plaster from his toes to his hip – he had fallen out of a tree a few days before, after he

saw something that seemed odd and interesting in the tree and climbed it in order to have a better look!

What is the Relationship of Creativity to Intelligence?

Conventional intelligence is heavily dependent on recognizing, recalling, and reapplying, and requires among other things substantial knowledge of facts, effective acquisition of new facts, rapid access to the contents of memory, accuracy in finding the best answer to factual questions, and logical application of the already known. Creativity, on the other hand, requires generation of novelty: that is, departure from the facts, finding new ways, inventing answers, seeing unexpected solutions. The initial position adopted in the 1950s and 1960s by psychologists was that creativity and intelligence are thus separate, more or less competing or even mutually exclusive dimensions of intellect. However, later theory has emphasized that the two overlap or interact. Some writers have referred to this interaction as involving 'true' intellectual giftedness, with neither intelligence alone nor creativity leading to the production of effective novelty. In studies of achievement at school or university level, for instance, it has been shown that, by and large, those students are most successful who display both creativity and intelligence. Research on practical creativity showed that engineers rated as creative displayed a combination of characteristics.

Liam Hudson conceptualized creativity not as a separate ability but as a way of applying intelligence or of organizing ideas, the difference between the two being that they are *thinking styles* or *tactics*. Another approach is seen in the threshold model, according to which a minimum level of intelligence is necessary before creativity is possible. A slight extension is the idea that, as intelligence approaches this threshold (corresponding to an IQ of perhaps 130) from below, the possibility of creativity rises (i.e., creativity and IQ are positively correlated below the threshold). When intelligence lies above the threshold, increases in intelligence have no consequences for creativity (i.e., IQ and creativity are uncorrelated once intelligence is high enough).

This view has been expanded somewhat by the idea of a 'one way' relationship between creativity and intelligence. Intelligence determines the upper limits of a person's ability to obtain and store information, without actually being itself part of creativity. The degree of creativity depends upon the amount of divergence displayed in the processing of the information made available by intelligence. An approach even more clearly oriented towards information processing is the idea that intelligence involves channel capacity, while creativity arises from flexible and versatile handling of the information delivered by the channel to generate novelty, lack of creativity resulting from use of this information to yield orthodoxy.

A different way of looking at the issue is the *overlapping components* approach. For instance, Robert Sternberg identified six 'facets' of creativity: knowledge, insight, intrinsic motivation, the courage of one's convictions, special personal factors such as flexibility and willingness to take risks, and relevance. Some of these facets are shared by intelligence and creativity, with the result that the two are correlated: for instance, knowledge is indispensable for both a high IQ and also for creativity. Other facets, by contrast, may be favorable for one but not for

the other, with the result that creativity and intelligence do not correlate: although highly facilitatory for creativity, flexibility, and risk taking may even detract from performance on an intelligence test. Insight, which seems to be involved in creativity, may be favorable for intelligence without being absolutely necessary for obtaining a high IQ. Intrinsic motivation is favorable for the acquisition of knowledge, but it is possible to operate rapidly, accurately, and logically without it, whereas it is believed to be particularly helpful for creativity. To the extent that they share facets, creativity and intelligence are correlated, to the extent that they depend on different facets or give greater or lesser weight to particular facets, they are separate. Summing up, it can be said that creativity and intelligence are neither identical nor completely different.

What is the Relationship of Creativity to Problem Solving?

The term 'problem solving' has a special meaning in research and theory, especially in psychology. It is often discussed in cognitive terms or as a special form of information processing. In conventional problem solving, the person solving the problem knows that it exists and understands the nature of the problem, intends to solve it, possesses special knowledge, some or all of which is required to solve the problem, and knows, at least in a general way, what broad form the solution will take. Creativity researchers, however, distinguish between problem solving and *creative problem solving*. The latter is required when one or more of the elements just mentioned (knowledge of the problem, of the means of solution and of the nature of the solution) is missing. In other words, creativity can be involved in problem solving but is not always necessary, while not all problem solutions are creative.

One way of showing the role of creativity in problem solving is to divide problems according to: (a) their degree of definition; (b) the degree of familiarity of the means for solving them; and (c) the clarity of the criteria for recognizing solutions. Clearly-defined problems that are solvable by means of standard techniques and for which there are obvious and well-known criteria identifying the solution constitute 'routine' problems. They can often be solved without the help of creativity, although when existing knowledge is applied in settings where it has previously been treated as irrelevant, a certain 'technical' or 'inventive' creativity occurs. Nonetheless, creativity is not absolutely necessary, and is probably not usual. By contrast, some ill-defined problems require, in the first instance, becoming aware that there is a problem at all, defining it, working out techniques for solving the problem, and developing criteria for recognizing a solution. Such 'complex' or 'intractable' problems demand a high level of creativity.

It is possible to distinguish between *recognizing* problems that are already evident in the present organization of available information and are obvious to any qualified observer, *discovering* hidden problems as a result of an intensive analysis of a situation, and *inventing* problems that are only apparent after the available information has been reorganized according to novel principles. A number of researchers see the discovering or inventing of 'good' problems as the vital step in creativity. The Semmer case study (see above) is a good example: He knew the answer (penicillin cures infections), but failed to ask the 'right' question. As a pathologist, whose job was

investigating deaths, he recognized and solved the obvious problem of how to prevent dying horses from getting better; had he re-defined the problem as how to make use with other sick horses of the life-saving phenomenon he had just observed, he would probably have made the momentous discovery for which Fleming received the Nobel Prize 75 years later.

Creativity as a Social Phenomenon

The Social Rules of Creativity

Creativity requires doing things differently from the way they are usually done, or even defying the norms of society, what Robert Sternberg and Todd Lubart called 'contrarianism' (although they were writing about giftedness in general, and not specifically creativity). In a certain sense, creative people defy the rules, even those who do not call attention to themselves through antisocial behavior. Thus, creativity can be seen as involving a failure to conform to the norms of society.

In principle, all people are capable of a wide range of responses to life situations, but in the process of growing up they learn that most of these are forbidden, and usually restrict their responses to a narrow range of socially tolerated behaviors. This has the advantage that life becomes predictable, since it is known what can be expected in everyday situations, but the disadvantage is that unusual, unexpected reactions are discouraged and become rare. There are even rules about the right way of thinking and the contents of correct thought. Societies are prepared to tolerate the breaking of the rules to a certain degree, which rules can be broken or how large a deviation is accepted varying from society to society and from time to time, as well as according to the age, social position, occupation, and other characteristics of the individual doing the rule breaking. For instance, the North American society would tolerate deviations from the norms for behavior at a wedding by a 21-year-old art student that would not be tolerated from the local bank manager. In general, there are rules about breaking the rules. People publicly acclaimed as creative break these rules, but succeed in staying within acceptable limits. If they do not, and produce excessively 'radical originality' they are likely to be regarded as eccentric, immoral, mentally disturbed, or criminal rather than creative, with the possibility of being criticized, shunned, or even locked away.

Research suggests that, as a result of the issues just outlined, creative people often need the support of advocates or facilitators. Some such people may achieve this by energizing, activating, or releasing creativity in others, without necessarily producing effective novelty themselves. An important function of such people is to offer creative individuals a safe space where they can break the rules without sanctions, as well as to offer them a positive perspective on themselves, for instance the view that their ideas are not crazy but creative. This recognition can help to foster the courage to deviate from what everyone else is doing, among other things by offering an opportunity to test the limits of the acceptable without risk or feelings of guilt. Creativity facilitators can be unsung people, such as a grade school teacher. In mature workers, such as scientists, working in a team may provide contact with facilitators. The groups of which a person is a member, either intimate groups such as the

family, more public groups such as playmates or friends, or more or less formally defined groups such as experts/critics, colleagues, or employers can also foster creativity by offering a social environment marked by recognition and encouragement (or, of course, hinder or block it by withholding such positive feedback). Some researchers regard exposure to social support in a congenial environment as the crucial factor in the emergence of creativity.

Socio-Cultural Validation

To have an effect or be recognized, a creative product must not only be novel, but must also be communicated to other people and, most important in the present context, be accepted or at least tolerated by them. This acceptance involves what Mihaly Csikszentmihalyi called 'socio-cultural validation' of a product, without which it is not creative, but involves only generation of variability. According to this view, creativity is not really a property of products or processes at all, but a category of judgment in the minds of observers, often acknowledged experts or specialists. In some areas the rules for applying the label 'creative' are well established, with the result that there is a high level of agreement not only among judges, but also between experts and ordinary members of the public. In other areas, however, there is less agreement, with the result that there are often controversies, for instance over the quality of a painting or a piece of music, the creativity of a new building, or even the acceptability of a novel law-enforcement procedure. This approach not only places great emphasis on *communication*, but it also emphasizes the final step in the emergence of a creative product: the phase of *validation* by the surrounding society. Interestingly, the socio-cultural validation of products does not occur in a social vacuum. It is striking that research has shown that there is a relationship between the economic/political situation of a society and the contents of the relevant and effective novelty created in that society: After an economic depression, there may be a burst of, let us say, literary creativity, after a successful war (if any war is ever 'successful') creativity in the performing arts, after an unsuccessful war, in business and industry, and so on.

The Organizational Environment

In business and industry, the emphasis is frequently on *innovation*, rather than creativity. The difference is that innovation requires not only creating novelty, but also putting it into concrete practice in a particular setting: Thus, in a certain sense, creativity can be seen as a prerequisite for innovation or as encompassing a stage or phase of innovation. Several definitional problems are easy to solve in the framework of innovation, for instance the question for whom novelty should be surprising, relevant and effective, or the issue of chance: Innovation requires the deliberate introduction of ideas, products, production and marketing processes, and the like, that are novel for a work group or an organization into which they are introduced. Effectiveness is also, at least in theory, easy to judge: production rises, sales improve, costs sink, absenteeism or staff turnover falls, or accidents in the workplace occur less frequently, to give some concrete examples.

Innovation can also be seen as a process having two phases. In the initial *ideational phase* ideas emerge that are new for the setting in which they occur. These ideas can be novel in an absolute sense (i.e., involving 'innovative' or 'emergent' creativity), but they need not be: For instance, a manager could make suggestions based on standard practice at a former place of work, novel only in the new workplace. Applying the already known in a new setting constitutes a creative act ('inventive creativity'), but only involves minor or secondary creativity. After this ideational phase comes the *behavioral phase*, in which the novel idea is put into practice. Creativity can occur without the behavioral phase, but this phase is essential for innovation.

In the case of innovation, the context is usually referred to in the relevant research literature as the *organization*. The process of insertion seems to occur in steps or phases, described in, for instance, the five phase model involving 'agenda setting' (the problem is defined and possible solutions considered), 'matching' (the suitability of possible solutions is considered), 'redefining/restructuring' (the innovation is adapted to the specific situation of the organization or the organization adapts itself), 'clarifying' (the organization grasps what the innovation is all about), and 'routinizing' (the innovation becomes part of the daily life of the organization).

Researchers have described aspects of the organization that facilitate or block innovative behavior, and these bear a strong similarity to the properties of the 'congenial environment' described by creativity researchers. Among these factors are freedom to make decisions, support from colleagues with whom one directly works, and facilitating attitudes or other factors (e.g., leadership style) of superiors. Inhibiting factors include negative aspects of the organizational climate, negative attitudes and leadership style of superiors, and inhibiting structure of command. In the case of the individual person, innovation often demands acquisition of new skills, on the one hand, cognitive reorganization on the other (changes in thinking strategies, in the organization of knowledge, or in ways of evaluating work activities). These can lead to a conflict of values with resultant uncertainty or anxiety, and may have consequences for the self-concept. As a result, personal characteristics of the individual such as openness for the new, willingness to take risks, and flexibility interact with the characteristics of the organization to facilitate or inhibit innovation and to moderate its psychological consequences.

The Psychological Basis of Creativity

Thinking Processes

The decisive event in modern psychological analyses of creativity was the acceptance speech in 1949 of the – at that time new – President of the American Psychological Association, J. P. Guilford. In a nutshell, he complained that existing concepts of intelligence visualized it as the finding of single correct answers to circumscribed problems. By contrast, he argued that intellectual power could also be applied to the finding of substantial numbers of new, original and unexpected answers, quite possibly to loosely defined problems. He referred to this process as a special kind of thinking, which he labeled 'divergent.' Guilford's original paper had the title 'creativity,' and the

equating of creativity with divergent thinking quickly established itself, especially after the Sputnik shock already mentioned. Other researchers have also concentrated on thinking processes as the basis for creativity. A well-known popular scientific approach emphasized 'lateral' thinking. Other concepts are 'janusian' thinking (named after the Roman god Janus, who could look backwards and forwards at the same time), 'homospacial' thinking (ideas from different domains are brought together into the same space), 'biphasic' thinking (in the first phase uninhibited combinations of ideas, which are then organized and sorted out in the second phase, for instance according to social acceptability), and 'tertiary' thinking (in the psychoanalytic sense, primary process and secondary process thinking are combined).

Associational theories emphasize the process of linking ideas. The theory of 'remote associates' is based on the observation that, in the course of their experiences, people learn a number of responses to a particular stimulus. Some of the stimulus-response associations occur frequently, others seldom. As a result, people learn a hierarchy of associations. Pairings that occurred frequently in the past stand high in the hierarchy, and have a higher probability of being chosen when the stimulus occurs again than associations which occurred infrequently in the past. These less likely associations are 'remote' and the person who makes them produces unusual or unexpected ideas. A similar approach is seen in the theory of 'bisociation,' which assumes that ideas occur in 'matrices' or fields. Normally, ideas from the same field are combined in a process of association. However, some people combine ideas from separate matrices in a process of bisociation which, by virtue of the fact that the ideas are not normally found together, means that the combination is surprising.

Cognitive Processes in Creativity

Generation of effective novelty depends on special cognitive processes over and above reception, organization, storage, and recall of information which are basic to all cognition, creative or not. Special processes include branching out, generating alternatives, recognizing similarities, making remote linkages, and the like. It is possible for 'ordinary' cognition to function efficiently without these, but they are vital for creativity. In a number of relevant studies, however, actual creators have emphasized the importance of heuristics such as construction of neural networks. The processes may also be guided by, for instance, intuition, a sensing that certain approaches offer more promise than others. Quickly discerning promising lines of attack is greatly facilitated by possession of rules or guidelines for detecting such approaches or for recognizing blind alleys from the start and ruling them out. Evaluation skills that make it possible to see that a line of attack is proving inadequate or to recognize that a solution is at hand (for example, mental blueprints or patterns of what an effectively novel solution might look like and techniques for matching the present state with this blueprint) are of great help. Thus, creative thinking processes seem to be guided by knowledge about how to acquire, organize, or apply knowledge: heuristics, strategies, hunches, or 'rules of thumb' – what is commonly called 'meta-cognition.' These include monitoring progress, redefining plans or the existing line of attack where

necessary, being aware of alternative routes, recognizing opportunities, or understanding the costs and benefits associated with possible changes.

Personality

A number of writers have emphasized the importance of *personality* in creativity, some even arguing that creativity may have little to do with cognitive processes at all, and may be the result of a special personality constellation. Reviews of the relevant research typically list characteristics such as flexibility, sensitiveness, autonomy and ego strength. Recent analyses of earlier research, however, suggest that the relationship between creativity and personality is by no means simple and straightforward. It is not possible to identify a certain kind of personality profile that is typical of the creative, regardless of their field, and also distinguishes the creative from the noncreative. Some research has emphasized the importance of a 'complex' personality that combines, among others, sensitivity with toughness or high intelligence with naïveté. Striking in the discussion of this point is that the personality characteristics regarded as important for creativity sometimes seem to be contradictory: for instance, the creative personality seems to be simultaneously stereotypically 'masculine' (autonomy, self-confidence, toughness) and yet stereotypically 'feminine' (sensitive, intuitive, responsible). Creativity requires a 'paradoxical' personality characterized by polarities such as openness combined with drive to close incomplete gestalts, acceptance of fantasy combined with maintenance of a strong sense of reality, critical and destructive attitudes together with constructive problem solving, cool neutrality combined with passionate engagement, self-centeredness coexisting with altruism, self-criticism and self-doubt together with self-confidence, and tension and concentration side by side with relaxedness.

Motivation

The creation of novelty requires not only appropriate thinking and personality, but also the desire or at least the readiness to diverge, take risks, defy conventional opinion, or expose oneself to the possibility of being wrong: In other words, appropriate *motivation*. Many studies have confirmed that *motivation* plays an important role in creativity. In addition to interest or curiosity, creative individuals are also affected by *cognitive motives* which derive from their knowledge, especially from recognition of gaps in existing knowledge (incompleteness), a drive to round out recently emerging knowledge (development), and identification of contradictions in accepted knowledge (conflict/discrepancy). Albert Einstein, for instance, indicated that he experienced *all three* of these motivating forces, but at different times.

A widely accepted idea popularized by Therese Amabile is that creativity is based on *intrinsic* motivation: the wish to carry out an activity purely for the sake of the activity itself, regardless of external reward. This position can be contrasted with working for external rewards such as praise, awards, pay raises, promotion, and even avoidance of punishment (extrinsic motivation). More recently, however, researchers, including Amabile herself have accepted that extrinsic motivation is not

necessarily fatal to creativity. Some researchers report negative effects of extrinsic motivation, to be sure, but others claim positive effects, and still others report mixed effects. Kerrie Unsworth argued that the effects of external versus internal motivation depend on whether the problem is imposed from outside or is self-discovered.

According to the Edward Nečka's 'triad' model, there are five classes of creativity motive: Instrumental motives, playful motives, intrinsic motives, control motives, and expressive motives. In contrast to the emphasis on intrinsic motivation, this approach argues that creativity can be a means to an end, for example a person might write a book in the hope of making money. Motives interact or change with time. To take an example, a person might begin to write novels in order to earn money – instrumental or extrinsic motivation – but might become aware in the course of writing of the feeling of having an important message that must be expressed regardless of the consequences (expressive or intrinsic motivation). At a particular time a creative person may be dominated by extrinsic, at another by intrinsic motivation. Such 'individual structures of motivation' are capable of changing with time, so that a given person might at one point be more extrinsically motivated, at another more intrinsically. The idea of a dynamically changing structure of creativity motivation is supported by the 'evolving systems' approach of Howard Gardner, according to which a creative product emerges as the result of a long process of development of knowledge, emotions and feelings, and goals.

Feelings and Creativity

Research on creativity and mood, such as that of Geir Kaufman has shown that mood is a precursor to creativity, accompanies it, and results from it. Furthermore, despite the widespread belief that positive mood is necessary for creativity and negative mood is fatal, research indicates that there is a role in creativity for negative mood too. Thus, both 'generative' feelings such as the 'thrill of the chase' when facing a challenge, the feeling of excited anticipation when generating novelty, or the feeling of satisfaction after achieving an effectively novel product, but also 'conserving' feelings such as anxiety in the face of uncertainty, frustration when progress is impeded, or disappointment when a product is not validated play a role in creativity.

The Psychological Paradoxes of Creativity

The Phases of Creativity

The 'classical' description of the emergence of creative products is the phase model, first introduced into modern creativity research about 100 years ago. Nowadays researchers usually focus on the four-phase approach attributed to Graham Wallas (although he initially identified seven phases). In the phase of *Information* a person becomes thoroughly familiar with a content area, in the *Incubation* phase the person 'churns' through the information obtained in the previous phase until a solution appears; this marks the phase of *Illumination*. The solution may seem to the person in question suddenly to have appeared from nowhere because its emergence into consciousness may come all at once, thus creating the subjective feeling of creativity without perspiration. This could explain why some creative people overlook the hard work involved in their own creativity

(see above). Finally comes the phase of *verification*, in which the person tests the solution thrown up in the phases of incubation and illumination.

The phase of 'incubation' is the subject of disagreement among researchers. It is intuitively obvious that creativity requires processing of information. However, there is disagreement among more recent theorists and researchers about whether such processes are chaotic and more or less random, or whether they involve incremental improvement of an initial solution in a sequential series of orderly steps. The first version of incubation would involve many possible solutions popping up more or less complete out of the seething cauldron of ideas, until one was recognized as better than the others and survived through a Darwinian process of survival of the fittest. The second version would involve 'monotonic' sequential refinement (polishing) of a single preliminary solution, step by step, each step improving the result of the previous step until the final form is reached.

Resolving the Paradox of Creativity

A phase approach is helpful in sorting out the problem of the paradoxes of creativity (see above): Creative individuals seem to combine apparently contradictory or even incompatible factors including thinking processes (e.g., divergent versus convergent thinking), personal motivation (e.g., intrinsic versus extrinsic motivation), and personal feelings (e.g., thrill of the chase versus fear of failure). Martindale described this as involving moving backwards and forwards between poles, and labeled it 'oscillation.' In cricket-playing countries, people who are good at this are described in everyday language as 'all-rounders,' while in baseball terms until recently they might have been known as 'switch-hitters.' A phase approach suggests that both poles of the paradoxes really are of central importance, but *not simultaneously* – certain properties wax and wane in importance depending on what phase of the innovation process is currently active. Particular human properties may foster production of effective novelty in one phase, but inhibit it in another. For instance, the personal trait of non-conformity or the process of unfettered thinking may together foster seeing problems in a new light and getting novel ideas about what to do about them, but inhibit painstaking verification of the ideas or effective communication of them in ways that are understandable and acceptable to others.

Figure 1 shows an expanded phase model incorporating other psychological components of creativity including feelings. In each phase (see left-hand column), core psychological processes (second column) are applied to content generated in the previous phase (third column), to produce the material for the next phase. The psychological processes are made possible or at least facilitated by factors such as positive motivation, openness for the new or willingness to take risks. The total process is accompanied in its various phases by feelings such as fascination, pride, or satisfaction.

The figure shows how apparently contradictory psychological factors are of particular importance in different phases of the process of generation of creative products. For instance, convergent thinking might dominate in the phase of *Preparation*, divergent thinking in that of *Illumination*, the personal property of modesty in the phase of *Verification*, self-confidence

during *Communication*. The figure depicts a successful process of creation culminating in a socially validated product. In practice, the process can be broken off earlier, for instance when evaluation of the product to date indicates that it is a failure. The creative process can also start part way through, for instance when a person returns to an earlier novel configuration to verify it. It can also function as a kind of spiral; for example new information could make it possible to verify a novel configuration that had earlier been rejected.

The Dark Side of Creativity

The Problem of Negative Creativity

A theme underlying almost all definitions of creativity is that it is inherently good. In closing, however, it is necessary to draw attention to what Keith James called 'negative' creativity: creativity that derives from evil intentions or leads to bad ends, or of course both. Sometimes the negative results of creativity are unforeseeable; for instance the discoveries of Edward Jenner and Louis Pasteur were hugely beneficial to humankind, but laid the foundation for germ warfare. Even where an undesirable outcome is foreseeable, negative creativity is not necessarily the result of deliberate evil intention. Some people may even create evil despite generally having benevolent motives, for instance, because they are unable to, unaware of, or unwilling to anticipate the dark side of their work, deliberately or sub-consciously blinding themselves to negative consequences. This may occur, for instance because of a lack of information, their fascination with what they are doing, or because they are deceived or coerced by factors like the prospect of money and fame.

Creativity is misused, perhaps in the way just outlined, in advertising, where it is employed for instance to promote the sales of among other things unhealthy food or dangerous products, in business to evade regulators or to steal competitors' secrets, in entertainment to promote repulsive values, glorify crime, etc., in politics to promote, for instance, racial hatred, in science and technology to develop and build weapons of mass destruction, in social or work life, for instance to avoid work, curry favor, gain unfair advantage, or steal from an employer, in crime, in war, or in terrorism. Most obviously dark, however, is the deliberate application of creativity with the conscious primary intention of doing harm to others – 'malevolent' creativity. However, such intentional negative creativity may be widely applauded as positive by one side (for instance the victors in war), even though it is devastatingly negative for the other. Thus, it is necessary to avoid being carried away by a general euphoria about creativity, and to look at it in a more differentiated way.

Moral and Immoral Creativity

To define creativity in a more differentiated way, it is necessary to consider not just the presence of novelty and effectiveness in products, the degree of divergence in processes, or the existence of motivation or other personal properties of the people who generate the novelty (with the tenor that these are either inherently good or are not subject to moral judgment), but to look also at issues of 'goodness' or 'badness.' These lie in the domain of morals, and imply that not everything that is creative is

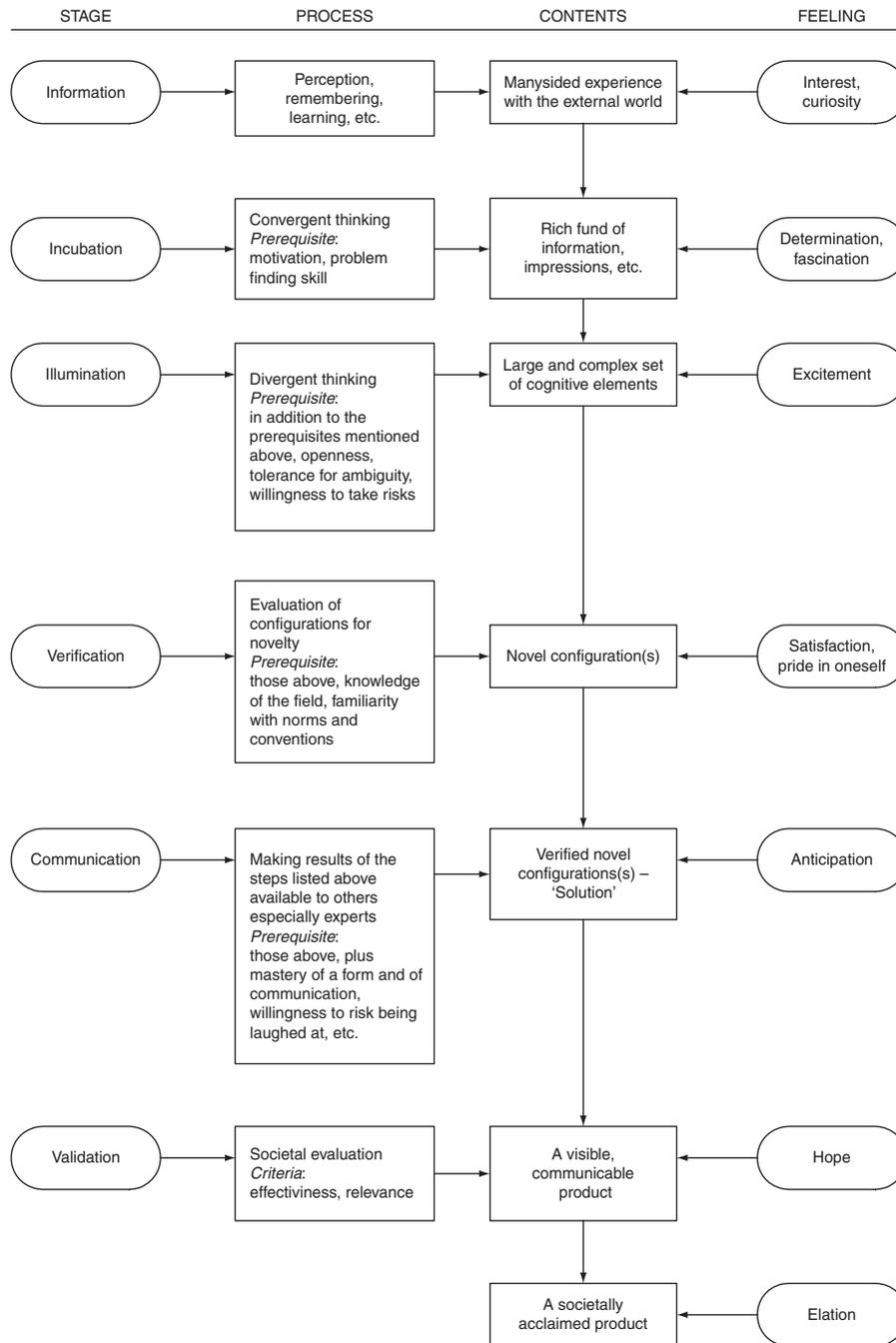


Figure 1 The psychological elements involved in achieving a creative product. Reprinted from Runco M (ed.) (1997) *Handbook of Creativity*, p. 100. Cresskill, NJ: Hampton Press.

moral, thus raising the idea of immoral creativity. Despite the subjectivity of ideas of good and evil, a common core of moral principles that transcend cultures and eras has been worked out in philosophical discussions. Broadly stated, these center on placing concern for the common good ahead of narrow self-interest; the golden rule, in fact. Sternberg called the ability to do this 'wisdom,' and argued that creativity that is tempered by wisdom is automatically moral. Although I have introduced them last, I believe that in defining creativity moral issues should come first.

See also: Architecture; Art and Aesthetics; Associative Theory; Behavioral Approaches to Creativity; Contrarianism and Creativity; The Dark Side of Creativity; Domains of Creativity; Everyday Creativity; Evolving Systems Approach; The Four Ps of Creativity: Person, Product, Process, and Press; Incubation; Insight; Intelligence (as Related to Creativity); Intuition; Janusian, Homospatial and Sepconic Articulation Processes; Mental Health: Affective Disorders; Metacognition; Moral Issues in Creativity; Motivation; Problem Finding; Serendipity.

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Design

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Glossary

Behavior The attributes that can be derived from the structure of an artifact. Informally, behavior can be described as ‘what the artifact does.’

Design The outcome of the process of designing.

Designing The process that transforms requirements into designs. It creates new worlds by reformulating some of the requirements based on the designer’s situation. This provides opportunities for producing designs that were not possible or not obvious in the previous world.

Design world The set of expected design alternatives produced by the designer’s current situation. A design world consists of three subspaces: function subspace, behavior subspace, and structure subspace.

Emergence The process of making implicit properties of a design explicit.

Function The teleology or purpose of an artifact. Informally, function can be described as ‘what the artifact is for.’

Situated creativity (or s-creativity) A type of creativity in which novelty is defined relative to a current situation. It is the result of a change of the world of possible designs.

Situation The process that directs what concepts are produced during designing, based on the designer’s experience and interactions.

Structure The components of an artifact and their relationships. Informally, structure can be described as ‘what the artifact consists of.’

What Is Design Creativity?

Designing

Everything around us with the exception of natural things is designed, and even an increasing number of what appear to be natural things are designed. We will use the word ‘designing’ as the verb and the word ‘design’ as the noun to distinguish between the process (designing) and the outcome of designing. Designing is the process by which we posit changes to the physical and virtual worlds in which we live through intentional acts. Designed physical objects include architectural, mechanical, industrial, textile, electronic, graphical, and chemical objects, amongst the many physical objects designed. Designed virtual objects include those that exist in virtual environments (e.g., computer games) as well as plans and strategies, processes and conceptual models, representations and systems, and hypotheses and theories. Designing is not a unitary activity and as a consequence cannot be simply explained from a single perspective. The distinguishing feature of designing is that it creates new worlds within which it operates. These worlds can be thought of as new ways in which design requirements are viewed. They provide opportunities for coming up with designs that were either not possible or not obvious in the previous world. This feature of designing is most apparent when designs are required to meet conflicting constraints. For example, aircraft fuselages are designed to exhibit high strength but low weight, and digital cameras are designed to provide sufficient image resolution at affordable prices. Some of the conflicts can be resolved through simple tradeoffs that do not require new worlds to be created. However, in many cases of designing there are hard constraints (such as physical or legal constraints) that cannot or must not be violated. As an example, let us assume that an engineering design problem requires the length of a physical part to be at least 10 cm. However, during designing adjacent parts it turns out that this length must be restricted to a maximum of 5 cm.

This conflict is depicted graphically in [Figure 1](#), where x is a variable that represents length. Using this representation, it would not be possible to find a solution.

The conflict can be shifted into a different space by introducing a new design variable y that represents a new geometric dimension (e.g., width), as shown in [Figure 2](#). The constraints now become $x \leq y + 5$ and $x \geq 10 - y$, which leads to the feasible solution space as depicted.

New worlds can be created at all levels of a design. At a low level, they lead to changed elements of the same overall design. At the highest level, they lead to changed needs and actions of users of the design. As the architect Denys Lasdun put it:

our job is to give the client [...] not what he wants, but what he never dreamed he wanted; and when he gets it, he recognizes it as something he wanted all the time.

This may even require violating some of the constraints that initially appear mandatory. A famous example is the Sydney Opera House; its architect, Jorn Utzon, broke all of the original design constraints and yet won the design competition. He even broke the constraint that required the ‘building to lie wholly within the site.’ His design required a larger site than the one specified. In this case since the site had water along three of its four sides it was possible for the client (here the state government) to expand the site to fit the proposed building. The resulting building is considered to be highly creative and is one of the architectural icons of the twentieth century.

Designing involves activities that range in a continuum from selection to routine through to the nonroutine activities. Selection typically occurs at the level of individual elements. For example, materials, springs and bearings can be selected from standard design catalogues. Selected elements do not need to be assessed. Routine design activities involve the generation and testing of alternatives within existing worlds of designs.

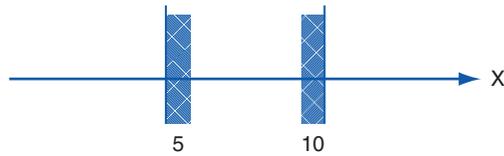


Figure 1 The constraints $x \leq 5$ and $x \geq 10$ lead to no feasible solution.

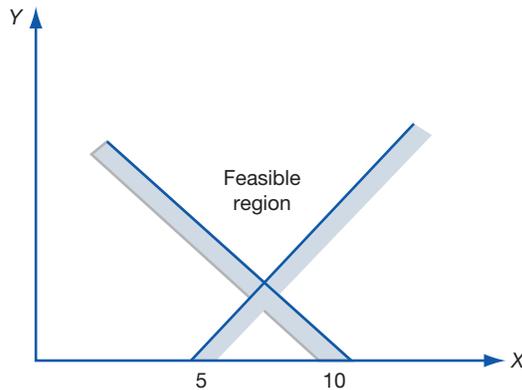


Figure 2 Introducing a new variable changes the constraints to $x \leq y + 5$ and $x \geq 10 - y$ that now lead to a feasible solution space.

They are often carried out iteratively. The criteria for testing alternatives are known and fixed, making designing resemble a process of search within an existing world of designs. Nonroutine design activities are those that create new worlds that allow searching in areas that were not available before. As a result, novel designs can be generated that are potentially creative.

Nonroutine design activities account for the common observation that designs tend to be unique even though they have been produced using the same initial requirements. This means that different designers create different worlds within which they operate. And the same designer often creates different worlds at different times during the process of designing. The notion that accounts for these changes is called the 'situation.' When designers reason about and act upon a design problem, they do so within a unique situation that directs what concepts the designer brings together based on experience and how the designer interacts with the design, the design process and other designers.

Design Creativity

For designs to be creative, three necessary conditions must be fulfilled: (1) The design needs to be novel; (2) the design needs to be useful; and (3) the design needs to be surprising. The first condition allows separating creative designs from routine designs. The second condition is often used for delineating design creativity from purely aesthetic creativity (although 'usefulness' can be understood in a broad sense that may include aesthetic value). The third condition describes the unexpectedness of creativity, providing the potential to change people's expectations.

Creativity in design draws three distinctions: the common distinction between historical creativity (or h-creativity) and psychological creativity (or p-creativity), plus a third distinction that is situated creativity (or s-creativity). h-Creativity is

the strongest form of creativity, where novelty is assessed in relation to the history of humankind. For example, the first steam engine was an h-creative design. p-Creativity implies novelty with respect to the history of an individual. An architect designing a high-rise building using, for his or her first time, reflecting glass can be viewed as producing a p-creative design. h-Creative designs must also involve p-creativity. s-Creativity is defined relative to the situation that pertains during the process of designing. A design or design feature is s-creative if it is the result of a change of the world within which designing operates. p-Creativity must involve s-creativity.

It is important to distinguish design creativity from design innovation. Design innovation turns the outcomes of design creativity into practice by realizing (implementing, manufacturing, assembling) or using them. Therefore, design innovation needs design creativity as a precursor. On the other hand, design creativity also needs design innovation, because outcomes of designing must be realized to be useful. Consequently, the study of design creativity must consider both the producers and the adopters of creative designs.

Design creativity can be located in designs, in the process of designing, in designers, and in users.

An Ontology for Locating Design Creativity

Identifying and characterizing the loci of creativity in design requires a systematic framework for describing the knowledge of the design domain in terms of all the concepts in this domain and their relationships. The notion of an ontology provides such a framework. The function-behavior-structure (FBS) ontology is a design ontology that describes all designed things, or artifacts, irrespective of the specific discipline of designing.

Structure (S) of an artifact is defined as its components and their relationships ('what the artifact consists of'). **Table 1** shows some examples of the structure of various artifacts.

Behavior (B) of an artifact is defined as the attributes that can be derived from its structure ('what the artifact does'). Behavior provides measurable performance criteria for comparing different artifacts. The examples of behavior in **Table 1** show that most instances of behavior relate to notions of quality, time, and cost.

Function (F) of an artifact is its teleology ('what the artifact is for'). It is ascribed to the artifact by establishing a connection between one's goals and the artifact's measurable effects. **Table 1** shows some examples of function.

Relationships between function, behavior and structure are formed by humans through experience and between behavior and structure through the development of causal models based on interactions with the artifact.

Locations of Design Creativity

Design creativity can be located in designs, the process of designing, designers, and users.

Creativity in Designs

There are three locations of creativity in a design: function, behavior, and structure.

Table 1 Examples of function, behavior, and structure of different artifacts

	<i>Building</i>	<i>Text editing software</i>	<i>Manufacturing process</i>	<i>Team</i>
Structure(S)	Geometrically interconnected walls, floors, roof, windows, doors, pipes, electrical systems	Computationally interconnected program components	Logically and physically interconnected operations and flows of material and information	Socially interconnected individuals
Behavior(B)	Strength, weight, heat absorption, cost	Response times, cost	Throughput, accuracy, speed, waste rate, cost	Working speed, success rate, cost
Function(F)	Provide safety, provide comfort, provide affordability	Be time efficient, provide affordability	Be safe, be time efficient, provide sustainability, provide affordability	Be time efficient, provide affordability

Creativity in function

Creativity in function is the result of ascribing novel and surprising purposes to the artifact. An example is the 'pet rock' conceived and marketed in the 1970s. Pet rocks were simple grey stones to which a new function was ascribed – 'be a low-maintenance pet,' because unlike living pets they did not require feeding. Although pet rocks seem like a bizarre idea, they were very successful in the market.

Creativity in function may or may not require changes of behavior or structure. In the pet rock example, no further behaviors needed to be added to the stones' existing ones, and no changes had to be made to their structure (although some pet rocks had 'eyes' attached). The new function was just a changed interpretation of the stone.

Other instances of creativity in function do require changes in behavior and structure. For example, changing the function of a chair from that of an artifact for sitting to a multifunctional artifact that includes both sitting and being used as a ladder would involve changing its behavior to allow for 'ladderly' behavior by having more than one step and hence changing its structure such that the chair's back could be rotated to produce an additional step or two.

Creativity in behavior

Creativity in behavior is the result of deriving novel and surprising attributes of an artifact. These attributes are often new mechanisms, techniques, or physical principles that may support existing or new functions. For example, replacing a car's existing behavior 'petrol consumption' with the new behavior 'rapeseed oil consumption' may not change the existing function 'move people from A to B' but is likely to introduce the new function 'operate ecologically responsibly.'

Creativity in behavior may or may not require changes of structure. The new behavior 'rapeseed oil consumption' of the car is likely to require changes of the structure of the engine and other parts. No structure changes are required when the new behavior can be brought about by modifying the interactions between the artifact and its environment. For example, holding a large piece of hardboard and shaking it in a lateral direction produces sounds without changing the hardboard's structure. This novel and surprising behavior was used by the Australian musician Rolf Harris to create a new musical instrument, known as the 'wobble board.'

Creativity in structure

Creativity in structure is the result of introducing novel and surprising components or relationships between components

in an artifact that may support existing or new behaviors. Studies of designers indicate that this is the most common form of design creativity. For example, the first suspension bridges introduced novel components, component configurations, and materials with respect to the earlier arch bridges. Suspension bridges have left most behaviors unchanged, except for replacing compression strength with tensile strength.

It is more common to replace some element or relationship in the structure than to replace an entire structure by another. For example, replacing a large petrol engine with an electric motor and a smaller petrol engine, along with the elements needed to capture energy in the battery that runs the electric motor, produced the novel, useful, and unexpected design of the hybrid system in many cars today. The rest of the car remains unchanged.

Some creative designs involve a subtractive change in structure followed by the addition of a new structure element. An archetypal example of this is the design of the Sony Walkman. Prior to the Walkman all portable electronic music players had speakers and as a consequence were large and heavy. They were difficult to carry around. The Walkman eliminated the speakers and shrank the player dramatically so it could fit into a pocket. The speakers were replaced by earpieces. Earpieces themselves had never been used with music players previously. This change in structure resulted in a change in behaviors of the design (sound from earpieces) and a change in the function of the design. Previously, music listening via portable players was a group, social experience (hence their nickname 'ghetto blaster'), however, the Walkman changed listening to music from a public to a private experience. This social dislocation was an emergent function (see 'emergence' later in this entry). It took the recent introduction of the design of digital file sharing applied to music to turn music listening into a social experience again, albeit a new kind of social experience.

Creativity in Designing

Creativity in designing is located in the activities that produce new worlds in which new designs can be found. A world can be thought of as a set of possible design alternatives based on expectations produced by the designer's current situation. Design worlds are partitioned into three subspaces: function subspace, behavior subspace, and structure subspace, as shown conceptually in Figure 3. The subspaces are interconnected through the designer's knowledge of qualitative and quantitative relationships between function, behavior, and structure.

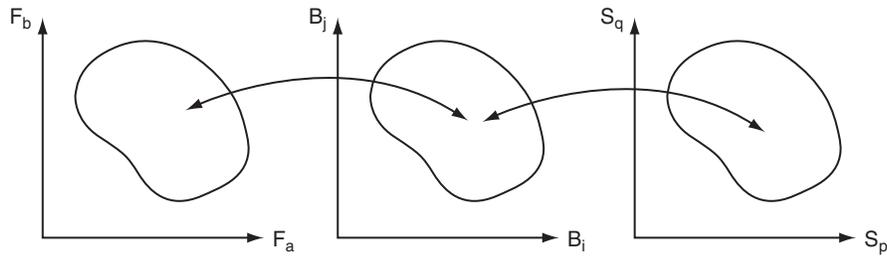


Figure 3 Function, behavior, and structure subspaces, and their interconnections.

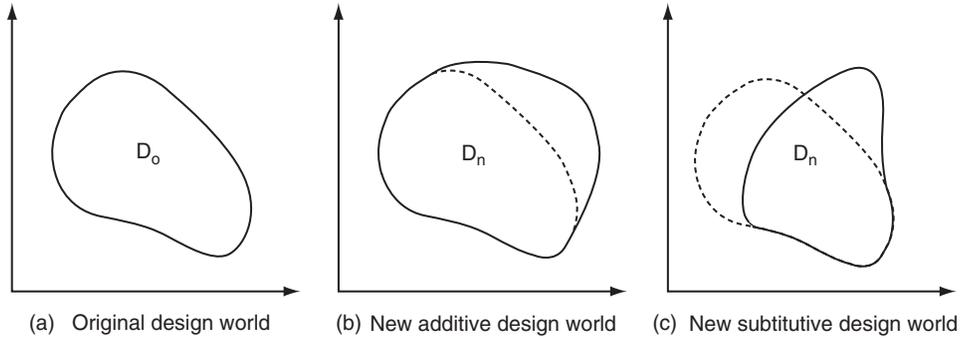


Figure 4 Possible changes of a design world. (a) The original design world, (b) additive change, (c) substitutive change.

The notion of a design world allows distinguishing two fundamental classes of design activities:

- Activities that use a situation to create new design worlds: They are described as shifts of an existing design world through changes in the designer’s interpretations and expectations. The changes may be additive or substitutive, as depicted in Figure 4. The example shown in Figure 2 is of an additive change produced by introducing a new design variable. Figure 5 illustrates a substitutive change where one set of variables (the two squares) is replaced by a different set of variables (the two L-shapes and the smaller square). It is in these activities where creativity in designing is located.
- Activities that operate within a design world produced by a situation: They are described as moves through an existing design world to search for the most appropriate design alternative. Most commonly, the moves occur within the structure subspace and involve mapping their effects on behavior, as depicted in Figure 6. A good example is design optimization that searches for the ‘best’ design by generating and then testing variants of the same type of structure. Figure 7 shows different variants of the same cross-section of a beam and their effects on two behaviors: section modulus (related to the strength of the beam), and moment of inertia (related to the stiffness of the beam). As the moves do not cross the boundaries of the design world, no creativity is involved. All creativity in designing is in the activities that operate on, rather than operate within, the design world.

Creativity methods for designers are concerned with changing existing design worlds or producing novel design worlds within which the designer then continues to operate until they change that world. Some creativity methods are formal and others informal, in the sense that they are used unconsciously. Typical

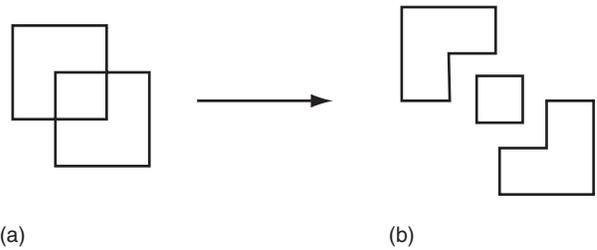


Figure 5 Example of a substitutive change: two overlapping squares (a) are replaced by two L-shapes and a smaller square (b).

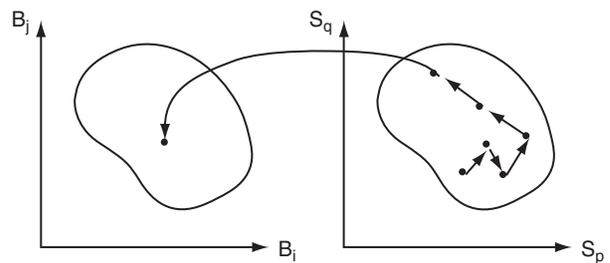


Figure 6 Search within a design world.

creativity methods employed by designers include: brainstorming, morphological analysis, synectics, back to first principles, analogy, mutation, inversion, and TRIZ (the acronym for a formalized method, developed in Russia, for invoking physical principles that can be used to produce creative solutions). All these methods are concerned with introducing new variables and hence changing the design world within which the designer is designing.

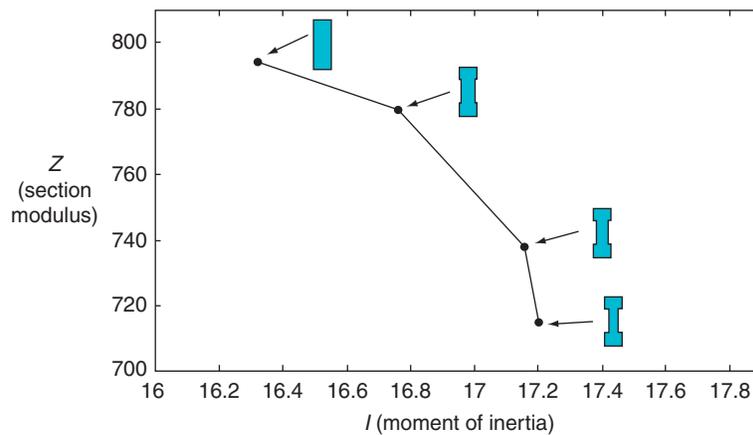


Figure 7 Example of search within a design world: optimizing the cross-section of a beam.

Creativity in Designers

Creativity can be located in individual designers or teams of designers, whose creative designs have led to innovations that have been exceptionally successful. In many cases, these designs spawn new classes of artifacts. For example, the first ballpoint pen spawned a whole new class of ballpoint pens that vary in form but use the same underlying design concepts. The creativity in this design certainly reflects back onto its original designer, Laszlo Biro. In fact, his surname has been used in many countries as a generic term for all ballpoint pens.

Once designers have gained a reputation of being creative, any subsequent design from the same designers is likely to be seen as creative even though its degree of novelty is relatively low. This is because the designers' names suffice to produce expectations of creativity without the need for objective assessment. Many examples can be found in the world of fashion design, where expectations of designers' creativity are based more on the designers' (or brands') names than on the actual designs. These names can be thought of as representative for certain styles of design creativity.

The close connection between a designer's reputation and successful design innovation is one of the reasons why most designers strive to be creative all the time. It also underpins the widely held view that designers belong to the 'creative professions.'

Creativity in Users

Creativity can be located in individual users or groups of users that discover new ways of using existing artifacts for new purposes. There are often adoption effects among users with similar needs and goals, leading to wider spread of the new use of a design. The pioneers of this process may then gain a reputation of being creative, depending on their visibility among peers. The 'wobble board' mentioned earlier in this article is an example of a new way of using an existing design, and many people would agree that its inventor, a popular musician, was creative.

Similar to the creativity in designers, the reputation of being a creative user often lasts for a long time, even when no more creative use is demonstrated by that user. However, these users are often accepted as opinion leaders for assessing creativity or

adopting creative designs, as their own choices of using designs influences their peers' choices.

Many creative users may never gain such a widespread reputation. For example, the skateboard was reportedly invented by children that experimented with different uses of a scooter whose handles had fallen off. This is a form of serendipitous design creativity.

Interactions in Design Creativity

There are three primary interactions in design creativity; they are in the sociotechnical environment of designers, designs, and users, as shown in [Figure 8](#):

1. Interactions between designers and their designs
2. Interactions between users and designs
3. Interactions between designers and users.

Interactions Between Designers and Their Designs

Designing is an activity during which designers perform actions to change their current designs. By observing and interpreting the results of their actions, they then decide on new actions to be executed on the design. The designers' situations may change according to what they are 'seeing,' which itself is a function of what they have done. The design researcher Donald Schön has coined the phrase 'interaction of making and seeing' to describe this phenomenon. The interaction between designers and their designs is one of the fundamental acts that can lead to creativity because it can lead to the generation of new design worlds. Because of this interaction design creativity is not predictable.

One of the processes that result from this interaction is emergence, a process that makes implicit properties of a design explicit. Implicit properties are those that are not intentional. An example of this process is shown in [Figure 5](#). Emergent properties often include visual forms and their potential consequences. They are based on the fact that producing designs, by means of sketching or modeling, necessarily imposes organization and detail on the design, not all of which are specifically intended by the designer. For example, sketching components of a design on a piece of paper produces a set of lines that compose shapes with intended spatial relations.

Other spatial relations emerge when the designer inspects the sketch at a later point in time.

Take the layout of a set of buildings produced by an urban designer, shown in Figure 9(a). At the initial time of drawing the layout, the designer attends to the four buildings individually. Upon inspection of the layout, the designer becomes aware of a horizontal axis and an urban space between two buildings, as shown in Figure 9(b). These features are spatial relations that were implicit in the initial design but are now made explicit. Figure 9(c) shows how the designer subsequently changes the design of an individual building to more directly produce an urban space.

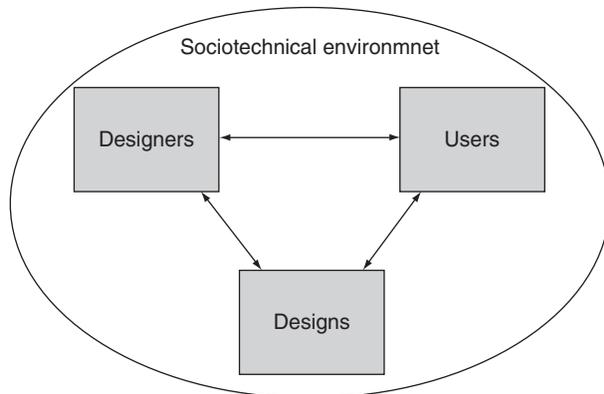


Figure 8 Interactions in the sociotechnical environment formed by designers, designs, and users.

Emergence is well known in the art world, as is its role of driving creativity. For example, in his description of Leonardo da Vinci’s creative process, the art historian Ernst Gombrich stated that “in searching for a new solution Leonardo projected new meanings into the forms he saw in his old discarded sketches.”

Interactions Between Users and Designs

Users interact with designs in various ways based on their current situation. These interactions are visible mostly as the users’ actions aimed at using the design. Similar to designers’ interaction with their designs, users observe and interpret the results of their actions, to decide on subsequent actions. This changes their situation that can affect their view of the design and consequently any further interactions. A creative use can be the result of these changes.

Most creativity driven by the interaction between users and designs is related to function and behavior.

New function can arise as a result of changes in a user’s goals and needs. Some of these goals and needs arise dynamically from the unique circumstances of an individual user. For example, using a screwdriver as a weapon introduces the new function ‘injure someone.’ This function may arise from a user’s sudden need for self defense.

New behaviors can arise as a result of changes of the artifact’s environment that were either accidental or intended for different purposes. For example, a user may accidentally drop a timber slab into water. By observing it floating on the water’s surface, the user realizes a new behavior, ‘buoyancy.’ The user

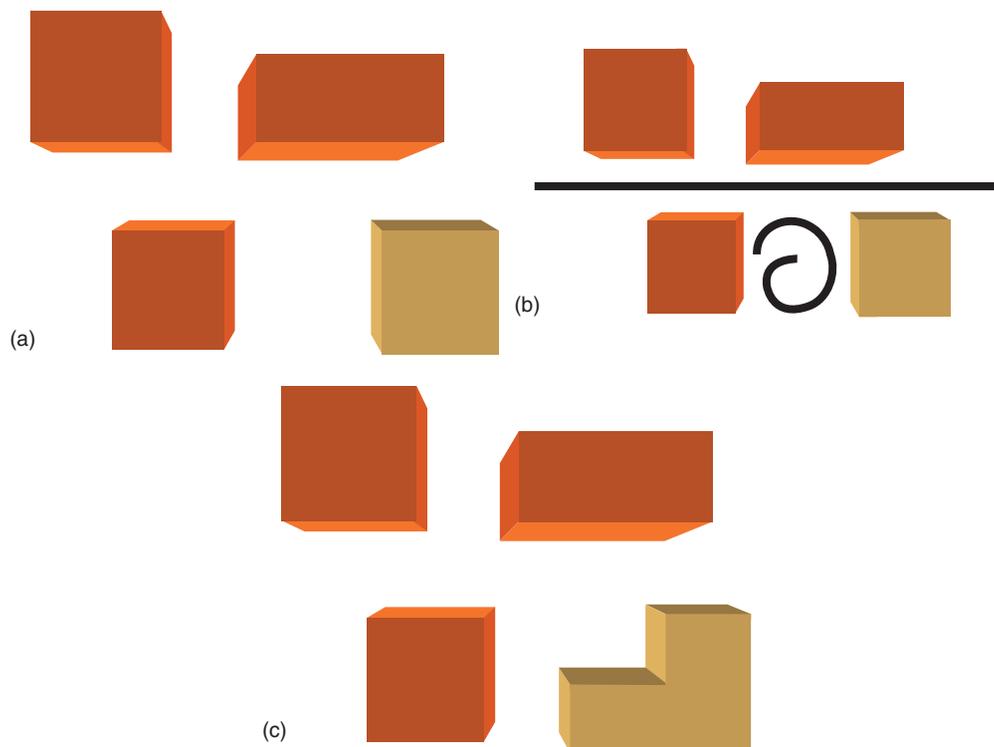


Figure 9 A sequence of sketches of a town layout: (a) the initial layout, (b) the same layout highlighting an emergent urban space and horizontal axis, and (c) subsequent change of the design as a consequence of the emergent urban space.

may explore further possible behaviors by grasping, pushing, or pulling it. This produces a new 'floating' behavior, which the user may find useful for activities such as transporting objects.

New structure can arise as a result of changes of the artifact itself, occurring either accidentally or for different purposes. The skateboard mentioned earlier was an instance of an accidental change of structure. The children found this changed structure useful after they explored new ways of interacting with it.

Interactions Between Designers and Users

Designers and users interact in two ways: directly, and indirectly via the market.

- Direct interaction includes all forms of design-related communication between designers and users. The communication from designers to users includes the designs, instructions of use, and marketing campaigns. The communication from users to designers is via studies of focus groups and general customer feedback.
- Indirect interaction via the market includes all other forms of communication and the interpretation and analysis of market data. The most common form of indirect interaction is the influence of indicators of market success on both designers and users. These indicators may be market share, sales figures or other metrics. Creative designs that are successful on the market will affect expectations of what future creative designs are produced by designers and adopted by users.

Both direct and indirect interactions between designers and users generate new situations that can lead to novel designs. Situations can change in designers and users. Their interconnection allows propagating changes from one individual to another.

Conclusions

Just as designing is multifaceted, so too design creativity has multiple facets. The creativity can be in the design or artifact, in the designer or in the user. Equally it can be in the interactions of the designer with their developing design, in the interaction of the user with the design or with the user with the designer. Most commonly it is in the interactions between the designer

and the developing design. It is here where most design creativity support tools are targeted.

The examples in this entry have been mainly about physical artifacts, however, virtual artifacts are no different and much of design creativity is increasingly focused on them as designing is applied to manufacturing processes, business processes, government processes, and research processes.

Creative designs can be thought of as Lamarckian evolution rather than Darwinian evolution in that the attributes of a creative design change all the designs that follow it. It matches Schumpeter's notion of 'creative destruction' as a descriptor of innovation.

Creative designs change our expectations of future designs by changing our perceptions through changing our value systems.

See also: Architecture; Creative Products.

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Relevant Website

<http://www.jaist.ac.jp/ks/labs/nagai/DesignCreativity/index.html> – Special Interest Group - Design Creativity.

Developmental Trends in Creative Abilities and Potentials

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Glossary

Assimilation The process by which information is altered to fit into existing cognitive structures. In behavioral terms it reflects the construction of personal interpretations of experience.

Conventionality Tendency to go along with norms, expectations, rules, and conventions.

Fourth Grade Slump The drop in original thinking and behavior that occurs for many children at about age 9.

Problem Finding Occurs before a problem can be solved. Operationally, it may involve the identification of a problem or the definition of an ambiguous situation into a workable problem.

Strategic Creativity Actions or processes used intentionally to increase the likelihood of original insight or creative behavior.

Development as Experience

Continuity theories of development assume that the more experience an individual has, the more mature and capable he or she will be. Experience supplies knowledge, or information, and once obtained that information can be put to use. Since experience is obtained in a gradual fashion, a little bit each day, so too is the increase in one's maturity gradually developed. This increased experience may directly influence creative potential. This is, after all, the crux of 'expertise,' and famous creative works are often produced by experts.

There is, however, also a possibility that experience may lead an individual to make certain assumptions which in turn preclude original thinking. Experience may lead individuals to think that one method is best, and they can easily come to rely on that method, thus becoming inflexible and rigid in their thinking because of their expertise. In this light children's lack of experience may keep them from performing creatively (if they lack important information), but it may also keep them from making unoriginal assumptions. They may be more open-minded than someone who has more experience. In discontinuity theories experience contributes to development, but developmental progress is constrained, at least within stages. Thus if a child is in what is called the 'conventional stage,' he or she is sensitive to conventions, norms, and peer pressure. New information and experience may be useful to the child, but it cannot take him or her to a new stage of development until the child in question is of an age where he or she is ready to make the move. The four most commonly recognized stages of cognitive development are 'sensorimotor,' 'preoperational,' 'concrete operational,' and 'formal operational.' An alternative conception better applies to moral reasoning, artwork, language, and originality in children and adolescents. This alternative describes 'preconventional,' 'conventional,' and 'postconventional' stages. Children in the middle stage are likely to be very literal in their use of language (and thus avoid creative metaphors and the like); they are likely to prefer realistic, perhaps representational, art (and thus stop making art that is wild and unconstrained); and they are unlikely to

give truly original ideas (perhaps falling into the quite common 'fourth grade slump').

The four more common stages are suggestive of the kinds of information the individual may be capable of accommodating. The sensorimotor child, for example, only grasps information from immediate sensory or motoric experience. The preoperational child develops the ability to deal with symbolic information, but he or she is not yet very logical in the conventional sense until the stage of concrete operations. At that point the individual has the potential to be very logical, although he or she is still limited in the kind of information that can be used. As the name of the stage implies, at this point the individual is only capable of dealing logically with concrete information. Only in formal operations can the individual deal logically with hypothetical and highly abstract information.

A fifth stage of development – the postformal stage – has also been proposed, but it has received much less attention and confirmation than the other four. It would be an important stage because one manifestation of it is a kind of 'problem finding' whereby the individual recognizes that problems can be redefined to be workable. This kind of activity is an important part of many creative achievements. What is most important here is that the stages are qualitatively different, and the differences are manifested in what information individuals can use in their thinking. Clearly there are implications from this for parents and educators. Simply put, children in different stages require different kinds of experiences. They require experiences that communicate different kinds of information, information that is appropriate to their stage and cognitive tendencies.

Stages are also implied by the various descriptions of developmental trends in creativity. The fourth grade slump implies that development can be characterized by a U-shaped function. Other functions, including a J and an inverted J, have also been reported. The ages of the slumps and peaks vary, depending on the measures used to estimate creativity. Slumps and peaks have also been found throughout adulthood. In certain areas (e.g., mathematics), the peak is in the 20s. In other domains (especially those dependent on large knowledge

bases), peaks are much later. In some of the arts there are even peaks in the 80s and 90s, especially if the artist initiates the 'old age style.'

Given the variety of measures used and the lack of replication used in research in this area, most trends are at this point merely suggestive, or at best descriptive, of certain groups. The evidence for individual differences suggests that slumps in creativity are not inevitable. Creative performances no doubt reflect both nature and nurture. While certain abilities or aptitudes may be expressions of the degree that biological potentials are fulfilled, similarly, slumps may occur as an individual's reaction to his or her environment and experience.

Developmental Differences in Cognitive Processes

Importantly, the cognitive mechanisms used when processing information may not change all that much in the various stages of development. These mechanisms are thought to involve a kind of assimilation of information and a kind of accommodation of that information. As noted above, the information that can be accommodated differs at different ages, but this is because experience is always interpreted in the light of the individual's existing cognitive structures – his or her current understanding of the world – and not because the mechanism or processes differ.

Children may seem to be uncreative because they have particular responses to their experiences. Indeed, one reason children are occasionally described as uncreative is because they may not express their insights. Even if they create some new insight, it may be a personal accomplishment and not one that they express. They are not, in this sense, productive. The expressive and productive components of creativity can be separated from the creative components, however, which means that children can in fact be creative even if they do not have anything to show for it. This may be clearest in their pretending and imaginary play, and in their tendency to lose themselves in the play, even if there is no end objective of that play activity. It is also apparent in children's new understandings of their experiences. Those new understandings are probably useful (at least for the child him- or herself) and original (again, at least for the child him- or herself), and that means they are creative. Creativity is typically defined in terms of originality and usefulness. Each of these may be defined in relative terms; what is original to a child may not be original to an adult. Yet the process used by the child to find or construct that new insight is probably the same process that is used by a mature expert. The difference is in the expression and in the product. Children can then think creatively even if they are not productive.

Another difference between the creativity of children and adults involves intentions. Children's creativity may be unintentional, at least some of the time. Their originality may appear to be accidental, as is the case when a child says something that seems insightful or funny to adults but was simply an effort on the child's part to find the words to capture an idea. In this view children may often do something creative just because they do not know any better. Because they do not know the conventional way to say something ('children say the darndest things') or the conventional way to react to something, they may make up their own description or reaction.

Does this lack of intentions imply that the result is any less original and appealing? Is it uncreative because it was not planned? This question has been debated a great deal lately, but it is clear that if accidental insights are deemed uncreative, many serendipitous discoveries (e.g., penicillin) will also need to be reevaluated.

Once again this same issue can be turned to the advantage of children. Perhaps children are unintentionally creative in part because they are so spontaneous. That spontaneity has many benefits. It precludes the rigidity and inflexibility mentioned above, for example, and it probably ensures a kind of mindful awareness of one's experience. Improvisation of all kinds is creative and necessarily spontaneous.

Strategies, Flexibility, and Assumptions

Children can be strategically creative. The empirical research for this shows how well they react to 'explicit instructions' designed to communicate strategies. Most children, gifted and nongifted alike, respond well and use the strategies to find original ideas. This of course has clear implications for education. It also implies that children's creativity can be intentional, for strategies are by definition intentionally used.

The position that children can be *more* creative than adults was suggested when inflexibility was tied to expertise. Children lack expertise (and may even lack certain basic kinds of information) and this may ensure that they are *not* inflexible. Children also avoid making assumptions that adults often make. Assumptions, like conventions, are often very useful, but they can lead to routine and uncreative behavior. Because they lack experiences children have not yet developed those assumptions. They may try to fly and only conclude that they cannot leave the ground after they try again and again, running up and down a sidewalk, flapping their arms like wings. Adults will not even try to fly; they assume it cannot be done. Of course in this instance they are correct – humans need airplanes and jets – but the point is that assumptions can keep an adult from even considering certain options.

Assumptions can be tied to the information children lack because they are constructed as the individual learns more and more about the world. Many things come to be taken for granted. This can be beneficial because it makes information processing more efficient. We do not always need to examine all details of every experience but instead can focus on novelty and make assumptions about (and not even bother with or devote cognitive resources to) things we have experienced again and again. There is a cost, however, because assumptions lead to routine behavior, and that is never original. Children do not have the experience to develop the same assumptions, and they thus avoid these routines. In this way they may find original ideas more easily than adults, at least some of the time. The same tendency can give a novice in a field an advantage. The insights of Piaget, Freud, and Darwin have been attributed to their abilities to take a new perspective within one field, and that may have resulted from their studying one field and then moving into a new one. Some contemporary scientists explicitly recommend this kind of movement, from topic to topic or even field to field, as a means for maintaining the novice's original perspective.

Potential Versus Actual Performance

Consider also the idea that individuals sometimes have the potential to be creative but do not take advantage of it because they are constrained by cultural convention and taboo. This is yet another way of saying that experience can inhibit original thought by narrowing the options considered. Surely conventions must be learned, and many of them contribute to the smooth flow of social interaction. But it is difficult, if not impossible, to be original in a conventional way. This is the point of many creativity techniques which focus on the 'conceptual blocks' that keep a person from seeing a problem, tack, or solution clearly. Those blocks, be they cultural, social, intellectual, or perceptual, may depend on experience. Once again, if the child lacks that experience, he or she will not have the same blocks.

There is a time to be conventional and a time to be unconventional. Truly creative work occurs when unconventional thinking and behavior is appropriate – when it is only disruptive in a manner that gets people to reevaluate their experience. The point is that originality alone is sufficient for creative work. Creative contributions are original, but they are also timely. They fit in; they solve a problem. Creativity requires a kind of discretion. Surely we do not want children who are original all of the time. Instead, parents and educators need to ensure that children do not lose their capacity to be spontaneous and flexible. Many children do seem to lose this

capacity; many experience a 'fourth grade slump' at about age 9. At that age they are very sensitive to conventions: They react to peer pressure more than any other time; their art becomes highly representational and realistic; and they stick to the rules in their games rather than making them up as they go along.

The trick is to encourage children's originality while allowing them to learn important conventions. In that way they will use their discretion and know when to exercise their originality and when not to. They will be strategically creative.

See also: Attitudes and Creativity; Barriers to Creativity and Creative Attitudes; Definitions of Creativity; Expertise; Improvisation; Insight; Play; Problem Finding; Serendipity.

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Deviance

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Glossary

Contrarianism Behavior that is intentionally different or opposite from what others are doing.

Deviance Different from what is typical; differing from the norm.

Eccentricism Tendency toward unusual and sometimes outlandish behavior that may contribute to original thinking or may result from it.

Open-mindedness Tendency to consider all options and tolerate or even appreciate different perspectives.

Psychosis Disorder characterized by a loss of contact with reality. Historically, it has also been called madness, insanity, or lunacy.

Tolerance Seeing the value in behaviors or ideas even though they are deviant.

The word *deviance* may elicit various negative images. Indeed, whether from a sociological or psychological perspective, a deviant is often thought of as someone who is suffering mental illness, or someone who poses a threat both to individuals and to society in general. When viewed statistically, deviance is seen as a departure from the mean or some other measure of central tendency. Most dictionary definitions of deviance involve the departure from what people normally consider to be acceptable. Taken collectively, these implicit theories and formal definitions imply that deviance entails a departure or a difference from prevailing cultural, political, physical, behavioral, emotional, and psychological norms. Deviants are rule-breakers or offenders against social conventions. Someone who dresses in black on a hot sunny day, someone who scores very high or very low on a test relative to his or her peers, or someone who eats everything through a straw are all examples of behavior or persons who would be considered deviant. Deviance is necessary for societal and cultural evolution. In the Darwinian model of natural selection, deviance provides the variation from which adaptive ideas and behaviors are selected. Conversely, research in social psychology suggests that a lack of deviance within a group usually results in poor decision making and problem solving.

Relevant Aspects of Creativity

Research on the personality correlates of creativity behavior imply a profile of creators that is in many ways similar to the above-mentioned deviance definition: displays unconventional behavior, avoids entrenched ways of thinking, is dissatisfied with the status quo, sets own rules, takes risks, rejects limits imposed by others, is willing to try new things, is open to new experiences and growth, and is receptive to new ideas. Creative individuals seem to have less time to be courteous, often refuse to respect other people's opinions, and tend to be critical of others.

Some characteristics of creativity are found to be closely associated with deviance. For example, originality, the most

widely acknowledged aspect of creativity, assumes unusualness, uniqueness, or novelty. An original or new idea requires some sort of deviance. When we say something or someone is unusual in comparison to something or someone else, this typically means that the thing or person is different from a collection or group rather than a single instance. That group represents the norm. You cannot be like the norm and yet unusual, unless you are unusual in one particular way but fit the norm in all others. Deviance is, then, characterized by unusualness, uniqueness, originality, and novelty – and at least one of these is required for creativity, although it may be a necessary but not sufficient condition.

The Scales for Rating the Behavioral Characteristics of Superior Students are often used by teachers to identify students' creativity. This instrument includes the following descriptions of students' behavior: often offers unusual responses, is uninhibited in expressions of opinion, is sometimes radical in disagreement, is more open to the irrational in him- or herself, is nonconforming, accepts disorder, and does not fear being different. These behaviors are deviant from conventional classroom practices and the traditional values of our social norms.

Although people generally value creativity, both research on implicit theories of creativity and conventional wisdom suggest that creative individuals and the creative process test norms, question authority, and push limits. Creative persons explore and often seek out deviance, suggesting that the distinction between creativity and deviance is often blurred and difficult to identify. Given the common connotations of the concept of deviance, it might be worthwhile to recognize the value of deviance. Popular use of the adjective 'creative' in phrases such as 'creative accounting' and 'creative financing' quite frequently implies unethical and negative behavior. Creative work can be deviant – and yet not unethical.

Issues and Implications

Given both the negative connotations of deviance and the possible importance of deviance to creativity, an analysis of

the comorbidity of creativity with different types of deviance is necessary. In this section, the relationships between creativity and open-mindedness, psychosis, contrarianism, eccentricity, crime, and drug use and abuse are explored.

Open-Mindedness

Creativity is often defined as a complex construct or a syndrome, the idea being that more than one trait and ability is involved. This is pertinent in that autonomy, nonconformity, or even deviance may interact with a person's open-mindedness, a fairly common personality trait of creative individuals. Perhaps creative people, because of their open-mindedness (willingness to consider other ideas and concepts), are more accepting of the deviance of other individuals.

There is very probably a functional connection between open-mindedness and deviance within the individual: individuals may entertain unconventional and even deviant thoughts and behaviors because of their open-mindedness. This is a critical notion in several ways. Not only does it help explain the relationship between deviance and creativity; it also suggests that open-mindedness by one person may ensure that he or she will be tolerant and perhaps even appreciative of the creativity and apparent deviance of other persons.

Because open individuals may be more accepting of other deviant individuals, we might expect a kind of Matthew effect, found in other areas of creativity research, where those with something (in this case the right combination of open-mindedness and originality) will obtain and generate even more of it. Perhaps parents who have creative traits will model and value them, and thereby raise children who also have them. The tolerance supplied by the traits may subsequently generate increased creativity in others who are raised in the same environment.

This may also lead to an increased distance between creative and uncreative persons. This may explain why there are certain expectations for creative persons, such as the stereotypes commonly held about artists and other unambiguously creative individuals and their eccentricities.

Psychosis

Many distinguished artists, musicians, and writers were diagnosed with some kinds of mental illnesses, Adolf Wolfli, Lord Byron, Virginia Woolf, Edvard Munch, Victor Hugo, and Jackson Pollock, to name but a very few. Robert Schumann, who is one of the most productive Romantic composers of the nineteenth century, ended his life in an insane asylum. The world-renowned impressionist artist, Vincent Willem van Gogh, suffered recurrent bouts of mental illness during the final two years of his life, which at last led to his suicide. This link also holds for the average population. For a group of children with manic-depressive illness, researchers found an unusually high proportion of special ability among them.

Many explanations for the relationship between creativity and psychosis are offered. One is from Eysenck who suggested that both the capacity for creativity and the tendency toward mental disorder result from the same 'overinclusive thinking.' This occurs when something that does not belong in a category or concept is nonetheless included in it. At the extreme, this

leads directly to psychotic ideation. The psychotic individual is viewed as out of touch with reality – a deviant, at least in thinking, and often in manifest actions. At other times overinclusive thinking can allow the individual to find unusual but useful connections among ideas. In this way it can lead to creative thinking.

Another alternative explanation posits an 'inverted-U' shaped relationship between creativity and psychopathology, that is, moderate psychosis results in an increase in creativity while a severe situation may lead to a decrease. When individuals have moderate manic illnesses, the psychopathological symptoms lead to high arousal in brain activity, which may stimulate people with millions of novel ideas. On the other hand, creativity is seen as a channel to relieve psychological conflicts and emotional distress. Sometimes working on creative products serves as self-therapy.

The evolutionary hypothesis or Darwinian theory of creativity argued that the link between psychoses and creativity is a consequence of genetic selection. The genes that are liable to suffer from mental illness become adaptive and are retained in human evolution when they show the positive aspect of creativity. Here creativity is taken as one type of 'compensatory advantage' yielded by psychoses in the gene pools.

However, modern researchers are still struggling with questions such as what kinds of mental illness are associated with what types of creativity, and what kinds of creative people tend to experience psychoses. Kaufman used the term 'the Sylvia Plath effect' when he found that female poets were more likely to suffer from mental illness than other types of writers.

Contrarianism

Creative individuals often choose between working within the old prototype or pursuing a novel but probably unacceptable framework. When they think creatively, they are often more intentional than the section above might imply. Sometimes this is the result of tactics or strategies. One tactic is the contrarian one. Here the individual ensures that his or her actions are original by intentionally doing what others are not doing. The economic metaphor is 'buy low and sell high.' This tactic suggests that creative individuals often seek ideas which may be out of fashion but still have potential to gain favor. They do not back down from their unpopular view in the face of resistance, and later find an opportunity to sell those ideas high. This strategy works well because it does indeed ensure originality, the most commonly recognized facet of the creativity complex. There is, however, the caveat that contrarianism can be used in a manner that is contrary to creative achievement, and contrarian behavior is not necessarily creative. It will probably look like deviance, and for the same reason it ensures originality. A contrarian tries to find the boundary, tries to be an outlier, and is therefore trying to be in some sense a deviant.

Eccentricity

People's antagonism to conventional values and entrenched ways of thinking assumes many forms. Eccentricity is one form. In everyday life, eccentricity is shown explicitly either

by absent-mindedness or weird behaviors, especially in trivial matters. This may suggest that eccentrics are more engaged with their own work but pay scant attention to things other than the domain they are devoted to.

Eccentricity is a type of deviance that is often mistakenly associated with psychosis. While schizophrenia and other mental disorders usually lead to dysfunction, eccentrics tend to function well (albeit in ways that appear strange to most people). In both cases, the concept of freedom – to think and behave as one wishes – is present, but the exercise of personal freedom is less dysfunctional in the eccentric.

Studies of eccentrics tend to report that highly gifted individuals exhibit signs of eccentricity, and eccentrics are often creative. The relationship between eccentricity and creativity is hypothesized to hinge on the fact that individuals exhibiting both tendencies are individualistic and apt to go against established norms of behavior. Perhaps the most notable example of eccentric creativity is Albert Einstein, whose behavior was often described as erratic or eccentric (e.g., wearing slippers or pajamas to formal events).

Eccentricity has been found to be a predominantly Western phenomenon. This follows from the emphasis on rugged individualism and privacy rights in the Western world. But the evidence in support of the hypothesized link between eccentricity and creativity is very thin, with some research suggesting that eccentrics are not eminently creative, and creative individuals are not necessarily eccentric.

Crime

Throughout history, many creative individuals have spent time in jail. This is not surprising, because creativity is often perceived as a form of deviant behavior which can frighten people and threaten established societal norms. The jail lives of many famous persons are good evidence of the conflict between creativity and conformity. At the extreme, creative persons are willing to take risks and be nonconforming, and their novel ideas are not in line with traditional, societal norms. It may be that some of these individuals do not fear change and are deviant in thought, allowing them to produce creative works, but also leading them to break society's laws. A subtle distinction can be made between creators who were jailed because their creative activities were perceived to be threatening (e.g., Socrates, Thomas More, Galileo) and those who saw a stint in jail as furthering their creative endeavors (e.g., Thoreau, Gandhi, and Martin Luther King, Jr).

On the other hand, the difference between creativity and crime is hard to identify without referring to the product and press (e.g., the social context) in the four Ps, which also include person and process. Products that are socially useful can be considered truly creative, otherwise they are regarded as criminal. This is similar to Sternberg's opinion that creativity and intelligence need to be tempered by wisdom. In addition, researchers distinguish 'negative creativity' from 'malevolent creativity' due to the different intentions of the behaviors. Both kinds are seen as deviants in creativity research and may lead to criminal acts, but the former may not indicate evil-intentioned creativity or may suggest some potential benefit for society. One example is a man who found a novel way to enter and change the database of the bank where he was

working. He did it not because he wanted to destroy the database or steal the information from the bank but because he was curious. 'Malevolent creativity' makes use of creative ideas to inflict deliberate harm on other people or the society as a whole. It is frequently seen in warfare, and a striking example is the introduction of poisonous gas into Nazi concentration camps during World War II.

Convicted Criminals

Over the past decade, the empirical evidence has linked creative individuals and prisoners. Some studies found that like most criminals, creative people tend to be antisocial, while both are more likely to ignore authority and do things in their own ways. Other research showed that creative people tend to consider themselves impulsive, and impulsivity is a common characteristic shared by creative individuals and prisoners. Russell Eisenman has, however, investigated the creativity of prisoners and found little evidence that convicted criminals are more creative than noncriminals. On the contrary, Eisenman believes that prisoners are generally less creative than nonprisoners, although creative prisoners do exist. Much remains to be discovered about the relationship between creativity and crime.

Drug Use and Abuse

An indirect link between creativity and psychosis would be that the conflicts created by creativity might result in maladaptive coping strategies such as drug use.

At first glance, considerable evidence linking drug use and creativity appears to exist. Many eminently creative individuals, including Ernest Hemingway, Edgar Allan Poe, Tennessee Williams, Jackson Pollock, John Belushi, and Eric Clapton, abuse or abused alcohol or other drugs. Potential explanations for the apparent relationship include creative individuals' penchant for risk-taking, the disinhibitive effect of alcohol and other drugs on creativity, and the role of drugs in easing the stresses of the creative life.

But a deeper look at the issue raises serious questions about the relationship between drugs and creativity. First, while the deviancy necessary for drug use and creativity is often mentioned as a reason for suspecting the existence of a relationship, it is worth noting that the use of many drugs, especially nicotine and alcohol, is quite common and thus not dramatically deviant. Second, much of the evidence supporting the presence of a positive effect of drug use on creativity is anecdotal in nature; indeed, empirical research generally does not support a strong, positive, causal relationship between creativity and drug use. On the contrary, long-term use of alcohol, marijuana, and other drugs appears to have a negative effect on creativity. Even in studies which partially confirm disinhibiting effects, other factors appear to hinder the degree to which individuals capitalize on the production of disinhibited ideas.

However, this is not to say that creativity does not lead to drug use. Creative success often leads to the amassing of financial resources that increase the ability to obtain drugs, and people may turn to drugs to alleviate the many stresses

associated with creative activity. A relatively new hypothesis is that people who consider themselves creative may experience pressures to conform to societal expectations of creative individuals' behavior. For example, a writer may react to stereotypical depictions of the 'alcoholic writer' – stereotypes held by society and the other writers in his or her peer group – by using alcohol more frequently.

Conclusion

Consider the anecdotes surrounding the lives of creative individuals such as Einstein, Poe, Kafka, Martha Graham, and others mentioned in this article. Their deviant behavior was frequently considered outlandish or dangerous and threatened to overshadow their creativity. Their deviance was often such that only the most sympathetic friends and family members could tolerate it. Steven Spielberg's mother has observed that if she had known the typical means for dealing with her son's frequently bizarre behavior, the arts would have lost a major creative talent. Instead, she simply tolerated her son's deviant behavior and encouraged his creativity.

We each need to accept the role of deviance for both creative work or individuals and for societal progress. It should be accepted because we need to tolerate it – or we will lose it, and thereby lose an opportunity to enhance creative work and societal progress. Indeed, regardless of the ambiguity of research on creativity and deviance, most researchers voice the same basic conclusion: tolerance for creative ability.

More specifically, what is needed is (a) increased tolerance for seemingly deviant behaviors and (b) discretion about when to be deviant and tolerant and when not to be. Clearly, both can be taken to inappropriate extremes.

See also: Contrarianism and Creativity; Eccentricity; Matthew, Pygmalion, and Founder Effects; Substance Abuse and Creativity.

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Dialectical Thinking: Further Implications for Creative Thinking

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Glossary

Creativity A multifaceted term often including concepts of novelty, innovation, and effectiveness.

Dialectic In philosophy, the term has been used to refer to different concepts including form of reasoning, logic dealing, with contradictory aspects of knowledge, and a related family of worldviews.

Dialectical thinking A specific form of postformal reasoning that involves the coordination or integration of contradictory views or frames of reference.

Equilibrium A fundamental principle of development described in Piaget's theory of cognitive development through which qualitative change potentially takes place.

Nonabsolute/Relativistic (N/R) thinking A form of higher-order thinking that is operationally defined as multiple-frame operations on ill-defined problems and is associated with a nonabsolute worldview. It is considered a commonality underlying some of the most representative models of post-formal reasoning.

Postformal reasoning A form of higher-order thinking that employs a kind of logic that is different from that of formal (abstract logical) reasoning.

Problem finding A specific form of postformal reasoning that involves the raising of generic questions from ill-defined problem situations. It is also a concept used to designate the fifth or postformal stage in cognitive development.

Meanings of Dialectic

The dialectic has been studied from a cultural-historical perspective across the ages. Its philosophic roots can be traced back to the ancient Greek philosopher Zeno of Elea. The term dialectic (Dialektikos in Greek) means dialogue or conversation within one's self or between the self and others. As such, it is used as a method of inquiry for the purpose of generating knowledge or seeking truth through reasoning. The dialectic when used as a method of inquiry can be linked to certain forms of creative thinking.

Modern conceptions of the dialectic particularly in psychology emerged in the late nineteenth century. These conceptions were based largely on the works of Hegel (1910/1967) particularly his conception of dialectic idealism. According to Hegel, the essence of dialectic is contradiction which is inherent in everything and which is the source of change. Change and contradiction are terms that appear consistently in developmental psychology research on adult cognition. Dialectical thinking is a form of reasoning associated with the logic of dialectic: dialectical thinking is regarded as a form of higher order thinking or reasoning, specifically postformal reasoning, for which creativity is necessary. Dialectical thinking, however, is only one of several proposed factors that can be described as 'post formal.'

Dialectical thinking has been variously characterized as a process, a cognitive style/attitude, a type of thinking associated with advanced cognitive development, or a philosophic or political system. In 1980, Basseches describes dialectical thinking as involving "orienting toward, change, forms, or relationships or in integrating these three orientations" (p. 407). Building on Basseches' work in 1983, Kramer proposed three themes running through post formal thinking: "awareness of the relativistic nature of knowledge; (b) acceptance of contradiction; and (c) integration of contradiction into the dialectical

whole." Dialectic thinking is seen as core to the conception of adult cognition.

Recently Paletz and Peng described the nature of dialectical thinking as "involving the acceptance of contradiction or necessitating the resolution of tension" (2009: 139). Peng's earlier description (Peng and Nesbett, 1999: 714) emphasized the process associated with dialectic thinking as a "cognitive tendency toward acceptance of contradiction broadly defined." Similarly Ruisel describes dialectical thinking as referring to "knowledge of processes, comparing or synthesizing facts, standpoints and opposite viewpoints" (2006: 81). In effect, this is a restatement of the thesis–antithesis–synthesis process. Despite these various characterizations, dialectical thinking for the purpose of this discussion is one of several cognitive forms of reasoning that contributes to creative thought and is an essential feature of postformal thinking.

Thesis–Antithesis–Synthesis Process of Dialectic Thinking

The thesis–antithesis–synthesis cycle represents the form or structure of reasoning associated with dialectical thinking. In a dialectic analysis, the thesis refers to the statement and the antithesis refers to the counterstatement. Both constitute the contradictory aspect of an argument. The synthesis refers to the resolution that is achieved through the coordination or integration of the contradictory parts into a dialectical whole. A synthesis in turn becomes a new thesis thus renewing the cycle of change resulting in on-going development and greater construction, deconstruction, and reconstruction of knowledge at newer, more comprehensive levels.

Consider the following thesis–antithesis–synthesis example. Nuclear waste can have a half-life of 10000 or more years depending on the type of material. Scientists therefore

search for ways to protect the public from the effects of the radiation. One common solution is to put it in massive concrete blocks and sink it to the bottom of the ocean or bury it deep in the earth at a remote location until it is no longer active.

Antithetical thinking leads to the rejection that half-life necessarily has to run its temporal course. The question becomes "How can half-life be sped up so that storage is no longer necessary for public safety?" This leads to the proposal that nuclear waste can be rendered harmless and therefore would not require storage. This dialectic thinking is highly creative in the act of bringing about resolution. Dialectical thinking does not necessarily bring an immediate problem solution but it frames well the question.

The thesis-antithesis-synthesis dynamic also underpins both Piaget's and Vygotsky's views of how cognitive development occurs. For Piaget development occurs when the stability or equilibrium of the organism is disturbed and a type of disequilibrium occurs. Equilibrium is restored when the organism is able to coordinate and integrate the source of disturbance or contradiction into the overall system. For the organism, stability is its normal state and it seeks this integration. Vygotsky, by contrast, holds that cognitive development is a product of the dialectical interaction between the self (internal) and the environment (external). He introduces the essential role of cultural context into this internal/external interaction.

Dialectical Thinking and Postformal Thinking

Riegel (1973) also emphasized the role of disequilibrium (contradiction and change) in the course of cognitive development. He argued that 'primitive' dialectic is used by people at different developmental stages, but that it is the conscious and systematic use of the dialectic that marks the final stage of cognitive development. A similar cultural argument is made by Paletz and Peng (2009: 140) with respect to a 'naïve dialecticism' which is defined in the earlier work of 1999 by Peng and Nesbitt as having three main components: (1) the theory of change; (2) the theory of contradiction; and (3) the theory of holism, that derived from ancient Asian and religious traditions.

While Piaget considers that the stage of formal operations to be the final stage, a 'fifth' stage or post formal stage of cognitive development that includes dialectical thinking as one of its forms of reasoning was proposed by Arlin in 1975.

Basseches (1980) defined dialectical thinking as a group of specific moves of thought and he provides evidence that dialectical thinking is an instance of higher order cognitive development. Basseches categorized the most mature forms of dialectical thinking as "meta-formal schemata." Features of this type of dialectical thinking include:

1. location of contradictions or sources of disequilibrium;
2. resolution of contradiction;
3. operation on open self-transforming systems;
4. comparison and contrast among systems; and
5. coordination of multiple systems.

If one takes these features and reanalyzes the 'half-life' problem the parallel to the thesis-antithesis-synthesis process is quite apparent and what appeared to be a contradiction is not.

These complimentary views of what constitutes dialectical thinking reflect early work on post formal thinking. Post formal thinking can be characterized as reasoning that is meta-systematic, reflective, and dialectic. The logic of post formal reasoning is relativistic and dialectic. It involves simultaneous expansions and contradictions of thought, a fundamentally dialectic construction. Apostle used these terms in 1979 to propose to the Piagetians a model consistent with their framework to explain development beyond formal operational thinking:

something has to happen after formal stage has been reached is the combination of different spaces of possibilities. . . . This involves two simultaneous moves . . . contractions and expansions. [Both] consist in the comparison of different types of universal logical possibilities.

The act of this type of comparison is fundamentally dialectic in nature. In 1973, Riegel used the term dialectic operations as "those directed at the creation and tolerant coexistence of inconsistency rather than its removal."

The construct of post formal thinking thus emerged out of discussions of a 'stage beyond' Piaget's stage of formal operations. To understand postformal reasoning, one needs to understand the fundamental relationship between postformal thinking and formal operational thinking and the role that dialectic thinking plays.

Formal Reasoning and Postformal Reasoning

In the latter half of the twentieth century, the dominant theory of cognitive development was that of Piaget's. Conceived first as a progressive set of age range specific stages and later as more fluid levels of increasing complexity and generality of thought, formal operational thinking (hypothetical-deductive reasoning) was considered the final stage in cognitive development in Piaget's four-stage model. In later years, Piaget himself hinted at the possibility of stages or adult forms of thinking beyond formal reasoning.

Formal operations referred to a particular logical grouping of operations, the INRC group (Identity, Negation, Reciprocal, and Correlative) and all possible combinations of these operations. Through the application of these operations eight formal operational schemes developed. These formal operational schemes were by definition "concepts which the subject potentially can organize from the beginning of the formal level when faced with certain kinds of data, but which are not manifest outside these conditions" (Inhelder and Piaget, 1958: 308). What is remarkable is that the individuals begin to think about their own thinking and to reflect on it. Formal thinkers consider not only "what is," but also "what is possible." The concept of the possible opens up new forms of creative thinking as well as well as creative problem solving.

Kuhn (2008: 50) makes the point that Piaget "raises the possibility that new, more specialized structures will be identified that are specific to particular domains" or alternatively that formal operations develop late in adolescence but only in particular domains in which they have experience, this latter view very close to Inhelder and Piaget's original definition of the eight formal schemes (1958: 308).

Postformal Reasoning and Problem Finding

One of the eight formal operational schemes or concepts is the "coordination of two or more frames of reference." This concept implies a type of relativity of thought and is one of the later developing formal concepts. Careful analysis of the tasks used by Inhelder and Piaget in 1958 and the eight formal concepts suggest that each of these tasks presents a well-defined problem to be solved through logic and the problem itself, even if very complex, has one and only one correct solution. Only the one concept of the coordination of two or more frames of reference opens up the new possibility that, depending on one's frame of reference or point-of-view, contradictory views can both be 'right.' This type of thinking marks a real advance in cognition.

The coordination of two or more frames of reference is a concept that supports the physical knowledge of relativity – which introduces relativism into one thinking. Yan and Arlin suggested in 1998 that the transition from formal to postformal reasoning involved a shift from closed to open system thinking. Open system thinking they described as nonabsolute/relativistic thinking which they proposed underlies most models of postformal thought. Recently, Wu and Chiou found that "dialectical and relativistic thinking were positively correlated with creative performance, whereas formal thinking was negatively correlated." Their finding supports the view of formal operational thinking as logical convergent problem solving and problem finding, dialectic thinking and relativistic thinking as postformal and closely related to creativity. Wu and Chiou also found that postformal thinkers scored higher than formal thinkers in all dimensions of creativity. Recently Wu and Cheng concluded that "formal operational analysis does not appear to describe adequately the creative aspects of evolving thought, that is, of theory creation rather than theory testing." In fact, they see formal thinking as in opposition to creativity and novelty.

The outcomes between problem solving and problem finding also differ. Successful problem solving is "the discovery of one specific acceptable answer to one well-defined problem" while success in problem finding is "the discovery of many general questions from many ill-defined problems" (Mackworth, 1965: 57). Mackworth further observes that:

basically it is a rather exacting requirement to have to work back from an unknown point – or to have to simplify the mismatch between present position and an unknown destination. [In effect one is] ... searching for the unexpected. (Mackworth, p. 60)

In his 1965 work on originality, Mackworth distinguished problem solving from problem finding. According to Mackworth, these are essentially different processes: "Problem solving is the selection and use of an existing program from an existing set of programs" while problem finding is defined as the "the detection of the need for a new program by comparing existing and expected future programs." Ruisel (2006: 81) describes dialectical thinking as referring to "knowledge of processes comparing or synthesizing facts, standpoint and opposite viewpoints" which brings it more in line with Mackworth's sense of problem finding rather than problem solving. Savina (2000: 77) puts it more succinctly describing dialectical thinking as 'mediation of oppositions.'

What emerged from the research on formal operations and problem finding is the suggestion of a 'fifth' stage, the problem finding stage by Arlin in 1975, as a "stage beyond formal reasoning," (Riegel, 1973), that incorporates dialectical reasoning and living with contradiction, or simply a "stage beyond" (Niemark, 1975) that account for some forms of adult cognition not accounted for by Inhelder and Piaget's (1958) formal operations.

"Awareness of and reflection on one's own mental processes showed a similar developmental pattern to relativistic/dialectical thinking" (Verkman, 2005: 211). In her work Verkman described a variable developmental pattern with a low relationship in adolescence; an increase in early adulthood, peaking in mature adulthood and a slight downward trend in older adulthood with respect to relativistic/dialectical thinking. This is a line of inquiry consistent with the earlier cited work of Yan and Arlin in 1998.

Fifth Stage and Postformal Thinking

The recognition that the formal operational stage is about problem solving of well-structured problems that yields one agreed-upon solution led to the question of how to account for ill-structured problems for which there are no known solutions and no criteria by which proposed solutions might be judged. A proposed new stage, the fifth or postformal stage emerged. This fifth stage is the problem finding stage since the stage of formal operations is best characterized as the problem solving stage.

This new stage accounts for the formulation of and grappling with ill-structured problems, the solution of which is "the discovery of many general questions from many ill-defined problems" (Mackworth, 1965: 57). Mackworth quotes Bartlett (1958) that "the most important feature of original thinking was the discovery of overlap and agreement where formerly only isolation and difference was recognized" (p. 63). These early emphases appear to link originality and creativity to dialectical thinking, relativistic thinking, and problem finding or, in other words, the "searching for the unexpected." "Searching for the unexpected" is an apt description of the creative process.

Researchers from a variety of perspectives intensified their studies of different forms of uniquely adult cognition and in the process transformed the search for a fifth stage within the Piagetian framework to studies "beyond formal operations" and ultimately to studies of postformal reasoning which were in large measure "stage free" and represented competing philosophical and psychological stances about adult cognition.

Dialectical Thinking and Creative Thinking

Schon described in 1966, the process of invention as involving the displacement of concepts. Displacement takes place through analogy that he defined as the shift of old concepts to new situations. The old concept is taken as a symbol or metaphor for the new situation in the process of shifting

concepts. In face of conflicts, a process Schon calls 'frame-restructuring' takes place that involves the "coordination and reconciliation of conflicting descriptions of particular situations." The product of this coordination and reconciliation is a "new integrated image of the situation." 'Frame restructuring' seems to involve not only relativistic thinking but also a type of dialectical thinking that opens the door to a new way of thinking about the relationship between dialectic thinking and creative thinking.

New measures and assessments of postformal and dialectical thinking have contributed to the progress made in the study of advanced forms of adult thinking. There is no parallel development of ways to assess mature creative thinking. Even the most recent assessments rely heavily on Guilford's "structure of the intellect" model of 1967 and Torrance's translation of a subset of these factors into a set of divergent thinking tasks. What is needed to propel this research forward are well developed postformal measures of creativity. Paletz and Peng have recently taken a step in this direction.

In effect, it appears that the core of dialectical thinking is fundamentally creative in nature. Invention, discovery, originality, the use of metaphor as a process of thought, frame-restructuring are all ways researchers have sought to describe the creative process and creative thinking.

New work suggests that the relationship between dialectical thinking and creative thinking may be culturally moderated as well as moderated by task and process. Nonetheless, Paletz and Peng argue that dialectic thinking conceived as "an understanding of reality, thought, and the interrelation of systems supports creativity and is post formal" (2009: 141). Succinctly Peng in earlier work (Peng and Nesbett, 1999: 714) suggests that dialectical thinking is broadly defined as the "cognitive tendency toward acceptance of contradiction." What other factors there are that moderate the relationship between dialectical thinking and creative thinking for the most part remain to be discovered.

See also: Cognitive Style and Creativity; Problem Finding; Problem Solving.

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Isak Dinesen 1885–1962

Author

Wrote *Out of Africa*, *Seven Gothic Tales*, *Winter's Tales*, *Last Tales*, *Shadows on the Grass*, *Ehregard*, *Anecdotes of Destiny*, *The Angelic Avengers*, *Carnival*, *Letters from Africa: 1914–1931*, *On Modern Marriage and Other Observations*

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ISAK DINESEN was a Danish writer who married Baron Bror von Blixen, moved to Africa and established a coffee farm in Kenya from 1914 to 1931. Her experiences with the African people enabled her to write Out of Africa, required reading for U.S. Peace Corps members working in Africa. It was the loss of her coffee farm that led to her writing when she returned to Denmark. She wrote in English; her first book, Seven Gothic Tales, became an immediate success in the United States. She worked in the genre of the tale and in nonfiction narrative. Internationally admired by other authors and poets, she was a literary force both in the United States and in Denmark. When Ernest Hemingway accepted the Nobel Prize for literature, he cited Isak Dinesen as a writer who also deserved it.



Isak Dinesen. (Copyright Rungstedlund Foundation.)

Background

Isak Dinesen, Karen von Blixen, was born in Denmark on April 17, 1885, as Karen Christentze Dinesen (Tanne). Her parents were Wilhelm Dinesen (1845–1895) and Ingeborg Westerholz (1856–1939). There were four other Dinesen children: Inger (Ea), born in 1883; Ellen (Elle), born in 1886; Thomas, born in 1892; and Anders, born in 1894.

In Denmark, Dinesen and her sisters were privately educated, which meant that they were expected to marry and were not prepared to earn a living. Later they attended the Ecole Benet, where Dinesen showed a talent for drawing. Dinesen's family history formulates a basis for her creativity and the subsequent relationships in her life. Karen Dinesen was the second-born child. The firstborn daughter, Inger, was

smothered by the Westerholz females, and the father, Wilhelm, had been excluded. Overwhelmed by this enormous female presence, Wilhelm promised himself that the next child would be his. Karen Dinesen was the only one of the five siblings who became extremely close to her father. Wilhelm told her stories of his life. He had gone to America as a young man; it was a romantic pilgrimage from Quebec to Chicago to the wilderness around Oshkosh, Wisconsin, where he bought a cabin and renamed it Frydenlund. He lived there alone for months, during which time he hunted and he baked his own bread. He loved the Indians and saw them as romantic figures, powerful and wise.

Dinesen spoke of her father's total acceptance of and love for her as a small child. She adored him and did not want to share her intimacy with him with anyone. She took pride in being her father's girl, not "theirs," her term for the Westerholz women. Wilhelm confided in her, treated her like an adult, and shared confidences with her, especially when he was troubled. That is why she was devastated at the age of 10 when her father committed suicide in 1895.

In Wilhelm's suicide note to his wife, Ingeborg, he wrote that the two other girls would fend for themselves, "but my heart aches for little Tanne." He did not mention his two sons, Thomas (age 3) and Anders (age 1). Karen (Tanne) Dinesen felt an enormous guilt that somehow she was powerless to dissuade Wilhelm from his ultimate fate: He hanged himself from the rafters of his apartment. Thomas believed that his father had been suffering from syphilis. Ironically, when he shared this revelation with Karen Dinesen, years later, she herself was suffering from syphilis. "My father's destiny," she said, "has, curiously enough, to a great extent, been repeated in my own."

Dinesen grieved for her father, even into adolescence. She thought "constantly" about her father and felt his absence from her life as an intolerable tragedy. At the age of 15, in the following letter, she makes a passionate plea to him:

My dear and beloved friend, my wise and gentle brother: If you had been on earth still, I should have come to you and you would have taught me to love and to approach thine [sic] light, but you are gone away to high worlds, I know not where you dwell, spirit that I love. But do not leave me alone, if your spirit dwells still sometimes on earth, where you loved and suffered, let it dwell within me, who love you. And give me only once a token that you live and are the same, and that my spirit could reach thine, and if you give it me, I shall follow your footsteps and be your disciple, today and always. Perhaps I shall be it in all cases, but you know, my brother, how hard it is to be alone, be with me, and give me your bless [sic] dear beloved brother, my master, and teacher, my dearest friend.

It is significant that this letter was written in English, a foreign language to Dinesen, but a foreign language can provide distance and thus protect one's emotions. It can also ensure privacy.

This letter is also a remarkable example of Dinesen's romantic ideation of her father. She literally attempts to merge her identity with Wilhelm, to become him in order to possess his characteristics. His wisdom, his power shall be hers. She will not feel so vulnerable; she will not be alone. Her choice of words to address Wilhelm reveals her feelings toward him: "dear beloved brother, my master and teacher, dearest friend, wise and gentle brother." Theirs was a relationship that transcended father and daughter in an intimate and interdependent way, for Dinesen becomes both *personas*.

That sense of union extended into her later life. When her marriage and her farm were both foundering, she wrote to her mother: If I can make something of myself again, and can look at life calmly and clearly one day—then it is Father who has done it for me. It is his blood and his mind that will bring me through it. Often I get the feeling that he is beside me, helping me, many times by saying: "Don't give a damn about it."

Dinesen's idealization of her father and her subsequent romantic ideation of him pervaded her life. It was the first link to a series of romantic ideations and losses that also led to her creativity as a writer.

The second significant male in Dinesen's life was Bror von Blixen (1886–1946). Though he became Dinesen's husband, it was his twin brother, Hans, with whom she fell madly in love at age 24. Hans, who raced horses and airplanes, rejected her, and Bror was not interested in her either until he realized that she was passionately in love with Hans. Then he assiduously courted her. Hans's rejection was very difficult for Dinesen. Her maxim was that the final word as to what one is worth lies with the opposite sex. So it was Bror whom Dinesen accepted as her husband after his third proposal.

Her family fought the engagement; her friends questioned her integrity in marrying the twin of the man whom she really loved. All of this made her more tenacious in her decision to marry Bror, to leave Denmark, and to begin their coffee farm in 1914. It was Bror von Blixen who taught her how to shoot. He took her on safari with him, and she loved it—even the skinning of the lion down to his "elegant bones." It was von Blixen who gave her syphilis, a fact long hidden in her earlier biographies. Dinesen returned to Denmark for medical treatment in 1915, and by 1916 the disease was under control and she was noninfectious. Von Blixen never hid the fact that he slept with native women, and syphilis was almost epidemic among the Masai women.

In Africa it was Bror, not Hans, who became a romantic legend, immortalized as Robert Wilson in Hemingway's "The Short Happy Life of Francis Macomber," and worshiped for his enormous courage and spirit by Beryl Markham in *West with the Night*. He became the standard by which hunters were measured. Dinesen loved this aspect of von Blixen, and she loved being the "Baroness."

Though Dinesen tolerated von Blixen's affairs and entertained a few of her own, she did not want the divorce. Von Blixen left the house in 1919 and divorced her in 1922. It was in 1918 that Dinesen met Denys Finch-Hatton. Finch-Hatton, too, was a superb hunter who frequently went on safari with

von Blixen (von Blixen would laughingly introduce Finch-Hatton as "my friend and my wife's lover"). A year after the divorce, Finch-Hatton moved his things to the farm.

Denys Finch-Hatton (1887–1931) was the great romance of Dinesen's life. Adored by everyone at Eton, enormously successful at Oxford, worshiped in Africa, his charm, wit, and intellect were tremendously admired. Like Wilhelm and like Bror, Finch-Hatton came and went frequently; he, too, was restless. In 8 years of living on the same farm, he and Dinesen actually spent only 2 years and 2 months together. The constant separation heightened their passion: a blatant definition of romantic love. They never dealt with reality, and Dinesen catered to his every wish. He enriched her life with music and poetry; he gave her a new perspective of Africa from his small plane. Good food, fine wines, stimulating conversation—these were the things they shared.



Isak Dinesen (Karen Blixen) at 30 years of age taken outside of Karen House in Kenya. (Copyright Rungstedlund Foundation.)

Midway in their relationship, Dinesen (age 41) thought she was pregnant. She cabled Finch-Hatton, using the code name Daniel for the child. Finch-Hatton replied, "Strongly urge you to cancel Daniel's visit." A second cable read, "Do as you like about Daniel as I should welcome him if I could offer partnership but this is impossible." Given her age and medical history, Dinesen probably had a miscarriage: Daniel was never born. This was a reality she could not ignore. Nor was the loss of her farm in 1931. Never economically viable, the coffee farm finally folded. Again, Finch-Hatton refused to help her. There was no offer of marriage, no arrangement for her economic security. She returned to Denmark, to her mother's house at Rungstedlund. The couple later quarreled, and he took back his ring. It was Beryl Markham whom Finch-Hatton invited to accompany him to Voi, his final and fatal flight in his gypsy moth. At first she accepted, then refused because her flight instructor, Tom Black, had a "bad feeling" about her going. It was a fatal crash that claimed Finch-Hatton's life in 1931.

Ironically, it was only in Finch-Hatton's death that Dinesen finally possessed him. She picked his gravesite which they had once chosen, and presided at his funeral; she acted as the significant woman in his life, changing the stories of their last moments together. But this romantic ideation was not enough. Dinesen attempted suicide, slashing her wrists in a friend's house before she left Africa. She also left a suicide note,

which has since vanished from the von Blixen archives. Though she lost a lot of blood, her attempt served as a catharsis from her excruciating pain. It is not insignificant that Dinesen attempted to replicate her father's demise. Wilhelm was the idealized male model whom Dinesen repeatedly sought. Her choices of von Blixen and Finch-Hatton reflected her narcissistic needs. She projected onto these men what she felt she wanted, needed, to be complete. What she desired from both men was an intimacy, a commitment that even her father had not given her. Had she transcended her narcissistic needs, she might have observed that neither of the two men possessed nor desired a capacity for intimacy or commitment. They had much in common: their physical prowess as hunters, their courage, their independence from convention, their need for adventure and solitude, and their reluctance for commitment in relationships.

The two men were blatant in their words and actions. Dinesen saw and responded to what she wished to see. Von Blixen was uncultivated and rough beside Finch-Hatton, but she fought the divorce because she felt vulnerable, abandoned. With Finch-Hatton, the scenario was repeated. Things went well until she needed him. The possession, the control that she desperately sought, always evaded her—until later in Denmark where she met Thorkild Bjørnvig. Dinesen returned to Denmark to live with her mother at Rungstedlund and began writing *Seven Gothic Tales*. Published in 1934, it was a huge success both in the United States and in England. In 1938 *Out of Africa*, an account of her life on her coffee farm in Kenya and her experiences with the native Africans, marked Isak Dinesen as a modern classical writer. She explained why she chose Isak Dinesen as her pen name. Dinesen was her family name and a connection with her father, Wilhelm. Isak means "laughter" in Hebrew, and like the biblical Sarah, who miraculously bore Isaac past her prime, Dinesen now bore her literary creations past her own prime. She had found laughter, she said, and she continued writing: *Winter's Tales* was published in 1942 and *The Angelic Avengers* followed in 1946.

In 1949, Thorkild Bjørnvig, a young Danish poet, entered Dinesen's life when she was 64 years old, living in Denmark, and experiencing "a period of great starkness in her life." The more a "productive dimension" eluded her in her own writing, the more she considered turning Bjørnvig into a poet. "Imperfect and incomplete alone, together they would be a unity." Once more Dinesen was engaged in romantic ideation, searching for the male to bring her to perfection. They formed a pact, a mystical union, a vow of eternal love. Bjørnvig would justify her efforts by becoming a firstclass poet by bringing glory to them both.

Dinesen began by trying to make Bjørnvig "a man of the world"—like her father, Wilhelm, or Finch-Hatton. This relationship lasted for 4 years (until 1953). Though Bjørnvig had a wife and son, Dinesen repeatedly claimed him: he lived in her house for months at a time. She dominated him, played God with his life, caressed and bullied him simultaneously, and spoke of leaving Rungstedlund (her family estate) to him if he would live with her. When Bjørnvig fell in love with a young woman, Dinesen felt betrayed, both as a woman and as his "god." When the affair ended, Bjørnvig returned to his wife and attempted to break the pact with Dinesen. The following is an excerpt from the pact:

You shall belong to no one and to nothing, to no party, to no majority, to no minority, to no society except in that it serves me at my altar. You shall not belong to your parents, nor to your wife nor children, nor to your brothers and sisters, nor to them who speak your language, nor those who speak any other—and best of all to thine own self. You shall belong only to me in this world.

Dinesen signed this document and gave it to Thorkild Bjørnvig. It took time. In one of their last meetings, on a walk, they encountered a snake lying in the sun. It did not move as they approached it. How each construed the snake as a symbol defines their relationship. Dinesen saw it as a good omen, something to protect them both from good and evil. Bjørnvig saw it as an indication of Dinesen's satanic power over him. He wrote his final good-bye to her, and she accepted it. But she did not completely relinquish her control over him. She used him in her fiction.

Like most writers, Dinesen exploited her experiences and transformed them into her tales. In "The Dreamers" from *Seven Gothic Tales* she creates Pellegrina Leoni, a great opera diva who allegedly died in a theater fire in Milan 13 years before the story begins. Though she recovered from the burns, Pellegrina lost her voice and would never sing again. She insisted on a burial service, and the world believed her to be buried in a little cemetery in Milan. She had attempted suicide and now felt that Pellegrina was indeed dead. "I will not be one person again . . . I will be always many persons from now. Never again will I have my heart and my whole life bound up with one woman, to suffer so much."

Pellegrina admonished her Jewish friend, Marcus, "Be many people." And she does precisely that: She becomes Ollala who inhabits an Italian brothel; she is also Madame Lola, a milliner by day and a revolutionist by night; she is also a religious martyr named Madame Rosalba. Three men fall in love with each female character whom they have met, and when they tell each other their stories, they all define "their woman" as the possessor of a deep, white scar from her left ear to her collarbone who is followed by a very wealthy, elderly Jew. When each man tries to possess her, or force her into a fixed identity, she disappears.

Pellegrina's rejection of self, of identity, evolves from her excruciating pain: the loss of the beautiful voice that defined her. Knowing who she is and who she was, she consciously assumes a myriad of identities. In becoming all of these women, she is none of them. She has traded the myth of Pellegrina for a series of mythic women, none of whom really exists; she is spiritually dead. When Pellegrina is discovered by her three former lovers, she throws herself from a precipice and loses consciousness. When she awakens, she is Pellegrina, the opera diva, and she attempts to finish the aria of *Don Giovanni* that she was singing the night of the fire. She has returned to herself.

Dinesen admitted that Pellegrina represented herself; that the loss of the diva's voice by fire symbolized the loss of her farm. It is likely that this loss extended to Finch-Hatton, to her broken marriage, and even to Wilhelm. Her loss was inextricably bound to these men to whom she looked for her own identity. The romantic ideation in her life evolved into her fiction. It became a powerful source for her creativity.

Later, Pellegrina Leoni becomes the focal point for Dinesen's relationship with Thorkild Bjørnvig, the young Danish poet.

Dinesen admitted that his violent rejection of her possessiveness formed the basis of her story “Echoes” in *Last Tales*. The theme again deals with romantic ideation, with the possession of the qualities of the idealized romantic figure. Pellegrina no longer has a voice, but she has a young pupil, Emanuele, who sings like an angel. Pellegrina wants total control of and adulation from him. When she first hears him sing, she is convinced it is the voice of the young Pellegrina Leoni. She felt her own lungs drawing breath in his body and his tongue in her own mouth . . . she made him talk and made his eyes meet hers, and she sensed, as she had often done before, the power of her beauty and her mind over a young male being, her heart cried out in triumph: “I have got my talons in him. He will not escape me.” And later, “In three years we two will be one, and you will be my lover, Emanuele.” Pellegrina’s possession will be complete when she also sexually rules Emanuele. He will become *her* voice, the manifestation of her talent, her creativity, her genius. But Emanuele finally fights for his freedom, his identity. When Pellegrina pricks his finger with a needle, takes three drops of blood on her handkerchief, and sucks them, he believes she is a witch or a vampire and he flees. When she pursues him, he hits her with a large stone, drawing blood from her head. It is only his violent action that enables him to free himself from her possession. Pellegrina needs Emanuele to be whole, to be vital. First, she idealizes him, and then she needs to possess him. There is also an inherent narcissism here, because Pellegrina does not think or care about Emanuele as a person, but as an extension of herself.

Thus the theme of romantic ideation permeates the life as well as the writing of Karen von Blixen, whom the literary

world knew as Isak Dinesen. Although the men in her life whom she wished to possess finally eluded her—her father, Wilhelm; her husband, Bror von Blixen; her lover, Denys Finch-Hatton, and the young poet, Thorkild Bjørnvig—she possessed a portion of all of them in her writing as she sought out the idealized male figure as a way to make herself complete. In 1955, Dinesen’s spinal nerves were severed in surgery; 6 months later she experienced extensive surgery for a stomach ulcer. As a result she was virtually an invalid and never regained her health, but she continued to write: *Last Tales*, 1957; *Anecdotes of Destiny*, 1958; *Shadows on the Grass*, 1960 (a return to Africa and the native Africans). She was appointed an honorary member of the American Academy and was one of the founders of the Danish Academy. *Letters from Africa (1914–1931)* was published posthumously in 1978. On September 7, 1962, Dinesen died peacefully in her sleep at Rungstedlund; she was 77. She was buried at the foot of Ewald’s Hill (named for a poet) on her family estate.

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Discovery

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Glossary

Aesthetics The set of criteria used to decide what is worth investigating and to compare the relative values of discoveries and inventions.

Anomaly An observation that is reproducible but that challenges current theory by refusing to fit within its explanatory framework.

Hypothesis A provisional explanation of phenomena devised with the intention of testing its adequacy.

Illumination A sudden insight following a long period of fruitless problem-solving effort, resulting in a previously unimagined solution to a puzzle.

Invention The creation of something novel by intention (as opposed to serendipity – see below).

Serendipity Searching for one thing and finding another as a result of error, unexpected observation, or unpredicted results.

Theory A broadly explanatory, integrative, mature hypothesis that has repeatedly been challenged by skeptical testing, the predictions of which continue to be validated without yielding contradictory results of significant anomalies.

Definitions of Discovery

Scholars have offered many definitions of discovery, each of which captures a different facet of the subject. For Noble laureate Albert Szent-Gyorgyi, "Discovery is seeing what everyone else has seen and thinking what no one else has thought." Even in the discovery of new phenomena, there is always a concomitant intellectual or theoretical leap. At least a dozen people saw the fogging of photographic plates by radioactive materials before William Röntgen recognized that it was not a problem with the manufacture of the plates, but of something in the laboratory causing the fogging. The result was the first systematic search for what might cause fogging and the discovery of X-rays. More than two dozen bacteriologists saw antagonisms between microbes before Alexander Fleming brought to his observations the problem of how to cure pathogenic infections and perceived the antagonisms as evidence of antibiotic properties. The result was penicillin. Even the discovery of a new species of plant compound or star is only interesting or important within the context of broader issues of chemical engineering, pharmacology, taxonomy, evolution, or cosmology. Martin Harwit argues that, "the distinction between mere detection and actual recognition of a new phenomenon is therefore crucial. We may now be detecting many phenomena that we do not recognize."

To discover something requires giving it meaning within a broader context of human knowledge. The more profound the discovery, the more data or phenomena it connects, the broader its applications, and the more diverse its implications and meanings. Nothing has been discovered if its meaning is not understood. In consequence, there is often a delay between the first time a new object or phenomenon is described and when it is discovered.

Discoveries also link observations, ideas, or theories in new, previously unexpected ways. Albert Rothenberg suggested that discovery can be almost Janus-like: the melding of two

opposing faces or concepts into one body. For example, during the 1920s most scientists believed that Darwinian evolution and Mendelian genetics were contradictory because Mendel's laws assumed that genetic traits were conserved and unvarying, whereas evolution required constant sources of genetic novelty. Either one or the other was wrong. The apparent contradiction was resolved during the 1930s when T. H. Morgan and H. J. Muller discovered mechanisms of genetic mutation. Genetic traits are both invariant and new ones can also occasionally arise by mutation. *Either-or* became *both-and*. Rothenberg's Janus-like view of discovery also captures how discoveries link apparently unconnected concepts. J. C. Maxwell connected electricity, magnetism, and motion. Charles Darwin integrated comparative anatomy, paleontology, geology, geography, animal breeding, anthropology, and economics. Prior to the work of these scientists, these fields had developed largely without regard for each other. Afterwards, they were integrally linked.

An equally broadly applicable analogy for the process of discovery has been provided by Arthur Koestler who suggested that discoveries have the same basic structure as jokes. Jokes often employ structures in which the listener is led to expect one outcome and is surprised to find that the punch line provides an unexpected resolution. Indeed, many scientists have commented that the greatest discoveries are met with the same sort of surprised laughter elicited by a good joke. Sometimes the laughter is born of surprise, sometimes of disbelief, sometimes of ridicule.

One critical issue on which debate persists is whether discovery is a process or an act. Is the discovery, as Koestler would have it, made at the exact time one has the surprising insight, or is the preparation that precedes it also an integral part of the process, as Henri Poincaré argued? Is discovery synonymous with inspiration (the sudden illumination that has given rise to the popular image of a light bulb going off in one's head) or the 99% perspiration that Thomas Edison insisted was

necessary to make the inspiration pay off? This article assumes that discovery is a process in which inspiration plays only a small role.

The basic model of the process of discovery has a series of interlinked steps. Generally a problem is recognized by some inconsistency between accepted observations and theory; the nature of the mismatch between observation and theory defines the kinds of hypotheses that are possible to explain the problem; possible solutions to the mismatch are elaborated and ways to test the solutions proposed; techniques or methods are acquired or invented to test the possible solutions; more often than not, the cycle is repeated as the tests yield unexpected results that disprove or simply do not fit the proposed set of solutions; and thus, new problems are posed. Sometimes, however, the predictions made by one of the hypotheses appear to match the outcome of the tests. Then the investigator must verify the insight by repeating it and showing that other obvious explanations for it are untenable, communicate the results, convince skeptical colleagues of the legitimacy of the result, and demonstrate that the discovery proffers new things to be investigated or solves outstanding problems in novel and useful ways.

As Thomas Kuhn argued, one of the most critical aspects of any discovery is that it changes the way scientist think about and do their science. The change can be in theory, experiment, method, or even institutional organization. More and more investigators are recognizing that part of this process involves social forces that determine the latest fads in funding and hiring, and that aesthetic considerations, such as how the discovery fits into current scientific fashions, may speed or delay acceptance and recognition of a discovery.

In sum, the process of discovery is complex, involving philosophical, empirical, theoretical, aesthetic, and social elements, as well as the psychological ones that determine how the discoverer creates or stumbles upon his or her novelty. The surprise of insight that some investigators identify with discovery is but one temporally distinct phase within this complex process.

Who Discovers

Every discovery to date has been made by a person. In the age of computers, this is not a trivial statement. So far, several computer programs have generated novel proofs of previous conjectures made by human beings, but no computer has yet generated a new and useful problem, hypothesis, or conjecture, let alone observation. As Poincaré once said, logic proves, it does not invent. Thus far, his statement has proven to be true. Whether computers will be able to be programmed to have 'imagination' in the future will stand as one of the greatest challenges of artificial intelligence.

Given that people have made all known discoveries up to the present time, one must ask what characterizes discoverers. It is clear that the ability to make discoveries is just as asymmetrically distributed in the general population as is, say, musical or artistic talent. While nearly everyone can learn to do an experiment or play an instrument, very few have the talent of an Einstein or a Mozart. The difficulty is that recognizing this talent is not a trivial problem. Einstein's potential was

certainly overlooked well into his adult years. A few eminent scientists have, however, displayed the same sort of precocity as Mozart. William Bragg, who won the Nobel Prize at the age of 22 is one example. Notably, studies of precocity among scientists, as determined by high standing in Science Talent Search competitions for high school students, shows that precocious teenagers have no higher probability of staying in science as a career than do other students planning science careers. While some national winners have gone on to win Nobel prizes, the majority have not even remained within science. Intelligence tests, standardized tests such as Achievement tests, tests of divergent thinking, and psychological profiles have also failed to identify any significant predictors of who will succeed in science. A significant number of eminent scientists have moved into science careers only during or after college, in fact, so that their talents were late blooming.

The factors that do seem to correlate significantly with the ability to make discoveries are of quite unexpected sorts. One is training with a previously successful discoverer. Nearly all Nobel prize winners have studied with a previous laureate at some time during their schooling or early careers. Whether such training conveys certain tricks of the trade or creates personal networks of power that help to facilitate the acceptance of discoveries, or both, is not clear from current studies. In any event, there are clearly established student-teacher lineages of eminent scientists that can be traced for many generations.

Another personal correlate for success as a discoverer is hobbies, or intensive leisure time activities. Those scientists whose work is recognized as being the most important for their science (as measured by honors, total citations to their papers, or the number of individual high-impact papers they publish) tend to engage intensively in hobbies such as painting, music, writing poetry, sculpture, professional-level chess, or other endeavors that require significant time and energy to master. These discoverers are often highly talented in their avocations, so that a significant proportion of Nobel laureates report that they have faced difficult career decisions between science, one of the arts, and sometimes the law or business as well. A few, such as Desmond Morris, who is a professional painter as well as ethologist, and Aleksandr Borodin, whose musical compositions are better known than his chemistry, have even managed to carry on joint careers.

Mitchell Wilson, a physicist, inventor, novelist, and historian of technology, notes that the reason hobbies may correlate with scientific success is that the discoverer needs not only expert knowledge, but a poet's affinity for words and their meanings, the artist's ability to observe and think graphically and dynamically, and the musician's appreciation for complex patterns and the finesse of playing instruments – in this case, scientific ones as well as musical ones. A breadth of skills therefore hones the scientist's talents for discovering.

Non-scientific talents may also hone the discoverer's thinking skills. A direct correlation has been found between the ability of eminent scientists to think in three dimensions and their participation in the arts. Musical ability also seems to improve visualization as well as kinesthetic sensibility. Similarly, verbal skills are highly associated with verbal hobbies such as poetry. The ability to think in three-dimensions, dynamically, to use kinesthetic thinking skills, and to utilize an

unusually broad range of nonverbal forms of thinking, is in turn highly correlated with the importance and number of discoveries a scientist makes. As Max Planck, who received a Nobel Prize in Physics, once commented, “the creative scientist needs an *artistic* imagination.”

Age is also certainly related to the probability of making discoveries. Young scientists are more likely to make discoveries than older ones and the earlier that a scientist has the opportunity to do independent research, and the earlier they publish, the greater the probability of long-term recognition. The probability distribution of making a discovery varies by specific discipline, however. The probability peaks at around 25 years of age for mathematicians, 30 for physicists, 35 for chemists, and in the early forties for biologists. As with all statistical distributions, there are, in this case many important, exceptions. Some mathematicians have made their first major discovery in their sixties, and some biologists have done their best work in their early twenties.

What is perhaps more interesting about age and the probability of discovery is that there are two very different groups among discoverers themselves. The dominant group consists of people who make a single important discovery during their lifetimes – a Jonas Salk with his polio vaccine or Watson with the structure of deoxyribo nucleic acid (DNA). These people tend to stay within the field of their expertise. The minority group consists of individuals who make multiple, major discoveries often spanning their entire careers. These people tend to change fields often and are characterized by having made three or more major discoveries by their mid-forties. Such people tend to state explicitly that they use field changing, or what has been called the ‘novice effect,’ purposefully to stimulate new ideas. Linus Pauling, who worked on chemical bonding, protein structure, DNA structure, hemophilia, vitamin C, and many other scientific problems, is typical. Such field-changers state that they are invigorated by having to grapple with new problems and mastering new scientific tools, while they also bring to the new field their experience and knowledge of the ones they have explored previously. Insights, they say, often result from this melding of previously separate knowledge and practices.

While the most successful discoverers tend to be productive, productivity cannot be used as a measure of either discovery or potential to discover. There is no correlation between productivity and discovery at all. Gregor Mendel produced a mere seven papers and revolutionized science by inventing the basic principles of genetics. Banting gave the world insulin and a lifetime total of less than three dozen papers and earned himself a Nobel Prize. James Watson’s total scientific output consists of less than 50 scientific papers, and yet he, too, revolutionized science with his discovery of the structure of DNA, the molecule containing the genetic code.

Some discoverers are, on the other hand, prolific. Pauling produced many hundreds of papers, as have most of his Nobel-winning colleagues and Thomas Edison produced 1093 patents, still a record for an individual inventor. Edison, however, never discovered any new principles or devised any theorems that contributed to science, whereas another great inventor, Michael Faraday, not only invented electrical motors and generators, but also provided the intellectual basis for the science of electromagnetism. He, in other words, not only

created new things, but explored and explicated their meaning. He thereby raised his work from mere invention to the plane of real discovery. Thus, simply being prolific does not necessarily lead to discoveries. Indeed, some of the most prolific scientists are also the most obscure. John Edward Gray, an nineteenth-century botanist whose work is largely forgotten, produced 883 papers. Similarly, the most prolific author in current computer sciences, with more than a thousand papers, has not, according to his colleagues, ever written one worth reading and most of his papers have never been cited by anyone in the computer literature, including himself. Clearly, the quality of the discoveries or inventions made by an individual is, in the long run, of much greater consequence than the quantity.

It is also worth noting that a significant number of discoveries have been made by amateurs (see also the later section ‘Discovery Outside of the Sciences’). Amateur astronomers have been responsible for the first sightings of the planet Pluto and of many of the comets that have been named. Amateur geologists are a constant source of new finds for paleontologists and are responsible for the discoveries of some of the most outstanding dinosaur remains found in recent years. Dedicated investigators such as farmer Wilson Bentley, known to posterity as ‘the snowflake man,’ have provided some of the best data and many of the key concepts in meteorology. And it is worth remembering that Charles Darwin, Jane Goodall, Dian Fossey, and many other eminent biologists have also been amateurs. What makes a discoverer is not necessarily formal training, but the acquisition of expertise by dint of hard work and hard thinking.

Indeed, it is worth remembering that in the fields of ignorance, there are no experts; for if the experts had the answers, then persistent unsolved problems would not exist. Discoverers, no matter what their educational background, are therefore always pioneers.

How Discoveries Are Made

Discoveries come about in as many ways as there are discoverers. There are, however, some general strategies that seem to work more often than others. Peter Medawar, a Nobel laureate in Biology, has admonished students that if they want to make an important discovery, they must choose a big, important problem. G. P. Thomson, a Nobelist in Physics, notes that there is no correlation between difficulty and importance of a problem. The big ones can be just as easy (or difficult) to solve as the little ones. Neils Bohr, another Physics laureate suggested that the best problems can be found by focusing on paradoxes – the places where theories and observations are non-congruent or contradictory, and thus of the sort Rothenberg describes. Physicist and historian of science, Thomas Kuhn notes that revolutions in science always follow the recognition of outstanding anomalies to the assumptions underlying a field. Pauling argued that the key to success is to, “have lots of ideas and throw away the bad ones.” And almost everyone agrees that the greatest discoverers have great courage when it comes to speculating and inventing. Thus, the greatest discoverers are also universally characterized as having made some of the biggest scientific blunders on record. Einstein, for example, announced at least three times in his life that he had

invented a unified field theory to explain all of physics. He was demonstrably wrong each time. The lesson is that to succeed in science, you must dare; and to dare, you must be willing fail.

Error itself is a frequent source of discoveries. "Man errs, so long as he is striving," said Goethe. Indeed, every discoverer of note has made errors from Newton and Vesalius to Einstein, Crick and Watson. What distinguishes the discoverer from the forgotten scientist is that the discoverer recognizes in his own errors the seeds of new possibilities. As Magendie, the founder of modern physiology, often said when an experiment gave a result different from that he predicted: "I was mistaken, but it is much more interesting than if I had succeeded. . . . A new phenomenon, so much the more important as it is so little expected." Similarly, J. J. Thomson was found of saying that "though a theory might be Bohemian, it might be the parent of very respectable facts." What counts in science is the dialectical process of self-correction that constantly pits theory and experiment against one another. In fact, if one follows Sir Karl Popper's philosophy of science, then error is the only true method of science, since Popper maintains that theories can only be disproven, but never verified. The best scientists are therefore often those who actually search for errors, comparing and contrasting existing theories.

Error is, of course, only one of many strategies employed by successful discoverers. Some discoveries have resulted from scientists taking infinite pains with the minute details of systems they are studying. The discovery of the element argon resulted from the observation by Lord Rayleigh that nitrogen prepared from the air is heavier volume for volume than that prepared from chemical compounds. This observation suggested that something must be contaminating the aerial nitrogen. This contaminant turned out to be argon.

Another common strategy is to extrapolate. As soon as Rayleigh announced the discovery of argon, William Ramsay predicted that an entire column of previously unsuspected inert gases must be present in the period table of elements, and he proceeded to isolate them. Rayleigh and Ramsay both won Nobel Prizes for their work.

Other scientists have played mental games with current scientific dogmas, turning them on their heads, contradicting basic premises, or simply wondering 'what if' some principle that everyone considered to be unquestionable were not. Curare, which kills by paralysis, for example, has been turned into a useful drug by harnessing its paralytic effects for surgical procedures in which complete cessation of movement is necessary on the part of the patient. A deadly poison thus gives life. Analogies, metaphors, and even the recreation of ancient historical experiments have all been touted as additional aids to discovery.

In conjunction with various strategies of research, many scientists and inventors have also discussed the mental 'tools' that they have used to make their discoveries. Their descriptions are generally similar and quite surprising. To begin with, very few scientists use either mathematics or verbal languages to do their thinking. Einstein, in fact, stated explicitly (in what may amount to an overstatement) that, "No scientist thinks in equations." He then went on to explain that in his case, he did his problem solving by using "certain signs and more or less clear images which can be 'voluntarily' reproduced and combined . . . as well as muscular feelings. . . ." Einstein also noted

that the use of words and equations came only when the images and feelings had become well enough developed that they needed to be formally tested and communicated. Cyril Stanley Smith, a metallurgist, also noted that "The stage of discovery was entirely sensual and mathematics was only necessary to be able to communicate with other people." Notably, both the use of visual images, kinesthetic feelings, and other non-verbal forms of thinking, as well as the secondary nature of words and mathematics have also been reported by a very large number of other eminent scientists and inventors including Richard Feynman, Nichola Tesla, Charles Kettering, Stanislaw Ulam, Santiago Ramon y Cajal, Joshua Lederberg, Jonas Salk, and Barbara McClintock.

McClintock, whose work in genetics earned her a Nobel Prize, is also remembered for explicitly speaking about her 'feeling for the organism.' Far from attempting to be objective about her work, she studied each individual plant until she knew it so intimately that she empathized completely with it. She even found that she could do this with chromosomal preparations, imagining herself down among the genes. "The important thing," she said, "was that you forget yourself." Indeed, Jonas Salk reported that his best ideas about how to fight polio came from "imagining myself to be a virus." Physicists have reported 'becoming' photons, electrons, black holes. Ethologists such as Jane Goodall, Dian Fossey, and Desmond Morris, who study animal behavior, say that their best ideas have come from empathizing so completely with the animals that they can imagine being one themselves. Thus, Joshua Lederberg, another Nobel laureate proclaimed that every scientist, "needs the ability to strip to the essential attributes some actor in a process, the ability to imagine oneself *inside* a biological situation; I literally had to be able to think, for example, 'What would it be like if I were one of the chemical pieces of a bacterial chromosome?'"

This nonverbal, nonmathematical nature of creative thought creates some interesting conundrums for understanding the nature of discovery. What is Stan Ulam talking about when he claims to "calculate, not by numbers and symbols, but by almost tactile feelings combined with reasoning"? To what was Richard Feynman referring when he talked about solving quantum physics problems using "acoustical images"? How do objective and verifiable results come from a process of thinking that has been described as entirely sensual, empathic, and subjective? Here, physicist-novelist C. P. Snow may hold the key. "If," he writes, "we could follow the process of scientific thought through many minds, as it actually happens and not as it is conventionally expressed after the event, we should see every conceivable variety of mental texture. . . . There are exactly as many ways of approaching the scientific world as there are individuals in science. It is only because the results are expressed in the same language, are subject to the same control, that science seems more uniform, than, say, original literature. In effect, in the end, it is more uniform." Unless we recognize the idiosyncratic and nonlogical nature of thinking itself, and the immense constraints that logical systems of communication place on how we express our insights, we cannot make progress on this thorny problem. There is clearly a process of translation between individual and the scientific collective that is as essential to success as having the insight itself.

When Discoveries Are Made

The temporal patterns of discovery, and especially when individuals are most likely to have their insights, are perhaps the least-studied aspect of the discovery process, but some interesting phenomena have been noted. The influence of age and changing fields has been noted above. People tend to make discoveries within five to ten years of entering a field, and they tend to have only one major insight per field they enter. Thus changing fields tends to restart the discovery clock, as it were.

Equally important to understanding discovery is that insights seem to occur more often when scientists are *not* directly working on a problem than when they are. Thus, several studies have shown that only about a third of scientific problems are solved by a direct, brute force approach. An equal number are solved when scientists give upon on the original problem and begin working on a related problem. The remaining third of the problems get solved during leisure-time activities, which range from going on vacation to taking a shower to dreaming the answer in one's sleep. Some investigators, such as Linus Pauling have even gone so far as to claim to be able to 'program' their minds to make use of this leisure time. Pauling said that when he worked on a problem that he could not solve directly, he would turn to something else during his work hours, and think very hard about the unsolved problem every night before he went to sleep. After a few weeks, he would forget to think about the problem before he slept, and then, within a few days, almost inevitably, he would wake with a plausible answer. Other scientists, such as Poincaré and August Kekulé, the discoverer of the structure of benzene, have reported using similar techniques of purposeful meditation or relaxation to stimulate ideas.

This phenomenon of nonconscious problem solving raises interesting questions for understanding the nature of discovery. As Poincaré noted, it is almost as if the conscious mind, employing the rules of logic, can prevent insights from occurring. In fact, the nature of many discoveries is such that they do break the rules of logic as they are understood at the time, or posit the existence of phenomena that are unknown and so beyond the knowledge of reason.

One can also look at the concept of temporal patterns of discovery from an historical perspective. Discoveries as a whole tend to occur during times of economic growth and cultural mixing. The Scientific Revolution, for example, occurred during a period of prosperity associated with the Renaissance and this historical period is also characterized by many voyages of discovery that led to trade – both economic and intellectual – between cultures as diverse as the Europeans, Arabs, Chinese, and native Americans. Other major periods of innovation in the sciences, such as the Industrial Revolution and the post-Sputnik era, are also associated with such economic and cultural prosperity.

What Is Discovered

Much of the literature on discovery assumes that what is discovered is a solution to a problem. Thus, one popular book about discovery is actually entitled *The Search for Solutions*. In fact, discovery is better characterized as a quest for questions.

The problem must be discovered before the search for its solution begins. Indeed, as noted above, one of the most fruitful strategies for discovering is to find anomalies and paradoxes that reveal the limitations of current theory and practice.

The greatest scientists have often excelled at discovering new problems. As Camille Jordan wrote in praise of fellow mathematician Henri Poincaré, "He solved problems which before him nobody would have even dared to pose." Indeed, it is a truism in science that properly defining a problem gets an investigator more than halfway to its solution. Thus, Einstein once wrote that "The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and works real advance in science." Being able to perceive problems where no one else sees them is therefore one of the most important skills a discoverer can cultivate.

Different types of problems lead to different types of discoveries. If we ask "what is energy or velocity, or what species is this," the problem involves one of definition, and will require invention of a concept or taxonomy. If we ask what governs the manner in which weights fall or why species are distributed as they are through space and time, then we are dealing with problems of explanation, and these require the development of a theory. To test the adequacy of a theory or definition, one will need data, and one therefore has a problem of experimentation or observation. In some cases, the experiment or observation cannot be made using existing techniques. Human eyes cannot see ultraviolet light or objects smaller than a cell. Such problems require the invention of new techniques or instruments for observation and analysis. This conjunction between problem type and the nature of what is discovered or invented may seem obvious, but experience shows that many theoreticians act as if they believe that all problems are ones that can be solved by inventing or enlarging a theory, while many experimentalists approach every problem as one that can be solved by gathering more data. Much time is wasted in science as a result.

Problems, of course, are only one of many things that can be discovered and one need not invent a problem to solve it. Outstanding problems are often as widely disseminated and discussed by scientists as are great experiments and theories. James Watson and Francis Crick, for example, tackled the well-defined problem of how genetic information is encoded and transmitted by living organisms. They neither discovered the problem nor the fact that DNA carries genetic information. They did, however, make the very remarkable discovery of how the structure of DNA itself carries information and is adapted to replicating itself. This structure was quite unexpected.

Watson and Crick's discovery was, in turn, made possible by other types of discoveries. W. H. and W. L. Bragg had previously invented the technique of X-ray crystallography by which the structure of DNA was analyzed; Linus Pauling had developed sophisticated physicochemical modeling methods that Watson and Crick could apply to DNA; and so forth. In addition, Watson and Crick's discovery led to other discoveries. All of modern genetic engineering is based on the manipulation of DNA sequences and the enzymes that a control DNA

in cells – not one wit of which was foreseen even at the time of Watson and Crick's work (*ca.* 1950). Thus, it is correct to say that every discovery builds upon other discoveries and makes new ones possible. This is what Isaac Newton meant when he said that, "If I have seen further than other men it is because I have stood on the shoulders of giants." The structure of discovery is a very complex and tightly woven tapestry of ideas, observations, techniques, explanations, inventions, and their histories.

Mention of invention raises the important issue of distinguishing between it and discovery. In general, scientists usually argue that inventions are made with intention, while discoveries occur serendipitously. Had Galileo known that there were mountains on the moon, he could not have discovered them. Had Columbus known of the Americas, he could not have discovered them. On the other hand, Galileo could not have discovered the telescope. That required intention. Morse could not have discovered the telegraph nor Fulton the steam-driven boat nor the Wright brothers powered flight by accident. These had to be planned. This is not to say that in carrying out plans to build an invention, one will not stumble across unforeseen principles or phenomena of nature, and thereby make a discovery. Nor is it to say that discoverers are not also inventors. More often than not, a discovery can only be made because of a technological invention, or can be interpreted only in light of a theory that is invented in response to what is discovered. Thus, invention and discovery are integrally entwined and both can be the results of the investigative process.

Where Discoveries Are Made

Interestingly, there appears to be a geography of discovery and its form is full of surprises. One might expect discoveries to cluster in the major centers of science at any given historical period since these centers are where the most prominent scientists are to be found. For various reasons indicated above, including the inverse correlation between age and discovery and the generally conservative tendencies of most major institutions, the most interesting science is usually done in peripheral institutions.

Before proceeding further with this point, it is first important to distinguish between what Thomas Kuhn has characterized as 'normal' and 'revolutionary' science. Kuhn defined normal science as having a well-articulated paradigm, or set of problem-solving techniques, that can be described in textbooks and classrooms and implemented in laboratories. In essence, normal science focuses on areas of science in which a major advance has opened up a well-defined set of problems that can be addressed with a fair assurance of success. Revolutionary science, on the other hand, is science that overtly challenges the assumptions of existing problem solving modes. It undermines textbooks, makes standard classes irrelevant or outmoded, and creates new methods of working and training.

In addition to Kuhn's normal and revolutionary science, historians of science have generally begun to recognize yet a third category of science as well: new sciences. There was, for example, no science of physical chemistry until the late nineteenth century when a number of scientists began to realize

that the techniques of physics could be applied to chemistry, thereby revealing many new phenomena that were unpredicted and unprecedented. Physiology, immunology, molecular biology, biophysics, astrophysics, and ethology are other examples of new sciences that emerged during the last century, carving out new scientific territories without attacking existing sets of theories, practitioners, institutions, or textbooks.

Each of these three types of science has its own geographical distribution. Normal science does indeed cluster in established centers of science. These centers have the resources and funding to attract recognized discoverers. Funding, in turn, is dependent upon granting agencies or patrons being able to identify fields in which progress is most likely. Such fields are those in which the major discoveries have already been made. The major scientific institutions at any given historical time are usually engaged in what might be characterized as being developmental, rather than breakthrough, science. Thus, if one looks at where Nobel laureates end their careers, they often end up at Harvard, Stanford, MIT, Cambridge, Oxford, Paris, Berlin, etc.

Breakthrough or revolutionary science tends towards the geographical peripheries of the scientific collective at any given time. Innovators tend to be people who go their own way rather than follow the crowd. They pay the price of having to work in third rate conditions with inadequate funding and resources. But as one scientist said, one makes a choice between the "shackles of the palace or the freedom of the shack." Thus, if one looks at where Nobel laureates train as undergraduates and obtain their first employment, it is most often at institutions that have no particular claim to prestige. In some cases, experts at major institutions actually force innovators out. William Shockley, one of the inventors of the transistor, for example, refused to allow the group of men who invented the integrated circuit, or 'chip,' to stay in his laboratory, considering their work irrelevant and unlikely to succeed. They were forced to create a small company to continue their work. Many small computer innovators and biotechnology companies have begun under similarly discouraging circumstances, when large companies have refused to sanction work that ran counter to their established research directions.

New sciences also tend to emerge on the geographical peripheries of science. This phenomenon is related to the doing breakthrough or revolutionary science – except that no field exists previously to revolutionize. Notably, only two sets of institutions tend to take up new scientific fields: major institutions that purposefully restructure existing departments to create a new one to embody the new science and its discoveries; and, more frequently, new institutions. Discoveries, in other words, tend to flourish where new opportunities for personal and institutional growth are available.

Why Discoveries Are Made

What motivates scientists to make discoveries? The basic drives seem to be control, curiosity, necessity, serendipity, and aesthetics. Often several of these drives are at work simultaneously.

Einstein commented that one of the primary reasons he became a scientist was to avoid the daily hassles of life. Many studies of the psychology of scientists and engineers suggest

that they have a need for control. Creating theories or performing experiments provides that control. Control, in turn, yields power, since understanding nature allows human beings to manipulate nature's laws. Thus, discovery provides a means for individuals to obtain power over nature and their own circumstances.

Necessity can also be a motive for discovery. 'Necessity is the mother of invention' is a well-known saying, no less true for its triteness. It is certain that many scientists, such as Louis Pasteur and Jonas Salk, have tackled questions of the cause of diseases precisely because of the threat these diseases posed to human beings.

At least half of all discoveries occur serendipitously, however. A careful distinction must be made here between serendipity and chance or accident. Chance and accident denote total lack of control of the process leading to discovery. No discovery has ever been made by chance or accident, despite many articles and books on these topics. When the laboratory notebooks detailing discoveries are examined, they inevitably reveal that all discoveries begin with some goal in mind. Those discoveries that are often said to have occurred by chance or accident, in every case, turn out to have been made while looking for something else. Finding one thing while searching for something else is the definition of serendipity. The term originated in a story by Horace Walpole called the 'Princes of Serendip,' which concerned the adventures of the Princes as they went in search of various treasures and were continuously, and fruitfully, sidetracked by more interesting adventures. Thus, Fleming, for example, discovered the antibiotic enzyme lysozyme in his mucus and tears when trying to isolate a virus that causes colds. Intention set up the experiments; serendipity yielded the surprising discovery.

Perhaps the most unexpected and yet common motivation for discovery is aesthetic. A very large number of scientists are drawn to science in the first place by the beauty of the experimental preparations they examine in the microscope or the sublimity of the intellectual constructs that we call theories. Santiago Ramon y Cajal, who won a Nobel prize for his work in neuroanatomy often waxed eloquently over the magnificent scenes that the architecture of the brain afforded, while Max Planck said forthrightly that he was drawn to physics by the beauty of the laws of thermodynamics. In some cases, the desire to recreate literal physical beauty has even led to discoveries. For example, C. T. R. Wilson became so enamored of the coronas and glories that he observed when climbing in the Scottish hills that he decided to recreate them in his physics laboratory. His success inventing cloud chambers not only allowed him to make these beautiful optical phenomena at will, they also allowed subatomic particles to be observed for the first time, and earned Wilson a Nobel prize. Similarly, it appears that Fleming's habit of making 'paintings' in Petri dishes using a 'palette' of colored microorganisms provided the basic techniques and observations that led to his discovery of penicillin.

Multiple or Simultaneous Discoveries

While most discoveries, such as Fleming's discovery of penicillin and Röntgen's discovery of X-rays, are unique, a significant

portion are made simultaneously by two or as many as a dozen other people or groups of people. Discoveries that are made independently by more than one individual or groups of individuals are termed 'multiple' or 'simultaneous' discoveries. The probability of simultaneous discovery is, in fact, hinted at by the fact that many other scientists saw what Fleming and Röntgen saw without thinking it. Sometimes, if a problem is well enough defined and the techniques for investigating it are available to enough people, several will converge on the same general answer at the same time. The simultaneous discovery phenomenon brings into contrast the extent to which discovery is dependent on unique forms of individual creativity and the degree to which there is a logic to discovery that is independent of individual psychology. The existence of simultaneous discoveries is also a necessary prerequisite for understanding the controversies over priority that frequently occur in science.

The phenomenon of multiple discovery has been well documented in several cases. One is the invention of calculus by Newton and Leibniz at the end of the seventeenth century. Similarly, in the 1840s, Robert Julius von Mayer, James Prescott Joule, Ludwig A. Colding, William Robert Grove, and Hermann von Helmholtz (among others), all published versions of what would eventually become known as the first law of thermodynamics (energy is conserved), and numerous priority disputes broke out among the claimants. The co-publication of the theory of evolution by natural selection by Charles Darwin and Alfred Russell Wallace in 1858 is one of the few cases in which a simultaneous discovery did not result in friction between the codiscoverers, mainly because Darwin gave Wallace credit for his contribution, but clearly had a far more articulated theory to present in his *Origin of Species* the following year.

Each of the examples described above showcase the differences that always exist in the formulations of discoveries. Newton and Leibniz utilized very different, largely incommensurable notations that required mathematicians to choose one of their formulations or the other, and in the event, Newton's applications of his invention were deeper, wider, and more insightful than those of Leibniz. Darwin's formulation of natural selection was far more developed and encompassed a much wider range of phenomena than did Wallace's, including copious examples from animal husbandry, plant breeding, animal behavior, and paleontology, which were fields that Wallace had never investigated. Thus, Darwin's formulation was much more far-reaching and integrated far more material than did Wallace's – one of the reasons that we refer to 'Darwin's theory of evolution' rather than 'Wallace's' today. Similarly, Kuhn has shown that each of the formulations of the first law of thermodynamics has many more differences than it has similarities, and that it is only in retrospect, and largely due to the work of Helmholtz, that one can recognize that all are partial statements of the same basic principle.

Simultaneous discovery does not, therefore, necessarily, or even frequently, denote *identity* of discovery. Every investigator has a unique style of research that is manifested in how they pose problems, what tools they use to solve them, and how they present their findings. Nowhere is this clearer than when several scientists claim to solve the same problem at the same time since part of the subsequent squabble over priority in

such cases is really about which formulation of the solution will become canonical. A classic case is that of Richard Feynman, Julian Schwinger and Sin-Itiro Tomonaga, who eventually shared the Nobel Prize in Physics in 1965. Each man addressed the problem of quantum electrodynamics using a different set of very abstruse mathematical techniques. When each claimed to have solved the problem, the formulations were so dramatically different, and the equations so difficult, that it was not clear to any one which, if any, of the solutions was correct. It took a fourth physicist, Freeman Dyson, to resolve the problem by demonstrating that all three formulations of quantum electrodynamics were essentially interchangeable. Dyson also translated the results of all three men into mathematics that was far more accessible to other physicists than were any of the original formulations. Dyson's work, along with 'lost' discoveries such as Gregor Mendel's on genetics, reminds us that it is not enough to discover something new; it is also necessary to convince one's peers that what has been discovered is meaningful and useful.

So what studies of simultaneous discovery tell us is that science-in-the-making is actually much more similar to art-in-the-making than might first appear. Style matters. Even when the logic of the field suggests to several individuals that an important discovery is in the offing, how each individual attacks the shared problem, the techniques they use to address it, how broadly they link it to other problems, and how they choose to convey their discovery to their colleagues all affect the reception of their work. Even when several scientists or groups of scientists make a common discovery, they imprint their unique personal and psychological factors onto that discovery so that no formulation is exactly like any other.

The existence of multiple or simultaneous discoveries therefore argues that while there very likely *is* a logic to discovery that permits many scientists to perceive the same possible solutions to similar problems at the same time, individual differences in experience, knowledge, and psychology affect the precise way in which different versions of the resulting discovery are manifested. This conclusion must cause us to rethink the common saw that a major difference between sciences and arts is that ten scientists given the same problem will arrive at the same solution whereas ten artists given the same scene to paint will paint ten different pictures. In fact, ten scientists working on an unsolved problem will very likely arrive at ten different solutions that will share only some features in common. Equally, ten artists all using the same style to paint the same scene will produce ten recognizably similar pictures (as Expressionist and Neo-Expressionist painters often did!).

Discovery Outside of the Sciences

The notion that scientific discovery may be more like artistic creativity than is at first apparent raises the more profound issue of whether discovery is possible outside of the scientific disciplines. The answer depends largely upon whether one looks primarily at the *products* of the discovery process or at the *process* itself. The literature comparing science with the humanities and arts is clearly split as to whether nonsciences make discoveries or progress in ways similar to the sciences.

It is generally accurate to say that all those authors who compare the products of the sciences with those of other disciplines find that science alone makes progressive discoveries, while those who compare the processes by which people in different disciplines work claim that people in all fields make discoveries.

Similarities may also hide differences, however. Even within science itself, there are very different ways of making discoveries. Geology and paleontology present cases of sciences in which it is rarely possible to make what most scientists would characterize as predictions. In general, predictions are defined as constituting the description of events or phenomena before they have happened. Geology and paleontology, however, deal largely with things that have already happened. Thus, philosophers characterize the description of as yet undiscovered artifacts or physical objects by those in historical fields as properly being called *postdictions* or *retrodictions*. Each discipline, in other words, may require a different set of logical and physical tools in order to make discoveries, and the nature of these discoveries may differ quite markedly even when proceeding from the same basic process of investigation.

The distinction between prediction and retrodiction is critical for analyzing whether fields such as history and philosophy can make discoveries. It must be obvious that they cannot discover new things that have never existed before. But it must be equally obvious that they have the same ability as geology to unearth things that have previously existed and been forgotten, and to provide general understanding of the processes that guided the past and permit us a glimpse of the future.

Artists and musicians can also be said to make discoveries and inventions comparable to scientists. Artists, for example, have discovered perspective, anamorphosis (the process of mapping an image onto a nonflat surface), optical illusions, the techniques necessary for casting sculptures (which usually anticipated existing engineering capabilities), techniques for displaying motion (including motion pictures), mobiles (kinetic sculptures), and even the process of pixelization that underlies all modern computer and CD-ROM visual technologies. Musicians have similarly invented harmony, counterpoint, 12-tone and other 'natural' scales, aural illusions, and many other aural phenomena we take for granted. There is no reason, as artist-inventor-neurobiologist Todd Siler has commented, that these sorts of discoveries should be valued any less than those within the realm of science. Each is an intellectual addition to the panoply of human understanding.

In addition, artists, musicians, and other creative people often arrive at their insights simultaneously, resulting in the same kinds of multiple discoveries and consequent priority disputes that characterize many scientific discoveries. Igor Stravinsky and Arnold Schoenberg spent most of the first half of the twentieth century squabbling over which of them had invented twelve-tone musical composition. Claimants to the invention of electronic music include Lejaren Hiller, Jr., J. R. Pierce, Claude Shannon, and Max Matthews, Raymond Scott, Iannis Xenakis, and many others who had musical training and access to the first computers during the 1950s. Georges Braque and Pablo Picasso never agreed on which of them invented cubist painting. Kinetic sculptures were invented almost simultaneously in Italy by Giacomo Balla and Fortunato Depero, in Russia by Naum Gabo around 1915, and mobile sculptures simultaneously by Alexander Calder

and George Rickey in the United States and Jean Tinguely in France, during the 1940s. Buckminster Fuller and Kenneth Snelson never agreed on which one invented the sculptural principle of tensegrity after World War II.

Equally to the point is the undeniable fact that a large number of *scientific* discoveries has been made by professionals in the fine arts, most of whom had little or no formal scientific or engineering training. Here are a few examples. The concept of camouflage both as a biological principle explaining animal adaptation and as a military technology was discovered by portrait painter Abbott Thayer at the end of the nineteenth century. The principle of geodesy was discovered by architect-inventor Buckminster Fuller and applied to making geodesic domes long before it was applied by scientists to understanding the structures of spherical viruses or for synthesizing C60 carbon compounds now known as 'fullerenes.' The equally basic physical principle of tensegrity was worked out by Fuller and fellow artist Kenneth Snelson who used it to make sculptures. Tensegrity is now thought to underlie the structures of cells and is being applied to the building of stable platforms for use in space. And musician-inventor George Antheil collaborated with actress Hedy Lamarr to invent the concept of frequency hopping, in which a message is encoded in constantly varying frequencies in order to protect it from detection or interference from enemy sources. Frequency hopping is the basis for protecting a great deal of military communications at present.

These examples demonstrate that there is no fundamental difference between the creative thinking of the scientist, the artist, the composer, and the writer, and no reason to believe that discovery is the preserve of sciences or engineering alone. Unfortunately, too little research has yet been done comparing the thought processes of scientists, artists, writers, and others. Such comparisons would undoubtedly bear interesting fruit. For example, historian of technology Thomas Hughes has noted that "the invention of machines, devices and processes by metaphorical thinking is similar to verbal creation, but the fascinating possibilities have not been much discussed, probably because persons interested in language are rarely interested in technology." Similarly, some recent studies, most notably by James McAllister, are beginning to find that the use of aesthetic criteria in the sciences, engineering, and the arts are all virtually identical, and that the notion of beauty in science may be as essential as a motivation for discovery and as a criterion for evaluating novel ideas as it is in the arts. Thus, there is, at present, no reason to believe that the process of discovery in the sciences differs in any substantial way from the process of discovery in other disciplines despite obvious differences in the types of discoveries achieved.

An Evolutionary Theory of Discovery

Evolutionary theory provides a unifying concept for understanding the process of discovery in all its manifestations. Kuhn, for example, has argued that an evolutionary model could be applied to science in his classic *Structure of Scientific Revolutions* and the argument has been elaborated since by Donald Campbell, David Hull, and the author among others.

In order to apply evolutionary theory to discovery, one must make analogies between species and ideas. Standard

Darwinian evolution requires three key elements: (1) a source of diversity among species or ideas; (2) a way for individuals to inherit differences; and (3) a nonrandom means of selecting between differences. The source of diversity is provided in part by nature, which generates the phenomena for scientists to observe, and in part by scientists themselves, who invent techniques for exploring nature and explaining it. Here it is important to remember that the vast majority of ideas and observations that scientists make are incorrect or only partially correct. There is as much waste in the intellectual realm as when species produce many more offspring than can survive.

The inheritance of variations occurs by means of learning and teaching in cultural evolution. Thus, ideas and information take the place of genes. Evolution, in consequence, is more Lamarckian than Darwinian. Lamarck maintained that species evolve by willing themselves to change, and went on to argue that alterations during their lifetimes could be transmitted genetically. Lamarck's mechanism has been completely dismissed as a means of biological evolution, but may still apply to cultural evolution since people can, in fact, change their minds and transmit their altered ideas to the next generation of scientists.

Finally, evolution requires a non-random means of selecting between competing ideas. Here a combination of natural and artificial processes come into play. The touchstone of all science is nature itself. One compares observations and theories by means of tests with nature. Often, however, several explanations may account for existing observations equally well. In this case, other criteria, such as the compatibility of the various explanations with other scientific principles, the range of phenomena explained, its simplicity and usefulness, and aesthetic criteria come into play. The point is that selection does occur and, in fact, competition amongst scientists, their observations, and theories is very rigorous.

Evolutionary theory accurately describes several other elements of the discovery process. One is the literal growth of each new development in science from previous discoveries. Every discovery builds on previous discoveries. If necessity is the mother of invention, then existing discoveries are the fathers.

An evolutionary model also describes accurately the increasingly specialized nature of discoveries in science. If one looks at science since the seventeenth century, it has developed in almost perfect imitation of a taxonomic tree. As of 1670, there was one journal of science, and all of science as generally categorized under the heading 'natural history.' Over the next century, the number of practitioners grew exponentially, as Derek de Solla Price has so well documented, creating a need for new and more specialized journals. The specific sciences of astronomy, physics, chemistry, and biology were all recognized by the end of the eighteenth century. During the nineteenth century, exponential growth in the number of chairs of science, journals, practitioners, and papers all continued resulting in further specialization. Chemistry split into physical, organic, inorganic and biochemistry, for example. At present, the discipline recognizes over a hundred specialties in which doctorates can be obtained and papers published. Every scientific field has branched into similarly diverse specialties. Thus, from the trunk of natural philosophy have emerged the general branches of the basic sciences, followed inexorably by the twigs that have produced the current crop of

thousands of leaves that represent the crown of science as it exists today. Scientists diverge and specialize just as do species.

Many aspects of the evolutionary theory of discovery remain unresolved, however. For example, standard evolutionary theory places primary emphasis on the random generation of extremely large numbers of variants from which the best adapted can be selected. The implications of this approach for discovering are that an investigator should try as many random ideas or processes as possible in order to optimize his or her chances of making a discovery. Philosopher Paul Feyerabend (*Against Method*) provides the most lucid support for this strategy in his writings. Physicist Henri Poincaré places the greatest emphasis on the selection process. Anyone can, he argues, find two ideas, theorems, facts, or techniques that have not been synthesized before and do so. Most of the results will be useless or trivial. Poincaré therefore argues that what is most important is having an aesthetic sensibility that allows the discoverer to sort the wheat from the chaff: "To invent is to choose." Indeed, if we admit that discovery is a process and not an act, then choosing the best ideas to investigate can be critical, for every idea of any value needs a great deal of nurturing. The greatest discoverers have been those who saw the oak in the acorn or the giant in the baby and put in the 99% perspiration that Edison said is always needed to make the germ of an idea grow.

Another equally important difference between standard models of biological evolution and that characterizing cultures such as science concerns integration. Standard Darwinian evolution is portrayed as a tree that constantly branches. The most adapted new variants are the ones that survive through time. But much of scientific progress is characterized by the integration of previously separate lines of investigation. Many of the greatest breakthroughs in science are syntheses and scientists are all after their field's equivalent of a 'unified field theory.' Thus, the trees that represent scientific discoveries not only branch, but they also meld back together, forming a dense network of interactions. Symbiosis or synthesis in science is, in other words, as important as speciation or specialization.

The constant interplay between the need for ever-greater specialization and the drive to unify existing knowledge creates the tension so essential to continued discovery. Those who are most likely to create the most important discoveries are therefore likely to be both analytical and synthetic. They are likely to be just as interested in how this dynamic process of discovery itself works as they are in the special knowledge in their particular area. For discovering, as we have seen, requires more than merely finding something new – it also requires knowing how to interpret its meaning within the broadest context of science and society possible.

See also: Humor and Creativity.

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Distribution of Creativity

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Glossary

Matthew effect The phenomenon where the 'rich get richer, and the poor get poorer'.

Normal distribution A symmetrical distribution of data around the mean, usually represented by a bell-shaped curve.

Performance Behavior ranked with respect to quality, quantity, or both.

Positive skew distribution A case of mass mediocrity and rare exceptional quality.

Zipf distribution Distribution of data maximized at the lowest level.

Statistical Distributions

Of course, many physical objects and phenomena show normal distributions. **Figure 1(a)** shows, the most common or modal behavior is the average as well as the median, because half the cases are below and half above it. A plot of adult US heights, for example, might show an average and many instances around 5 ft 7 in. The largest number of cases are likely to be within 5 in. of the average, and very few would be less than, say, 3 ft or greater than 8 feet tall. As **Figure 1(a)** shows, the distribution is likely to be roughly symmetrical on either side of the average. Intelligence, educational achievement, and personality test scores often show normal distributions like **Figure 1(a)** but mainly because they are intentionally constructed to exhibit this distribution. It is mistaken to think that most psychological behavior follows the normal curve. As illustrated in **Figure 1(b)**, many human and social phenomena exhibit positive or right skew. This means that most people are mediocre to slightly above average, but a few are exceptional, and very few are very exceptional. Income and wealth show this distribution: In 1977 Sloan noted that the top 1% of the US population owns a third of the nation's wealth, the next 9% owns another third, and the other 90% owns the last third.

The Zipf distribution in **Figure 1(c)** forms a still more extreme curve in which nonperformance or the lowest level of performance is most common. The number of people in the world, for example, who speak a given number of words in English, Navajo, and Swahili would show this distribution; indeed, most people in the world could not speak a single word of any one of these or hundreds of other common and rare languages. The same appears true of performance in playing sports, running computers, and exhibiting expertise and creativity in many fields. Positive-skew distributions characterize many phenomena in education, linguistics, psychology, sociology, and the production of knowledge.

Causes of Positive Skew

The positive skew distributions of expertise, creativity, and other learned accomplishments often result from the Matthew effect of the rich getting richer (named by Merton in 1968 after a passage in the Gospel of Matthew in the Bible). Merton

described the stages in which distinguished scientific careers arise: initial talent advantages, study at distinguished universities, close work with eminent professors, early and frequent publication, job placement at famous laboratories, and citation and other recognition. These events and conditions multiply one another's effects to produce highly skewed scientific creativity. As few as a tenth of the scientists may account for nearly all the significant scientific work in a given field. Though a few mavericks are exceptions, Nobel laureates and similarly distinguished scientists usually follow the Matthew pattern, which resembles wealth creation in that small initial advantages multiply over decades. In modern times, the very wealthy have often gained from initial wealth, expert knowledge, and social contacts that multiply and cumulate over time. In science and other creative fields, however, the driving incentive may not be wealth but prestige, excitement, competition, the pleasure of pursuing difficult goals, and the possible contribution of research to improving human conditions. In any case, creative accomplishments are strongly determined by talent and long, intense, and specialized experience. An advantaged start and long investment of hard work often lead to later opportunities.

Motivation and Creative Performance

Why should anyone work so hard over such a long period to reach the top levels of creativity or other kind of performance? As **Figure 2** shows, more and more effort results in higher levels of performance but at diminishing rates. Because we can measure and think about physical performance more easily, consider runners: As shown on the performance curve, with more practice, those training for a marathon run at increasingly faster rates, especially those who have practiced little. Up to a point, however, each extra hour of practice per day in sports and other endeavors, other things being equal, yields a smaller rate increase. The time differences among the top few marathoners may be measured in seconds.

In most fields, much of the fame, honor, and possibly gratification goes to the winners, especially those who come in first, as shown by the value curve of **Figure 2**. Society tends to prize top performers and ignore others. Those at the top are

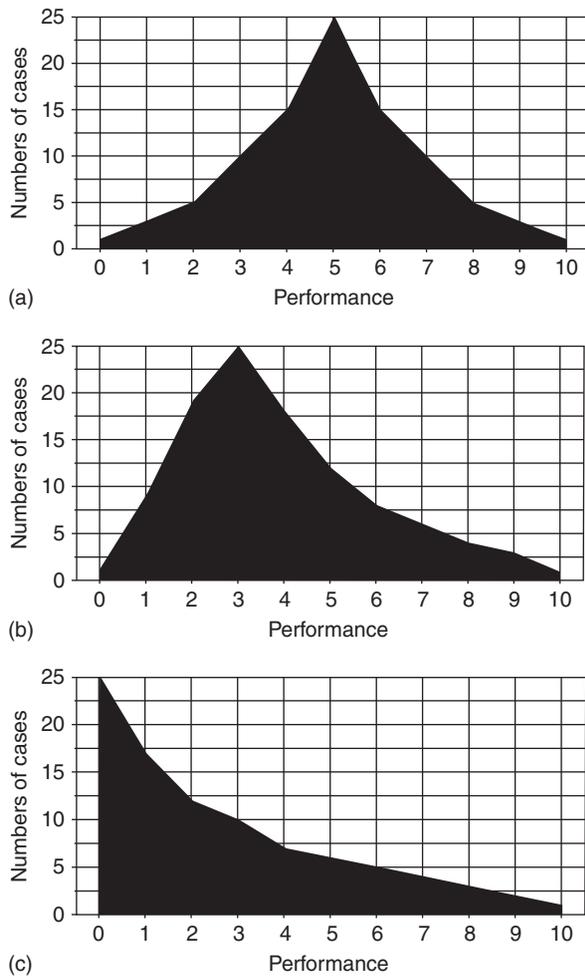


Figure 1 (a) Normal distribution; (b) positive skew distribution; and (c) Zipf distribution.

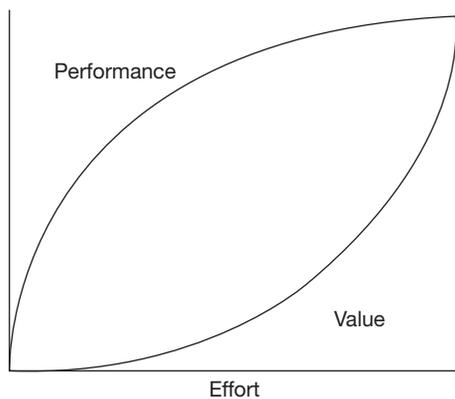


Figure 2 Effort, performance, and value.

often well compensated; those a few ranks down, though hardly different in performance, may be largely unknown except to aficionados.

Of the thousands of good painters and physicists of the last century, only a few are familiar names. Perhaps fewer than one in a thousand of all piano players have made a good living at it.

Multiplicative Theories of Creativity

Parallel to wealth accumulation and the development of scientific and other creative careers, Loehle suggested in 1994 that individual scientific discoveries are multiplicative products of cumulative events. For example, suppose a scientific discovery requires 20 necessary steps such as asking the right question, setting forth a researchable hypothesis, gaining financial support for the research, developing a detailed research plan, hiring capable assistants, supervising them, collecting data, analyzing it, drawing graphs, drafting a paper, submitting it to a scientific journal, and so on. Even if each step has an easy 90% probability of success, the multiplicative product ($.9 \times .9 \times .9 \dots$) or probability of project completion is only 12%. This poor overall success rate explains why many scientists rarely or never publish articles.

This cumulative, multiplicative theory draws together old and new ideas from several academic fields, and it apparently applies widely to behavior, education, and other fields. It is analogous, for example, to Darwinian evolutionary theory, which holds that plants and animals well adapted to their environments prosper, multiply, and ‘crowd out’ poorly adapted organisms. Mutations (random genetic variations), moreover, that are further adaptive prosper still further. Old and new cognitive theories extend such evolutionary theory to inventive thought. Campbell, in particular, pointed out that two years before Darwin’s publication of the theory of natural selection, Alexander Bain, in 1855, used the term *trial and error* in analyzing creative thought. In this evolutionary insight, psychology preceded biology. Campbell held that:

blind-variation-and-selection-retention is fundamental to all inductive achievements, to all genuine increases in knowledge, to all increases in fit of the system to environment. (p. 380)

In his view, therefore, three conditions are necessary for new ideas:

a mechanism for introducing variation, a consistent selection process, and a mechanism for preserving and reproducing the selected variations.

The efficacy of rare new ideas depends on whether they can solve problems at hand. Those ideas that are useful, often those that succinctly express important phenomena or synthesize many particular instances, grow in their frequency of expression and consumption. Such successful ideas can be routinized and widely shared. They become increasingly frequent – even dominant.

Diffusion of Creative Ideas

Once a creative idea proves successful, it can be widely adopted without endlessly recreating or even understanding it. We hardly need think about electrons when turning on lights nor internal combustion when driving cars. In a humanitarian vein, Alfred North Whitehead (1864–1947) declared:

Civilization advances by extending the number of important operations which we can perform without thinking about them. (quoted in De Wolf, 1980: 281)

Psychological theories of B. F. Skinner and other behaviorists may be similarly construed. Like successful genetic mutations, rare random behaviors, when rewarded, become more frequent, even automated. They may become widespread when transmitted from one person to another through imitation and learning. Much of human life depends on such vicarious experience and socially transmitted abstract ideas; children, for example, need not figure all things out from raw experience.

Learning, Expertise, and Creativity

Creativity, however, usually requires expertise, which is itself rare and positively skewed. In intensive case studies of experts in various fields, Ericsson and Charness, in 1994, showed that expertise is a function of (a) careful planning or goal setting, (b) daily hard work over long periods, and (c) continuous monitoring of progress – in short, self mastery. Such conditions may outweigh initial ability; missing any single one results in less than expert performance.

As many researchers have noted, studies on children's learning, creativity, and exceptional accomplishments suggest similar conditions are necessary, although parents, teachers, and coaches may initially foster such propensities. In many fields, moreover, children's acquisition of exceptionality may proceed in stages. In 1985 Bloom, for example, emphasized early talent recognition, parental encouragement, and further encouragement from first teachers (though with limited deliberate practice), followed by elite teachers with increasingly demanding standards. Ericsson and Charness, in 1994, pointed to the crucial role of exposure to tough peer-group standards. From biographies of world leaders, Gardner,

in 1995, identified general recurrent patterns of childhood experiences. Talent, opportunity, hard work, luck, and other conditions for creativity may each be common. Combining and focusing these, however, for a decade or more is rare. Although many are called, few are chosen.

See also: Expertise; Matthew, Pygmalion, and Founder Effects.

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Divergent Thinking

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Glossary

Criterion problem There is no widely accepted criterion of creativity. If there were such a criterion, there might be no need for any other test or indicator of creativity.

Experiential bias Some divergent thinking tasks may allow respondents to draw from memory of experience rather than testing cognitive capacity to generate ideas.

Ideational flexibility The number of themes or categories within an examinee's or respondent's ideation.

Ideational fluency The total number of ideas given on any one divergent thinking exercise.

Ideational originality The unusualness or uniqueness of an examinee's or respondent's ideas.

Ideational pools These are constructed for each examinee or respondent and contain each of that individual's ideas. Judges can evaluate the pools rather than individual ideas.

Structure of intellect J. P. Guilford's model, with 180 different kinds of intellectual processes and skills.

Background

J. P. Guilford is typically credited with distinguishing between divergent thinking and convergent thinking. (The latter is involved whenever the individual focuses on one correct or conventional idea solution. Convergent thinking is emphasized in most academic examinations and IQ tests.) He also argued cogently for creativity being a natural resource and is credited with initiating the empirical research on the topic in the 1950s and 1960s. Certainly he was the first to be explicit about the value of divergent thinking, and he did most of the early research on the topic, as part of his structure-of-intellect (SOI) model. (This model contained 180 cells, many of which represented divergent production, which was Guilford's own term for divergent thinking.) Several others before Guilford did, however, recognize the importance of divergent thinking, even if they did not call it that. Alfred Binet, for example, had several open-ended questions that required his examinees to think divergently on his early tests of mental abilities. These tests were later adopted by Louis Terman of Stanford University and refined as the first IQ tests (i.e., the Stanford–Binet). Binet was working on his tests in the late 1800s.

Guilford's work represents the most comprehensive model of divergent thinking. Several other theories are, however, largely supportive of divergent thinking as an estimate of the potential for creative thought. In 1962, Sarnoff Mednick published his 'Associative Basis of the Creative Process,' and although he developed his own test, the Remote Associates Test (RAT), the associative theory presented by Mednick also supported and encouraged the use of divergent thinking tests. This was especially the case because the RAT may be verbally biased. Individuals who do well on tests of verbal ability often do well on the RAT, and persons who do poorly on tests of verbal ability tend to do poorly on the RAT. In associative terms people respond to problems by generating ideas. Often one idea leads to another idea, which leads to another. Mednick discussed various ways that one idea could be associated with another idea, including acoustic similarity or functionality.

Very importantly, he predicted that ideas found later in an associative chain are more likely to be original than those found early in that chain. This prediction has been supported a number of times, often with divergent thinking tests. This prediction from Mednick about 'remote associates' is very important in a practical sense because it suggests that individuals taking a divergent thinking test or working on a problem that will benefit from creative insight should make certain that they invest some time into the task. Otherwise remote and original ideas might not be found.

In addition to the verbal bias mentioned above, tests of divergent thinking may be unduly influenced by experience. After all, if an examinee is asked to "list things that move on wheels," and he or she grew up in an extremely isolated area where vehicles are uncommon or are all pretty much the same, he or she will not have much information in long term memory. Another person, growing up in an area where most households own several vehicles may have a huge advantage. Yet that person may rely on long term memory and only think of things with which he or she had direct experience. This would indicate that the test is assessing experience and memory more than cognitive skill. The test would be *experientially biased*. At least one empirical study confirms this kind of bias, though it does seem to vary from test to test and from task to task. This takes us to a review of the different kinds of divergent thinking tests.

Tests and Example Questions

Guilford developed a large number of tests. Again, he was interested in the structure of the intellect and in distinguishing among 180 different kinds of thinking. (Most criticisms of Guilford's work are directed at his statistical methods, used to separate the different kinds of thinking. He often used factor analyses, for example, which required that subjective judgments be made by the psychometrician.) The three most commonly used by Guilford were probably Plot Titles, Consequences, and Alternative Uses. Plot Titles required the examinee to think of a title for a story that was presented by Guilford. Consequences

test questions asked examinees to list the consequences of some hypothetical situation (e.g., the world suddenly covered with water). Alternative uses required the examinee to generate uses of some common object (e.g., a coat hanger or brick).

E. Paul Torrance developed the Minnesota Tests of Creative Thinking in the late 1950s (published in 1966). They contained a wide variety of tasks. They were revised in 1974 as the Torrance Tests of Creative Thinking. Examples include Just Suppose, Product Improvement, Ask and Guess, Unusual Uses, Thinking Creatively with Words, and Thinking Creatively with Pictures. Torrance's work was extended in various directions. C. Woodruff Starkweather, for example, published materials describing the assessment of original ideation in preschool children. (The divergent thinking of young children can be assessed, though not with paper-and-pencil tests. Instead three-dimensional forms are given to them and they are asked to talk about all the things the form could be.)

Various other batteries are available, in addition to those of Guilford and Torrance, including Roberta Milgram's *Tel Aviv Creativity Test*, the Williams Creativity Assessment Package, and a set of tests used in several seminal investigations by Michael Wallach, including the one mentioned above. Wallach's battery has three verbal tests (Uses, Similarities, and Instances) and two Visual (or Figural) tests.

Divergent Thinking Indexes

Divergent thinking tests are scored in different ways, although most of the time a Fluency score and an Originality score are calculated. These are surely the most common indices of divergent thinking. Fluency represents the number of ideas given. Originality is scored in different ways. An objective score for originality might be calculated after determining the statistical infrequency of each idea. Highly infrequent ideas (e.g., those given by 5% of a particular sample) might be labeled original, each contributing to the Originality score. Unique ideas are sometimes viewed as original. Subjective scores have also been used, with judges rating the originality of ideas.

The next most common score is probably Flexibility. This is a very important score because (a) high flexibility precludes rigidity in problem solving and (b) it guards against an artificially inflated originality score. Without a Flexibility score, one examinee could give a large number of unique ideas, all within the same category, and each would earn an Originality point even though they are not original compared to one another. If the examinee does this but Flexibility is scored, the Originality score will be high but the low Flexibility score will indicate that it is an inflated Originality score.

In 2004 Allan Snyder and associates developed and demonstrated a new index of divergent thinking, which they called the creativity quotient. It assumes that ideas produced may not be equally indicative of creative potential. Those in disparate semantic categories are therefore weighted heavily and contribute more than semantically similar ideas to the CQ. In some ways the CQ takes both fluency and flexibility into account at the same time.

The various indices of divergent thinking are usually highly intercorrelated. This has led some psychometricians to conclude that only one score is necessary. Unfortunately, when

one score is used, Fluency is usually the one. It would make the most sense to use Originality since it is more closely associated with creativity in theory. Actually, it is probably best to use several scores because sophisticated statistical techniques (e.g., partialing unique variance and examination of interactions in canonical prediction equations) suggest that the different indices may each contribute.

The scoring of the Torrance divergent thinking tasks involves Fluency, Originality, and Flexibility, defined in a way that is comparable to the definitions given above. Torrance also recommended an Elaboration index for some of the tasks. This is based on the examinee's ideation within a category or theme. A streamlined scoring system was developed for the Torrance tests in 1980. It uses a composite of the various indexes.

Not long ago Mark Runco developed a scoring system that uses *ideational pools*. These pools are constructed for each examinee or respondent and contain each of that individual's ideas. They represent his or her entire ideational output. Judges then evaluate the pools rather than individual ideas. There are at least two advantages of this system. First is the amount of information available to judges. Second is the relatively low demand placed on their time. Judges have more information because they see everything any one examinee or respondent did, not just a small portion of it (i.e., one idea). The judges give one rating or judgment to each pool, rather than to each idea, so they need to invest much less time in the evaluations. This may preclude fatigue and allow them to concentrate better, and certainly it requires less of their time.

Task Differences and Additional Tests

The various tests differ in significant ways. The Similarities test, for example, is relatively constrained and not quite as open-ended as some of the other tasks. The Instances test seems to be wide open. The degree of openness is important in the sense that it can influence the order of test administration. If examinees have difficulty with divergent thinking, for example, which they might if they are in the midst of the 'fourth grade slump' or simply have had little or no practice at generating a large number of ideas, it might be best to start with Similarities. Because of its structure and relative constraint, it might be the most familiar to these unpracticed examinees. After working on Similarities, they might be presented with a slightly less constrained task, such as Uses, and then eventually a completely unconstrained task, such as Instances.

If divergent thinking tasks are being used in a practical setting, as exercises, it is probably desirable that the skills or strategies students learn for divergent thinking generalize to the natural environment. For this reason realistic divergent thinking tasks might be given. These ask examinees to solve problems that might occur in the natural environment, but problems that are open-ended and allow fluency, originality, and flexibility. Mark Runco has developed a number of realistic tasks, such as these tasks for students.

Example Problem 1

Your favorite TV show was on last night. You had so much fun watching it that you forgot to do your homework. You are about to

go to school this morning when you realize that your homework is due in your first class. Uh-oh . . . what are you going to do?

For this problem, you could answer, "Tell the professor that you forgot to do your homework; try to do your homework in the car or bus on the way to school; ask your roommate, boyfriend, girlfriend, or classmate to help you finish your homework; do your homework tonight and turn it in the next time the class meets; or finish your homework first then show up late for class." There are many more answers to this problem, and all of them are legitimate.

Now turn the page, take your time, have fun, and remember to give as many ideas as possible.

Example Problem 2

Your friend Pat sits next to you in class. Pat really likes to talk to you and often bothers you while you are doing your work. Sometimes he distracts you and you miss an important part of the lecture, and many times you don't finish your work because he is bothering you.

What should you do? How would you solve this problem? Remember to list as many ideas and solutions as you can.

Example Problem 3

It's a great day for sailing, and your buddy, Kelly, comes to your work and asks you if you want to go sailing. Unfortunately, you have a big project due tomorrow, and it requires a full day to complete. You would rather be sailing. What are you going to do? Think of as many ideas as you can!

There may be a trade-off with realistic tasks. They may motivate some examinees because they are realistic. Some examinees may not be all that interested in listing uses for a brick; but they might be more interested in listing excuses for not having completed homework! The trade-off arises because realistic tasks might be more constrained than the standard tasks, such as Instances or Uses. If this is the case the order of administration might be manipulated such that generalization to the natural environment is more likely. The order might begin with standard tasks, which are wide open, and then move to realistic tasks, which suggest that divergent thinking can be applied to problems found in the natural environment.

Runco has also developed divergent thinking tasks that reflect an examinee's ability to generate problems (rather than solutions). These are, then, problem discovery tasks rather than presented problems. This kind of task was developed because creative work often requires that the individual identify and define a problem before solving it. Problem generation tasks are open ended and can be scored for Fluency, Originality, and Flexibility. They can be used in conjunction with standard divergent thinking tasks to obtain a more general profile of an individual's ideational skills. Problem generation divergent thinking tasks are theoretically justified by the fact that creativity requires more than problem solving. Sometimes solving the problem is not the difficult aspect of the problem; defining it might be more difficult. And there are other important aspects of creative problem solving. Solution evaluation may be very important. Some persons seem to know an original idea when they have one, while others do not. The problem generation scores derived from divergent thinking tests may be important for certain clinical predictions. For example, the

interaction between problem generation and problem finding has been found to be highly related to suicide ideation. In particular, suicide ideation was related to the interaction between (high) Fluency scores on problem generation tasks and (low) Flexibility scores on the problem solving task. This interaction was expected because it indicates that the individual is aware of many problems (as seen in his or her Fluency) but not aware of many different solutions (as seen in the low Flexibility). Significantly, this interaction between problem generation and problem solving was more strongly related to suicide ideation than depression measures, which are typically quite respectable predictors of suicide ideation.

Psychometric Issues

The most critical psychometric issue is discriminant validity. This relates to the distinctiveness of divergent thinking. Is it distinctive or does it overlap with other forms of ability? Is it related to IQ? Can we predict divergent thinking ability from those measures of traditional intelligence?

Answers to these questions varied in the 1960s. In one seminal investigation Michael Wallach and Nathan Kogan administered divergent thinking tests under conditions that were dramatically different from the conditions typical of testing. Indeed, they told the examinees – school children – that the divergent thinking tests were games, and they avoided referring to tasks as tests. They allowed a great deal of time and were explicit about the need to generate a number of responses (rather than one correct response). Under these conditions the divergent thinking tests did display more than adequate discriminant validity.

The issue of discriminant validity is important in a practical sense because it indicates that divergent thinking tests provide information that would otherwise be unavailable. In behavioral terms it means that if we rely on tests of traditional ability we will overlook children who have outstanding divergent thinking abilities (but only moderate or even low IQs and academic aptitude).

The relationship of divergent thinking with IQ and traditional intelligence seems to vary at different levels of ability. There may even be a threshold of intelligence that is necessary for creative ideation. This would make sense because some basic information processing capacity is necessary for associative and divergent thinking. Additionally, many tests of divergent thinking require that the examinee has some basic knowledge, and that too suggests a modicum of traditional intelligence.

The 'threshold theory' suggests that some traditional ability is necessary for effective divergent thinking. The early estimates were an IQ of approximately 120, but this figure is probably just about meaningless, given that the average IQ in the population is on the rise, and given questions about the validity of the IQ. Still, the concept of a threshold does make good sense, even if we cannot pinpoint a specific IQ.

The threshold may be viewed graphically, as would be the case if divergent thinking scores were graphed as a function of IQ levels. When this is done a triangle of data points appears in the bivariate scatterplot. The top of the triangle is pointed at the origin of the graph, with the scatter of data spreading as IQ

levels increase. If that same scatterplot is bisected perpendicularly to the X axis (and at the hypothetical threshold) and once perpendicularly to the Y axis, four quadrants are formed. Empirical studies find some persons in the first quadrant, with low divergent thinking and low IQ. There are also persons with high IQs and low divergent thinking. There are a few persons with high divergent thinking and high IQ, but no one with low IQ and high divergent thinking. This is because of the minimum threshold of IQ which is necessary but not sufficient for divergent thinking.

There are persons with high IQs and low divergent thinking, which again supports the discriminant validity of the divergent thinking tests. It also suggests that individuals who are extremely good at the convergent thinking and memorization required for exceptional IQs may be at a serious disadvantage for divergent thinking and creative thinking.

A second critical issue is that of the predictive validity of divergent thinking tests. Here again, results have been quite varied. This is not much of a surprise, however, given that creativity can be expressed in so many different domains (some of which may not depend very heavily, if at all, on the kind of divergent thinking that is tapped by tests of divergent thinking). Moreover, divergent thinking tests do not guarantee actual performance any more than any other controlled assessment. As noted above, divergent thinking tests are estimates of the potential for creative thought. The biggest obstacle is the *criterion problem*. There is no widely accepted and universally applicable criterion of creative performance with which to give divergent thinking tests (or any other test of creativity) a fair evaluation. Divergent thinking tests have demonstrated only moderate, and sometimes disappointing, predictive validity. When fluency, originality, and flexibility are all taken into account, predictive validity coefficients have reached 0.55.

Divergent Thinking and Idea Evaluation

Divergent thinking tests assess how well people generate ideas. The generation of ideas is, however, only one part of creative thinking. It is very important to be able to judge ideas, as well as generate them. Further, for creative thinking it is also necessary to judge ideas specifically for originality. Some kind of critical thinking may allow an individual to recognize whether or not an idea will solve a solution, but this is a very different thing from recognizing originality. There is, then, a difference between valuation (seeing the originality of an idea) and evaluation (seeing the effectiveness of an idea). A series of studies suggests that both of these are correlated with, but far from identical with, traditional divergent thinking indices.

Hence someone can do one but perhaps not the other. Someone can generate ideas but not judge them accurately, or vice versa. There is also a difference between inter- and intrapersonal judgmental accuracy, but disappointingly, in both cases the accuracy is below 50%. In other words, original ideas are recognized as such less than half of the time! These findings of only moderate judgmental accuracy have been used to support the theory that creative thinking is more blind (or random, to use the Darwinian label) than guided.

Conclusions

Divergent thinking tests are grounded in sound theory. In particular, both associative theory and Guilford's own SOI model support their use. Divergent thinking tests have generated many interesting research findings. Divergent thinking has been used in studies of the fourth grade slump, for example, and in investigations of the relationship of creativity with suicide ideation. Much of this research is reviewed in other articles in this encyclopedia. The corpus of research is advantageous in the sense that the strengths and weaknesses of these tests are well known. Interpretations of test results are quite easy, given the large literature on divergent thinking. Another strength is the practicality of the tests. They can be used in various settings (e.g., educational, clinical, and organizational) and can be used as exercises or assessments. As noted above, when used as assessments, they are best viewed as estimates of the potential for creative thinking and problem solving.

See also: Associative Theory; Giftedness and Creativity; Intelligence (as Related to Creativity); Problem Finding; Suicide.

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Domains of Creativity

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Glossary

Divergent thinking A kind of thinking often associated with creativity which involves the generation of varied, original, or unusual ideas in response to an open-ended question or task.

Domain The set of representations that underlie and support thinking in a specific area of knowledge; also, any specific area of knowledge, such as art, literature, history, or astronomy.

Domain specificity A theory that argues that the skills, traits, or knowledge that underlie creative performance in a given domain are largely unrelated to the skills, traits, or knowledge that underlie or creative performance in other domains.

g General intelligence, a general factor that governs performance on all cognitive task. IQ tests are designed to measure g.

Microdomain A subset within a larger domain, such as the microdomain of poetry within the larger linguistic domain.

Modularity A theory of domain specificity that claims there can be no exchange of representations among different domains – that information is encapsulated within its given domain.

Task specificity A theory that argues that the skills, traits, or knowledge that underlie creative performance in different microdomains within the same more general domain are different and largely unrelated.

Introduction

Single-factor theories of creativity, like single-factor theories of intelligence, are very appealing because they allow one to paint the full picture of creativity – or at least a large part of it – with a single brushstroke. If creativity were a general trait or a single set of cognitive skills that influenced creative performance of all kinds, it would be much easier to understand, train, and test creativity.

Although single-factor theories of creativity have been popular for many years and continue to dominate creativity assessment, there is growing evidence that they may not explain creative performance across a wide variety of content domains as well as more narrowly defined, domain-specific theories and assessment techniques. In fact, there is considerable evidence suggesting that the skills underlying creative performance are not even so general as to span the many tasks that make up such common content areas as the verbal, mathematical, or artistic domains. This task specific (or microdomain specific) view of creativity argues that the skills that lead to creativity on one task in a broadly defined domain of knowledge, such as writing, are not the same (and show little overlap with) the skills that lead to creativity in another task within the same writing domain. Thus, for example, poetry-writing and story-writing creativity may not rely on the same set of cognitive skills, and creativity in writing plays might call on yet a third distinct set of creativity-relevant writing skills.

Such a fragmented approach to creativity, in which every domain (or even every narrowly defined task within a domain) relies on its own unique underlying set of traits or skills, is naturally less satisfying than a grand, all-encompassing theory of creativity. The most widely held general view of creativity, which posits divergent thinking to be a general, domain-transcending skill applicable in all areas of creative endeavor, has been popular

in creativity theory, training, and testing for many years, and despite doubts raised regarding the possible validity of *any* general theory of creativity by new research suggesting that creativity must be domain specific, divergent thinking theory continues to be used widely both in education and psychology.

After outlining the evidence for domains of creativity and current understandings of domain specificity and domain generality, this article will conclude by examining the implications of domain specificity of creativity for creativity theory, testing, and training. It will also consider theories that bridge generality and specificity and discuss how a newly emerging metatheory of creativity that is rooted in a modified divergent thinking theory and that incorporates a domain specific view of creative-thinking skills can replace earlier general theories as a unifying idea in creativity theory, training, and testing.

Domains and Domain Specificity

The concept of a domain as a set of representations or understandings underlying comprehension of a specific area of knowledge and performance of the tasks associated with that domain is, at the conceptual level, a fairly clear one. Applying this definition in a way that demarcates domain boundaries can be a much more contentious exercise, however.

In 1983 Howard Gardner published *Frames of Mind: The Theory of Multiple Intelligences*, and the domains (or, as Gardner termed them, ‘intelligences’) that he described have become familiar to many readers and are especially influential in the field of education. Gardner has distinguished the following intelligences:

- linguistic intelligence (abilities having to do with understanding and using the sounds, rhythms, and meanings of words and the functions of language);

- musical intelligence (abilities having to do with understanding and employing rhythm, pitch, timbre, and musical expressiveness);
- logical-mathematical intelligence (abilities having to do with finding logical and numerical patterns and producing chains of reasoning);
- spatial intelligence (abilities having to do with understanding the visual-spatial world and transformations within that world);
- bodily-kinesthetic intelligence (abilities having to do with control of one's body movements);
- interpersonal intelligence (abilities having to do with understanding and responding appropriately to the feelings, moods, and motivations of others);
- intrapersonal intelligence (abilities having to do with understanding one's own feelings, moods, and motivations, with assessing accurately one's own strengths and weaknesses, and with drawing upon such knowledge to guide one's behavior);
- naturalist intelligence (abilities having to do with recognizing, categorizing, and drawing inferences about features of the environment; this intelligence was added later and was not part of the original list of seven intelligences).

Gardner's classification is based on such evidence as: (a) the effects of brain trauma, such as strokes, that influence functioning in one domain but not others; (b) the existence of prodigies and autistic savants who show extreme abilities in one domain but not others; (c) psychometric evidence that suggests consistency among the skills that lie within a given domain and independence between the skills that fall in different domains; and (d) the existence of a set of core information-processing operations that can deal with specific kinds of input.

Gardner's eight intelligences are not the only way that domains have been conceptualized, but they will suffice as an illustration of the idea of broadly defined cognitive domains. The term domain is often also used to refer to general fields of knowledge or ways of knowing without specifying clear-cut boundaries between domains, and the breadth of what may be properly called a domain is in most instances not precisely defined. For example, a child's understanding of gravity may be viewed as a different domain of knowledge than her understanding of object permanence, number, animacy, and so on. It is also possible to lump many such understandings together as a single larger and more inclusive domain (in which case, e.g., a child's understanding of gravity and her understanding of object permanence, number, animacy, etc., might be thought of as all falling within the domain of early mathematical and scientific concepts). Overall, as the idea that development is domain specific has increased in popularity among psychologists, the number of such domains has also tended to increase, and the breadth of the hypothesized domains has tended to shrink.

Some writers use the term microdomain to refer to subsets of skills that seem to go together and yet have somewhat separate developmental histories. The use of pronouns, for example, can be considered a microdomain within the larger linguistic domain, and counting skills can be thought of as a microdomain within the larger mathematical domain. There are not clear guidelines for demarcating domains and microdomains, and usages often overlap.

An important area of disagreement among those who argue for the significance of distinct domains of knowledge is the possibility of interaction among the skills and knowledge that make up the various cognitive domains. Some theorists argue for strict modularity; under such an interpretation, each information-processing module is encapsulated and cannot make use of representations from other modules. One oft-cited example of such an encapsulated module is the perceptual system, which is at least relatively immune from input from other modules (and thus one's beliefs or preferences cannot interfere, or can interfere at most only slightly, with what one sees or hears – and the fact that one does not want or expect to see an elephant in one's living room will in no way interfere with actually seeing or hearing an elephant if one should appear there!). Strict modularity is an extreme version of domain specificity, but modularity and information encapsulation are not essential features of theories of domain specificity.

Evidence for Domains of Creativity

Any evidence that there are different cognitive domains, even when that evidence is collected with an indifference to creative performance, is indirect evidence that creativity is domain specific. This is true for the simple reason that creative performance must occur in *some* content domain; and if the basic cognitive skills underlying performance in that domain are domain specific, this will necessarily have an impact on creative performance in that domain as well as the performance of more ordinary tasks in the domain (tasks unrelated to creativity).

The larger battle about domain specificity – which includes, for example, disagreements about the degree to which generic intellectual competencies exist and can be tested, as is assumed in standard IQ testing – is beyond the scope of this article. The evidence for domain specificity of creativity goes beyond the assertion that different content domains rely on different basic skills for performance of all kinds, however. Even if there is a significant degree of general intellectual ability (or *g*, which is what IQ tests purport to measure) that influences performance across many domains, creativity may still be largely domain specific as long as *g* accounts for less than half the observed differences in performance across domains. Domain specificity in creativity isn't an argument against general intellectual skills per se. What domain specificity theorists claim is that the skills, traits, and understandings that underlie *creative* performance – which are conceptualized as a set of skills, traits, and understandings that go beyond those skills needed for successful (but not necessarily creative) performance – vary from domain to domain. Under domain specificity, general intelligence might still influence performance across domains, but creativity-specific skills or traits (such as divergent or associative thinking, resistance to premature closure, openness to experience, or intrinsic motivation) are not domain general skills of the kind that general intelligence (*g*) is theorized to be.

Arguments for the domain specificity of creativity are based primarily on research into the creativity of actual creative products, such as works of art, and not on the testing of specific intellectual abilities associated with various content domains.

This evidence suggests that levels of creative performance on tasks in one domain are essentially unrelated to levels of creative performance on tasks in other domains, especially once the effects of *g* (as measured by IQ or similar general aptitude tests) have been statistically removed. This research has even shown that creativity in performing one kind of task within a broad cognitive domain may be unrelated to creativity in performing other tasks within the same domain.

A widely used technique in creativity research is to ask subjects to create something, and then to have groups of experts in that field independently evaluate the creativity of those products. This method is called the consensual assessment technique. It was developed and validated by Teresa Amabile in the early 1980s and has been used widely in creativity research since then. It is based on the idea that no matter what creativity may turn out to be and no matter what theory may someday best explain it, judgments of the creativity of work or products or performances in a given field are most appropriately made by recognized experts in that field. Thus the creativity of poems is best judged by poets and poetry critics, and the creativity of cosmological theories is best judged by cosmologists. Although at the cutting edge of any field and where paradigm-shifting work is likely to be the focus there may be many disagreements about the creativity of a particular work or idea, assessments of more garden variety or everyday creativity – the kind of creativity that occurs in most psychological studies of creativity – tend to produce fairly uniform judgments among appropriate experts. Thus by asking a group of artists and art critics to independently evaluate the creativity of a group of collages, or a group of fiction writers and critics to independently evaluate the creativity of a group of stories, a researcher can obtain a reliable and valid measurement of the creativity of a group of creative products.

Several studies using subjects of different ages ranging from kindergarten to adults have shown that when subjects are asked to produce more than one creative product – such as collages, poems, stories, and mathematical puzzles – the creativity ratings of the products of each individual vary significantly. In fact, there is often little or no relationship between the creativity ratings a subject's various works of different types receive, despite the fact that the level of one's creative performance on a given task is highly predictive of performance on the *same* task, even when the second work is produced as much as a year after the first.

It should be noted that this lack of relationship among creativity ratings on different products is not only true across broadly defined domains – such as the linguistic and artistic domains – but also, in at least some cases, within domains. A prime example of such within-domain task specificity is the lack of correlation between poetry- and story-writing creativity that has been observed in several studies.

Approaching the question of domain specificity of creativity from a creativity training perspective, it has also been shown that training in divergent thinking (which is the most common kind of creativity training exercise) can also be targeted to specific domains, or even to specific tasks within domains. For example, divergent thinking training using only poetry-relevant exercises – such as brainstorming words with similar beginning sounds (alliteration) or words that can stand for or represent a given thing or idea (metaphor) – tends

to increase poetry-writing creativity far more than story-writing creativity.

An important source of evidence *against* domain specificity of creativity – evidence favoring domain generality of creativity – comes from studies using self-report scales of creativity. When individuals are asked to rate their creativity across various domains, the levels of creative achievement they report in the various domains tend to be moderately correlated. Critics of this research point out (a) the questionable validity of self-report scales and (b) the response-set bias that may lead individuals to systematically under- or overestimate their own creative activities in all or most domains.

Creativity theorists and researchers are far from unanimous about how best to interpret the available evidence regarding domain specificity of creativity, and although the trend in recent years has favored a more domain-specific approach, this could change depending on the results of future research.

Common Misunderstandings About Domain Specificity: The Puzzle of Polymaths

There have always been a few people of exceptional talent who are highly creative in many domains. Some observers focus on the rarity of such polymaths and take this as evidence in favor of domain specificity; others home in on the existence of polymaths, however rare they may be, and take it as evidence for domain generality. Either way, such arguments are misleading. Domain specificity does *not* predict there will be no polymaths; in fact, it predicts that some such multitasking people should exist. And domain generality theorists can explain their rarity just as easily.

What domain specificity claims is that creativity in one domain does not predict creativity in other domains. It thus claims that correlations between creativity in different domains should, on average, be zero. This means that one should expect some people will have high levels of creativity in many areas and some should demonstrate very low levels of creativity in many areas, not that everyone should be creative in the same number of domains. Some creative painters might also be creative poets, while other creative painters might exhibit no creativity as painters whatsoever. (By way of analogy, think of any two unrelated traits, such as having green eyes and being tall. The fact that a few people with green eyes are also tall does not show these traits are related. When two factors are unconnected, they will appear together in some cases. This is what randomness predicts.) If domain specific creative abilities are randomly distributed, one would *expect* a few people to be creative in many domains, some people to be creative in several domains, and some others to be creative in few domains or none, based on a normal distribution of unrelated abilities. The existence of a few polymaths does not disprove domain specificity. It is *exactly* what domain specificity predicts.

For very different reasons, the scarcity of polymaths can be explained by domain generality theorists. If creativity is domain general and a person has enough of it to be highly creative in any domain, then it might seem that one should be creative across the board. Most genius-level creators are *not* immensely creative outside the one domain in which they show excellence, however. This is probably best explained but what creativity

researchers call the ‘ten year rule,’ which argues that it takes many years of preparation in a field before one can do groundbreaking work in that domain. If it takes ten years of hard work in a field before one can produce works of genius, it is hardly surprising that few people manage to reach the highest levels of creativity in a variety of fields. There simply isn’t time.

So the presence of creative polymaths tells us nothing about domain specificity, and their rarity tells us nothing about domain generality. In this case, both theories predict well the world as we find it.

Mixed and Hierarchical Models

Creativity theorists needn’t choose simply between domain generality and domain specificity. There are theories of creativity that incorporate aspects of both positions.

At the most basic level, one can simply posit the existence of both creativity general and domain specific skills and traits. Amabile’s componential model, which argues for three factors – creativity general skills and knowledge, domain specific skills and knowledge, and task motivation – does just that.

James Kaufman and John Baer’s APT model is a hierarchical theory of creativity that includes both domain general and domain specific elements. The central idea of a hierarchical model is that there are varying degrees of domain specificity and generality ranging from the most general, such as general intelligence (*g*), to the most specific (e.g., microdomains or task specificity) There are four levels in the APT hierarchy:

- *Initial Requirements* are completely domain-general factors that influence creative performance to some degree across all domains (e.g., intelligence);
- *General Thematic Areas* are broadly defined fields or areas that include many related domains, such as Artistic/Verbal, Artistic/Visual, and Math/Science. The seven General Thematic Areas that they have identified are shown in [Figure 1](#).

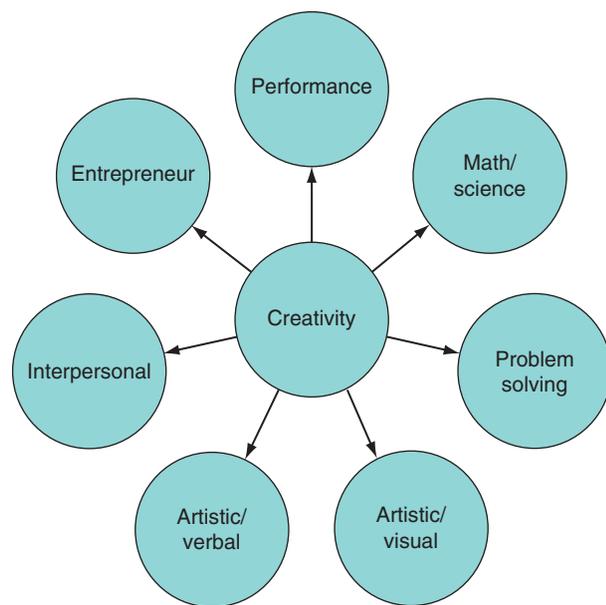


Figure 1 General thematic areas of the APT model of creativity.

- *Domains* lie within larger General Thematic Areas and refer to more limited ranges of creative activities. For example, in the General Thematic Area of Artistic/Verbal one would find subdomains such as narrative fiction, drama, and poetry.
- *Microdomains* refer to more specific tasks within domains. For example, within the domain of poetry one might find haiku, epic poetry, and sonnets.

A hierarchical model such as the APT provides a bridge connecting domain generality and domain specificity and argues that aspects of both theories should be not only acknowledged but incorporated fully into a complete theory of creativity.

Conclusions and Implications

If creativity is domain specific, it means that a single theory of creativity – such as the theory that divergent thinking is a basic component of all creative thinking – cannot account for the diversity of creativity across domains. Creativity theories must either become domain specific themselves or find some general approach to dealing with these domain-based differences. Similarly, domain specificity of creativity means that creativity testing as currently practiced is necessarily inadequate and of limited validity. And finally, creativity training programs cannot be assumed to increase creativity across all domains simply because they successfully promote creativity in one domain.

Baer has proposed a divergent thinking metatheory of creativity that, although encompassing all domains of creativity in a single conceptual scheme, nonetheless takes into account the domain specificity of creativity. According to this metatheory, divergent thinking is an important creative thinking skill, but the cognitive mechanisms underlying divergent thinking are different in each domain (or possibly even for each task within a given domain). Thus there are many *different* divergent thinking skills rather than a single divergent thinking skill. Divergent thinking as a general class of thinking skills is still a useful construct, however, both (a) because it makes this wide range of skills more coherent and easy to conceptualize and (b) because it makes it simpler to postulate and identify the appropriate domain-specific divergent thinking skills that will be important within any given domain or microdomain. Thus in terms of what is happening inside a creative thinker’s head, divergent thinking skill may actually be many unrelated, domain specific cognitive skills; but in terms of how psychologists can understand these many diverse skills (viewing divergent thinking from the outside, as it were), divergent thinking is a coherent class of skills that bear a strong family resemblance.

Moving from the implications of domain specificity for creativity theory to its implications for creativity testing, a domain specific understanding of creativity provides a very direct challenge to existing notions of how to test creativity. Simply put, to the extent that creativity is domain specific, creativity testing becomes that much more difficult. If creativity is domain specific, what exactly is one to test? Creativity testers will necessarily have to determine in which domain(s) of creativity they are interested, because under a domain-specific theory of creativity, general creative thinking skill becomes an empty

construct. Tests of creativity in specific content domains – which might use the consensual assessment technique to evaluate the creativity of products, or might instead find simpler (perhaps paper-and-pencil) techniques for assessing domain specific skills – would still be possible in principle, but they could be of only limited range and applicability. Major test developers may not be willing to support extensive test development efforts for tests of such limited potential use.

Creativity training, on the other hand, can accommodate domain specificity of creativity rather easily. Most creativity training programs already use a wide variety of tasks, spread across various content domains, in the exercises they use to improve divergent thinking and other creative thinking skills. Creativity training programs aimed at a particular domain can easily limit their training exercises to ones connected to that domain, while programs aimed at increasing creativity in general – the vast majority of programs – must be careful not to limit their training exercises to just one or a few content domains.

Creativity theory has only recently begun to accommodate research evidence suggesting that creativity is task specific, although the hierarchical approach discussed above is promising. General, domain-transcending theories – if true – would have far greater power than domain specific theories that account only for creativity in a limited content domain. For this reason, and because creativity theories have historically been one-size-fits-all theories, domain general theories of creativity continue to have great appeal.

It should be noted that the research evidence pointing toward domain specificity of creativity is fairly new, and, like the research that preceded it, this research may not tell the

whole story. As noted above, self-report scales of creative behavior suggest more generality of creativity than do assessments of the creativity of actual creative products. It is quite possible that both domain specificity and generality are true, each in part and in its own way. More research will be needed to clarify the conditions under which generality or specificity of creativity is the more valid perspective. In the meantime, both views will continue to claim adherents among researchers and theorists.

See also: Consensual Assessment; Divergent Thinking; Intelligence (as Related to Creativity); Multiple Intelligences.

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Dreams and Creativity

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Glossary

Creativity The English word creativity is linked, historically and etymologically, with the Latin word *creare* (to make) and the ecclesiastical Latin word *creator* (Creator); therefore, both refer to the concept of origin itself (consider the related term *originality*). One of several useful psychological definitions was given by Csikszentmihalyi in 1996, when he suggested that the term creative could be applied to “any act, idea, or product that changes an existing domain, or that transforms an existing domain into a new one.” A more subjective, but also useful, definition was given by Martindale, who wrote that a phenomenon is creative if it is novel and, in some manner, useful or appropriate for the situation in which it occurs. The noun *creativity* is used if a process or phenomenon is being discussed, while the adjective *creative* is used if a behavior, an experience, a product, a person, a group, or an environment is being described. In all these instances, there is the assumption that something is both novel and culturally appropriate to a given task.

Dream A series of images, reported in narrative form, that occurs during sleep. These images are usually visual and kinesthetic, but they can also be auditory or even gustatory or olfactory. They can be recalled spontaneously upon (or somewhat after) awakening, or can be evoked if someone is awakened from REM (rapid eye movement) sleep or even from non-REM sleep.

Dream interpretation An attempt by someone (often the dreamer) to attribute meaning to the content of dream reports for purposes of counseling, psychotherapy, or personal/social growth. Various approaches to dream interpretation exist, many of them contradictory; and some investigators insist that dream images are randomly evoked and dream content is essentially meaningless.

Electroencephalogram (EEG) A graphic depiction (voltage vs. time) of the brain’s electrical potentials recorded by scalp electrodes and usually delineated by ink tracings (as are the electromyograph (EMG) and electro-oculogram (EOG)).

Hypnagogia The pattern of phenomenological properties immediately preceding sleep. Hypnagogic reports typically include imagery (visual, auditory, kinesthetic, etc.) but little narrative.

Hypnopompia The pattern of phenomenological properties immediately preceding awakening.

Hypnopompic reports typically include imagery (visual, auditory, kinesthetic, etc.) and are more likely to contain narrative than are hypnagogic reports.

Lucid dream reports Characterized by claims that the dreamer was aware that he or she was dreaming during the

ongoing dream. Several techniques exist that purport to cultivate dream lucidity.

Nightmares Reports of anxiety-provoking dreams, marked by confusion, fear, horror, and other types of unpleasant affect.

Non-REM sleep Consists of four sleep stages that occur in a cyclical pattern. Stage 1 sleep occurs immediately after sleep begins, with a pattern of low amplitude and rapid frequency EEG tracings; Stage 2 sleep has characteristic EEG tracings of 12 to 16 cycles per second known as sleep spindles; Stages 3 and 4 have progressive, further slowing of EEG tracings, and an increased amplitude. Over a period of about 90 minutes after sleep begins, most people have passed through the four stages of non-REM sleep and have emerged from them into the first period of REM sleep. Non-REM sleep is also referred to as orthodox sleep or S-sleep (because of its characteristic synchronized EEG tracings).

Primary process In psychoanalytic theory this term refers to unconscious mental activity that operates without regard to logic or consensual reality, but provides for wish fulfilment, governed by the ‘pleasure principle.’

Rapid eye movements (REMs) Conjugate, coordinated horizontal or vertical eye movements, occurring rapidly during sleep and, less frequently, during napping, daydreaming, and hypnotic imagining, and at other times when one’s attention is turned inward rather than toward the external environment.

REM sleep A recurring stage of sleep, characterized by rapidly occurring conjugate eye movements, loss of muscle tonus, and desynchronized EEG brain wave activity. REM sleep is also referred to as Stage 1 REM sleep, Stage REM, D-sleep (because of its characteristic desynchronized EEG tracings), and paradoxical sleep (because its EEG tracings resemble wakefulness). REM sleep recurs in ~90- or 100-minute intervals in humans; it also occurs in nonhuman sleep, for example, among most mammals.

Sleep The recurring period of relative physical and psychological disengagement from one’s environment characterized by cyclical brain/body activity.

Sleep terrors (or night terrors) Episodic conditions usually occurring during Stage 4 sleep, marked by panic, confusion, and poor recall. Characteristically, the reports of sleep terrors do not include imagery or narrative. They occur developmentally, peaking by two years of age, but sometimes may occur later.

Wakefulness The recurring period of relative physical and psychological engagement with one’s environment and the presence of various patterns of phenomenological properties.

Creativity, Dreams, and Culture

From the perspective of Western psychology, *creativity* is a term that can be used to describe the process of bringing something new into being by becoming sensitive to gaps in human knowledge, identifying these limitations, searching for their solutions, making guesses as to a potential resolution, testing one's hypotheses (sometimes modifying and refining the results of these examinations), and communicating the final product. However, the creative process is imperfectly understood; these steps may be linear or may overlap, they may occur in a planned sequence or spontaneously, or they may be intentional or operate outside of one's awareness. It could also be said that people, groups, or cultures are creative during those periods of time when they exhibit activities, innovative for them, that yield concepts, objects, or behaviors that address human needs (e.g., for survival, for enhanced work performance, for enjoyment, for aesthetic satisfaction, for enriched quality of life) in ways considered valuable by a social group. These novel concepts, objects, and behaviors (e.g., a scientific discovery, mathematical theorem, philosophical insight, an artistic masterpiece, technological product, military victory, or diplomatic accomplishment) can be termed creative, although one social group might arrive at a different consensus from that of another group. In other words, the term *creativity* is a social construct used to describe various processes and outcomes.

The word *creative* has several possible meanings. To most observers, this adjective describes something new that has been brought into existence. Definitions of *creative* and *creativity* range from simple problem solving to the full realization and expression of all an individual's unique potentialities. There appear to be at least four aspects of creativity: the creative process, the creative product, the creative person, and the creative environment.

Dreams may play a role in the creative process, identifying problems, searching for solutions, testing hypotheses, and communicating the results to the dreamer. In 1996, Strauch and Meier discussed how the creative transformation of memories is an expression of human consciousness that can take place during both wakefulness and dreaming.

Ullman, in 1965, listed four reasons to explain why dreams partake in a creative process. All dreams are original; no two are alike. Dreams combine various elements to form new patterns. Like many creative processes, most dreams are involuntary experiences. Dreams contain metaphors and symbols that have creative potentials. Many non-Western societies have also appreciated the creative aspects of dreams. Among Australian aborigines, the Laws of the Dreaming were laid down during what they call the Creative Period. Each species has its own set of laws, and all of these laws are a part of the Dreaming, the ground of all existence. Humans can obtain new information (e.g., new songs and rituals) from the Dreaming; thus the Dreaming is dynamic, not static, in nature.

In *The Tempest*, Shakespeare wrote about "such stuff as dreams are made of." Many of the images that appear in dreams can be symbolic in nature. Images are mental representations of objects or persons not physically present. Whereas an image directly represents the object it pictures, a symbol is an image that stands for something else. In much the same way,

activities in dreams may be metaphorical, a metaphor being a narrative or an activity that stands for something else. Sometimes dream content makes no sense if the dreamer presumes that the images refer directly to the people or objects they depict. In those instances, the dream might make more sense if allowances are made for the possibility that its images are referring to something other than themselves. Freud complicated this issue by asserting that the symbols occurring in dreams differ radically from other symbols because dreams express, in disguised form, wishes the dreamer has repressed. However, this assertion implies a sleep/wakefulness discontinuity. Most contemporary dreamworkers believe that the symbol-making process in dreams exhibits more commonalities than differences with the symbol-making process in waking life. This emphasis on the continuity between waking life and dreaming life can be found even in the writings of Thomas Aquinas, who wrote, "Those things that have occupied a man's thoughts while awake recur to his imagination while asleep."

This continuous, cognitive-psychological position has also been taken by Adler, Hall, and Foulkes, all of whom described dreams as meaningful but not as containing preplanned encoded messages that need to be translated the way a linguist would work with a foreign language. According to Foulkes, the dream is "knowledge-based" and "bound to reflect some of the ways in which the dreamer mentally represents his or her world." Indeed, almost anyone awakened after a dream is able "to identify *some* events as having rough parallels in her or his waking experience." A body of research indicates that dreams often are characterized by complex thinking processes. Some differences between waking cognition and dreaming cognition exist, but they are continuous rather than discontinuous. In 1979, Rycroft mused that, if dreams are poetry, their creative efforts are imperfect. Poets and artists need to cast their meaning in metaphors and symbols that are a part of the shared legacy of their culture. But dream imagery tends to be too dependent on the dreamer's personal experiences to convert easily into works of art with wide appeal. Some dream theorists urge the dreamer to accept dream images and stories as creative experiences in their own right. However, writing from a neuroscience perspective in 1983, Crick and Mitchison proposed that dreams function to purge unnecessary, even parasitic, brain cell connections produced during wakefulness; dream content, therefore, is best forgotten.

On the other hand, Hobson, also taking a neurophysiological and neurochemical perspective, wrote in 1988 that, since virtually everyone dreams, the dream report stands as testimony to the universality of the artistic experience. In dreams, all become writers, painters, and film makers, combining extraordinary sets of characters, actions, and locations into strangely coherent experiences. Hobson concluded, "I strongly object to any implication that the artistic experiences of waking or dreaming are fundamentally pathological, defensive, or neurotic," adding that the brain is so determined to find meaning that it creates dreams out of images that have been randomly evoked by its own neurochemical activity.

It can be seen that dream specialists do not speak with one voice on the topic of creativity and dreams. But non-Western traditions lack uniformity as well. Among pre-Columbian Native American dream traditions, some saw dreams as having the same meaning for every member of the tribe, whereas

others felt that dreams conveyed meanings personal to the dreamer; some believed that dreams served problem-solving functions, whereas others felt that they forecast the future; some believed that dreams dictated actions that needed to be taken in daily life, whereas others believed that dream events took place in the spirit world. In some tribes, dream messages were direct and undisguised, whereas for others they required interpretation. However, few North American tribal groups neglected dreams; they were seen as sources of knowledge, power, inspiration, and what today would be called creativity.

Research on Creativity and Dreams

Weisberg, in 2006, stated that creative problem solving has occurred when a person produces a novel response that solves the problem at hand, but then he went on to debunk many highly publicized accounts of problem solving in dreams and other altered states of consciousness. A critical perspective needs to be taken regarding not only anecdotal accounts but also formal research programs. These phenomena are difficult to investigate for several reasons. Even if a useful definition of *creativity* can be implemented, an investigator never works with a dream, but rather with a dream report. These reports, whether obtained from archives, from field research, or from laboratory research, are subject to so many vagaries of memory, unconscious distortion, and deliberate omission or elaboration as to pervade the field with a well-deserved sense of modesty when even tentative results are announced.

Anecdotal Data

Keeping Weisberg's caveat in mind, many instances of creative breakthroughs in dreams have been well documented. They include Mendeleev's conceptualization of the Periodic Table of the Elements, Howe's invention of the lock-stitch sewing machine, Blake's development of a process of copper engraving that he later used to illustrate his songs, Tartini's composition of his most celebrated sonata, and famous fictional works by Robert Louis Stevenson and Daphne du Maurier, among others. Some dream-inspired books are nonfictional; the mathematician Jerome Cardan had a recurring dream that ordered him to write *De Subtilitate Rerum*, which was to become his most celebrated book. Whenever Cardan became lax in his writing habits, the dream returned with great force. Many creativity researchers have discussed creativity within the framework of preparation, incubation, inspiration, and verification, although these four stages may not always develop in a predetermined order in creative work and problem-solving, and some stages may not occur at all. It has been suggested that, when the problem-solver's deliberate efforts to evoke solutions are abandoned during sleep, dreams can impart clues and novel approaches that elude individuals during wakefulness. Many researchers cast doubt on the credibility of anecdotal reports of this nature, noting that many of them were made long after the event; hence there is the risk of distortion and elaboration. Even in cases that appear to be credible, a period of considerable preparation is required; however, simply taking a break from the problem is a more likely explanation than unconscious

processing, because during the break people typically mull over a solution. Many of the most frequently cited cases of dream creativity did not take place in dreams at all, but actually occurred in transitional states of consciousness, not sleep. Rarely do dreamers record their dreams and secure them in such a way that their creative potential can be assured.

Formal Research Data

Several investigators have used tests, questionnaires, and interviews to obtain information about creative problem solving in dreams. Some representative studies demonstrate the direction that formal research has taken; the journal *Dreaming* is an excellent resource for those who are interested in following developments in this field.

Barrios and Singer, in 1982, queried 48 volunteer subjects about their creative impasses, finding that most had been blocked for more than three months. The subjects were divided into four groups and randomly assigned to one of four conditions: exposure to either a waking imagery or to a hypnotic induction procedure, participation in a focused and collaborative examination of their projects in which task-irrelevant thoughts were avoided, and a control group encouraged, in a nondirective fashion, to discuss their projects.

Results indicated that the waking imagery and hypnotic imagery conditions were most effective in promoting the resolution of creative blocks.

An experiment reported by Brodsky, Esquerre, and Jackson in 1991 asked students, while they were awake, to apply an operational definition of dreaming to four problem-solving tasks. All proposed solutions were rated on a five-point creativity scale by raters, working independently. No gender differences were noted, nor was frequency of dream recall associated with the creativity ratings. However, students who attributed considerable importance to their dreams received higher creativity scores, as did students who reported having had lucid dreams. It was suggested that dreaming consciousness is a permission-giving format for eliciting active imagination, bypassing typical goal-oriented thinking processes.

A series of experiments reported by Cartwright in 1984 demonstrated that problem solving in dreams probably is more successful when the material to be processed is emotionally or personally meaningful.

Other studies have shown that dream reports of highly creative people exhibit more primary process thought than less creative individuals but also show greater symbolism and more unusual combinations of dream content elements.

Highly creative individuals also endorse beliefs that dreams have hidden and symbolic meaning, can produce inventions and artistic creations, can sometimes predict the future, and can be programmed (or 'incubated') more so than less creative individuals. The creative people also claim to make a greater effort to remember their dreams than the other group. Highly creative persons relax more easily and fall asleep more rapidly, and more of them claim to be able to solve problems in dreams than do less creative individuals.

The association between nightmares and creativity has long been a matter of conjecture. A questionnaire survey of college students found that art majors report the most nightmares,

whereas physical education majors report the fewest, with mathematics and science students in the middle. Furthermore, students with frequent nightmares tend to report more visual imagery during awakening, become easily absorbed in aesthetic stimuli, and score higher scores on a hypnotizability scale than do other students.

Other studies have found a close relationship between the frequency of nightmare reports and psychopathological scores on personality tests for dreamers reporting frequent nightmares. Furthermore, these high nightmare individuals have more primary process material in their dream reports than low nightmare individuals.

Cross-Cultural Considerations

It is not the dream itself that is available for interpretation, but the individual's or group's report of the dream experience. The visual, sensory, and emotional aspects of a dream are often lost in Westerners' accounts of dreams, but indigenous dreamworkers generally consider these qualities to be among the most important.

Remembered dreams and performed myths are both forms of production that bridge the verbal, logical characteristics of rational thought with the visual-sensory-spatial-emotional images that reach their most elaborate level of integration in art. The recounting of a dream brings the nonverbal, nonrational imagery of the dream to awareness, and begins to link it with logical reasoning.

Possible Mechanisms

Contemporary sleep and dream research has demonstrated the elaborate, entirely intrinsic mechanisms of *state* control. In other words, a change in the brain's state while asleep causes a change in the dreamer's mental state. Sensory input can be internally controlled so that even the transforming mechanisms do not operate alone to protect the system from overload. Three features of the modern conception of the nervous system – its intrinsic plasticity, its autoregulation, and its creativity – give us a very different set of operating principles on which to construct a scientific psychology. This model depicts a nervous system that can turn itself on and off, regulate the flow of internal information in diverse ways, and control external information's access to the system. It is in the context of this model that the incorporation of presleep stimuli, dream incubation, and lucid dreaming assume importance for the understanding of creativity and dreams.

Incorporation of Presleep Stimuli

The influence of presleep stimuli in dream content has been successfully attempted in experiments using hypnosis, subliminal stimulation, emotionally arousing films, and real-life stress situations. The results indicate that it is relatively easy to influence dream content in predictable ways. It has been suggested that dreams may serve the purpose of assimilating emotionally arousing information into problem solutions that are already embodied in existing memory systems.

Dream Incubation

If it is possible for an experimenter to influence the course of a subject's dreams, then it should also be possible for dreamers themselves to influence their dream content.

Dream incubation was common among the American Plains Indians, among artists in ancient China, and in the practices of ancient Egypt, Greece, and Tibet. Foulkes and Griffin moved from the anecdotal level to more rigorous types of inquiry, teaching 23 subjects 'dream control' methods, and asking them to dream about randomly selected topics. The subjects kept daily records of their dreams for 10 nights. Judges attempted to match dreams with the suggested topics; their matching did not exceed what would have been expected by chance.

The same investigators designed a second study using 29 highly motivated subjects who claimed some previous success in dream control or an interest in the topic. They spent ten nights attempting to dream about assigned topics, but in this case they were allowed to select the nights on which they felt they could successfully control their dreams. Again, judges were unable to match the dreams with the topics. Other studies have reported more encouraging results in projects in which incubated dreams focus not on abstract topics but on real-life concerns. Some people expect too much when they assume their dreams will become springboards for feats of artistic creation. Nevertheless, such former presidents of the International Association for the Study of Dreams as Barrett, Delaney, and Garfield have cited case studies indicating how dreams can help many people live more fully integrated lives and augment their capacity for adaptation and personal growth.

Lucid Dreaming

When a dreamer realizes that he or she is dreaming, the dream is considered to be lucid. The Tibetan Buddhist practice of 'dream yoga' focused on the ability to retain awareness and lucidity during night time dreaming. However, the Hindu yogic dream tradition eschewed such dream manipulation in favor of a waking meditation practice described as 'merging with the light.'

Aristotle wrote about lucid dreams, noting that when one is asleep, there may be something in one's awareness that declares what is presented is a dream: "The sleeper perceives that he is asleep, and is conscious of the sleeping state during which the perception comes before his mind." In the second edition to *The Interpretation of Dreams*, published in 1909, Freud noted that some people are clearly aware when they are dreaming and are able to direct their dreams.

First hand reports from lucid dreamers have produced a list of methods thought to be useful in facilitating dream lucidity. Presleep reflection is frequently mentioned; in other words, one can often incubate a lucid dream. Asking such critical questions as 'Is this a dream?' and 'Am I dreaming?' during a dream will often produce lucidity. Some dreamworkers encourage people to ask these questions during the day at regular intervals, with the expectation that these questions will later arise during the night. External stimulation is sometimes incorporated into a dream and triggers lucidity; again, this can be deliberately programmed.

Gackenbach has estimated that about 58% of the population experience a lucid dream at least once, while about 21% report one or more per month. Instruction in lucid dreaming has been used therapeutically, especially to help people who suffer from chronic nightmares. Studies have shown that lucid dreaming can be 'learned' by those who wish to use it for creative problem solving. There are anecdotal stories of more specific skills being learned as a result of lucid dreaming.

Neurophysiological and Neurochemical Mechanisms

Several studies with animals indicate that the frequency of time spent in REM sleep increases as a result of new learning, such as finding the way out of a maze. This relationship is evident in work conducted with cats, mice, rats, and newly hatched chicks. Therefore, rapid eye movement (REM) sleep may play an important role in the consolidation of such cognitive activities as learning, memory, and problem solving for both humans and other organisms that engage in REM sleep.

The role of learning in REM sleep production may be connected to an underlying biological process. It has been suggested that new protein structures are being synthesized in the brain during REM sleep. Evidence indicates that the initiation of REM sleep does come from the brain stem, and then extends itself over the entire brain cortex. Because animal experiments indicate that protein synthesis is present in new learning, it has been hypothesized that it also takes place during REM sleep.

Some theorists have used computer analogies to describe REM functioning as akin to 'off-line processing.' The acquisition of input information is placed in temporary storage, until processing components are available. Information about the day's events is gathered and stored until the onset of REM sleep, when it can be 'processed' (i.e., integrated with memories and formed into strategies for the future).

The spiny anteater, or echidna, is an early mammal whose sleep pattern shows no REM activity. The echidna's brain has a large prefrontal cortex, presumably to integrate new experience with older experience. The mammals that evolved later were able to handle this task more efficiently during REM sleep; as a result, their brains were smaller – a more productive direction for evolution to follow. This problem did not exist in the earlier reptilian species; their behavior was largely reflexive, and this activity was adequately handled by a small brain with a neo-cortex. Dreams, then, can serve as a window on the neural processes whereby – from early childhood on – strategies for behavior are being set down, modified, or consulted. This process and the mechanisms involved, which were termed the 'unconscious' by Freud, can be used advantageously in the clinical setting by both Freudian and non-Freudian psychotherapists and other dreamworkers.

A model that has tried to be inclusive in regard to incorporating physiological discoveries about dreams is that proposed by Hobson and his associates in 2000. They proposed that during both waking and dreaming states there is an *activation* of the brain, a source of *information* that is evoked during the waking or dreaming process, and a biochemical *modulation* that differs radically from wakefulness to sleep. Dream experiences are, in part, a product of self-organizing tendencies in

the brain during which the randomly evoked informational data are creatively patterned into a narrative to which meaning can be attributed. The cells deep in the pontine area of the brain stem are *activated*, generating REM sleep and randomly stimulating the forebrain, which then evokes *information* by using stored memories to make sense of the incoming neural firing. On the one hand, Hobson and his associates have connected dreaming to a *modulation* of biochemical events in the brain, but, on the other hand, they have evidenced a keen understanding of dreams as imaginative creative events.

In 1988, Hobson pointed out that Freud insisted that wishes and repressed desires caused dreaming, but that this notion has been discredited due to data that it is brain stem mechanisms during sleep that cause dreaming. Even though brain mechanisms trigger REM sleep (and dreaming), wishes may be expressed and may even shape dream plots, but they are in no sense causative of the dream process. Hobson concluded that dreams are not the result of an attempt to disguise repressed wishes but are a direct expression of a synthetic effort. One's memories are scanned for images that will match these internally generated patterns. This model sees dreaming as the pre-programmed running of an internal system. The bizarre features of a dream are naturally associated with the mode of operation of the system during dreaming sleep, and there is no need for a mechanism that would transform information. Since the system is capable of selecting what computer scientists would call the 'store' or 'no-store' modes, there is no need to postulate an active energy-consuming mechanism for the restoring of dream material in the unconscious. It can simply be the no-stored mode that is unremembered.

For once, wrote Hobson, contemporary scientists can agree with Freud's assertion that dreams are the 'royal road' to a scientific understanding of consciousness. Hobson's model is seen as unduly reductionistic by those researchers who hold that REM sleep and dreaming are two separate but related processes; indeed, dreams can be obtained from non-REM sleep as well as from REM sleep. Krippner and Combs have noted that in both REM and non-REM dreams, the formal analysis of activity patterns in complex neural networks can be carried out in terms of chaotic attractors. In 2002, they proposed that the dreaming brain 'relaxes' into natural patterns of self-organized activity that often reflect the residual moods, stresses, and concerns of waking life.

During dreaming, the brain is immersed in something like a sensory isolation tank, cut off from the influences of external sensory input. In this situation, patterns of brain activity can slip into forms that are primarily dependent upon internal considerations. This environment, they maintained, is especially conducive to the production of novel associations, as *chaotic attractors* produce unusual but potentially valuable dream narratives.

In the creative process, small changes in cognition or behavior can trigger an avalanche of new insights or novel creative products. Krippner and Combs have found this 'butterfly effect' to characterize many dreams that lead to a creative solution of an ongoing problem.

The human brain with its many chaotic patterns of activity is subject to the butterfly effect; the introduction of 'noise' into such a system can produce a response too small to be

ordinarily noticed. However, the presence of this 'noise' or 'vibration' keeps the system in motion, following the signal, rather than allowing it to become stuck. Termed *stochastic resonance*, this seemingly paradoxical effect has been demonstrated in electronic signals as well as in nerve cells. On the other hand, the dreaming trajectories may be more under autopoietic (displaying both divergent and convergent thinking) control than it is in those systems attempting to follow a repetitive signal, as in most examples of stochastic resonance. As in problem solving, they have a goal in mind, and use divergent trajectories and bifurcations to solve it.

Further Research

Future research studies need to identify the genetic markers for creative behavior, reconcile personality and cognitive research data in creativity, evaluate the part played by the dreaming process in creative ideation, determine the role of mental illness in blocking or facilitating creative expression, and specify what home and school variables are key factors in the development of highly creative individuals. The study of dreams can play an important role in each of these agendas; dreaming appears to have been adaptive in the evolution of the brain, and dream content can provide cognitive and affect clues in the understanding of creative processes.

It is apparent that individual differences exist in dream creativity, and that there are cultural differences as well. The vast preponderance of studies in the field are devoted to the neurophysiology and neurochemistry of sleep and dreaming as opposed to the psychosocial variables in dreaming; of the latter, only a handful concern themselves with creative aspects of dreaming despite the near-consensus of dream researchers that the two phenomena are linked in several ways. The unanswered questions posed by existing research data are legion: for example, why is color spontaneously reported in the dreams of half of art students studied, 16% of the science majors, and virtually none of the engineering students? Why do research participants, in general, tend to report color in their dreams more frequently if they claim to place greater reliance on feelings than on thinking? What is the nature of dreams in which color is greatly intensified, radiating with phosphorescent hues? What are the mechanisms that determine shifts in dream color when people wear colored goggles during every waking moment for a week? Why do recurring post-traumatic nightmares differ so radically in dream content from other dreams?

The answers to these questions can be sought from psychosocial, neurophysiological, and neurochemical investigations, as can the answers to dozens of additional questions relating to creativity in dreams. In the meantime, for the Australian

aborigines, the Amazon Kagwahiv, and other tribal people, the Dreaming still exists. They believe that, if other human beings would begin to make their own dream journeys, re-establish their links with nature, and creatively invoke Dreamtime songs and dances, many of the world's current dichotomies and discontinuities could be accommodated and transcended. For both the mind/brain and the individual/group, this has been one of dream's creative functions over the millennia. The need for creative solutions to the world's many social, economic, and environmental problems reflects the importance of creativity and of the researchers and dreamworkers who see creativity in dreams as a critical frontier in understanding and assisting human development in a world – and a species – currently at risk.

See also: Altered and Transitional States; Definitions of Creativity; Memory & Creativity.

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Relevant website

<http://asdreams.org> – International Association for the Study of Dreams.

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East vs. West

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Glossary

Collectivism The core element of this dimension is the assumption that groups bind and mutually obligate individuals.

Confucianism An intellectual and spiritual tradition based on Confucius' teachings that emphasize self-cultivation through effortful learning and the attainment of social harmony through virtuous and beneficent rule by the government.

Daoism An intellectual and spiritual tradition based on Lao Zi's teachings that emphasize the prepared mind, letting-be

and noninterference, and the attainment of enlightenment through meditation.

Human creativity The notion that creativity originates from the mind of human beings.

Individualism The core element of this dimension is the assumption that individuals are independent of one another.

Supernatural creativity The notion that creativity emanates from divine deities, God, or cosmic forces.

The Western and Eastern Perspectives

Creativity may mean different things to different people. However, if we ask around, few will disagree that it involves bringing something new into being. On closer examination, we understand that when we call something new, we attribute value to it. And this value attribution may in turn be associated with other judgment and criteria involving appropriateness, usefulness, or desirability. Despite that we seem to have a relative consensus on viewing creativity, it has to be noted that this conception of creativity is only the modern Western perspective. Indeed, it is said that the word creativity has come to be more widely used only in the past 60 years in the English-speaking world, and there seems to be no words that easily translate as creativity in other non-Western cultures.

When we speak of the Western perspective and the Eastern perspective (as distinct from the Western perspective), we are referring in broad generalities to views of people from two relatively distinct intellectual and cultural traditions. By the West or Western culture, we generally refer to the culture of Europe, North America, particularly Canada and the United States, Australia and New Zealand. There are undoubtedly many important cultural and subcultural differences among these Western countries or societies. But there are also similarities due to their continuing economic and political alliances and conflicts. Perhaps, the major distinguishing feature of the West is its 2000 years of cultural continuity with ancient Israel and Greece, that is, its common Greco-Judeo-Christian heritage. The same can be said about the East. By the East or Eastern culture, we generally refer to the culture of East Asian countries like China, Japan,

and Korea. These societies, although in many ways distinct, bear notable similarities in their cultural heritage due to the strong influence of Confucianism, Daoism, and Buddhism.

Bearing in mind that the East-West reference is a sweeping generalization, it is of interest to know that contemporary studies generally suggest that Easterners and Westerners do hold similar but not identical conceptions of creativity, and they do perform significantly differently on specific tasks requiring creativity. Thus, in this article we will examine these East-West differences. Specifically, we will first discuss the philosophical roots of Eastern and Western perspectives, which lead to the different ancient views and modern conceptions of creativity. We will then look at the empirical findings based on studies of East-West comparison. Finally, we will explore whether there are valid cultural and cognitive bases for the East-West differences.

Supernatural Creativity: Ancient Western and Eastern Views

Philosophical inquiries into the origin of creativity in the West as well as in the East generally follow one of two approaches. One approach is based on the belief that all things exist independently of human activity. Therefore, it is supposed that all creativity emanates from supernatural cosmic forces, from the divine power of God, or from the inspiration of gods. Creativity can thus be viewed as with supernatural or divine origin. The second approach is based on the belief that human beings are responsible for the existence of things, at least in certain realms such as morality. This approach

emphasizes human as opposed to supernatural or divinely inspired creativity, and is based on the notion that creativity originates in the human mind and in the individual's ability to bring something new into being. In this connection, creativity can be viewed as with human origin, and human creativity is the focus of study by contemporary scholars.

Although the notion of supernatural creativity emerged first in the history of both Eastern and Western thought, the Eastern view did differ somewhat from the Western view, probably due to the different philosophical and cultural traditions, and the different stories of human origin or different creation myths.

The Ancient Western View

Western philosophical inquiries into creativity can be traced back to ancient Israel and ancient Greece. The Hebrew root is the Biblical idea of God's creation. The Greek root is the ancient Greek expression of the inspiration from the gods of invention or the Muses.

According to the Bible in the Hebrew tradition, human beings do not have the ability to create new things. All things, including human beings, are God's creation. The Book of Genesis clearly describes God's original act of creation: "In the beginning, God created the heavens and the earth." The description also includes God's creative process in bringing into being the heavens, the earth, the living beings, and everything else. Particularly worthy of note are three features of God's creation. First, God is the sole creator of everything. Second, God brings new things into being from nothingness. Third, God's creation represents all goodness, including moral goodness. The second and third points naturally give rise to the emphasis of novelty and moral goodness in the ancient Western view of creativity.

In contrast to the Hebrew tradition, the Greek tradition does not have a clear creation myth by one God. Rather, there are diverse philosophical speculations on the origins and nature of things. The ancient Greeks believed that there are many gods, including the Muses or the gods of invention, and all human activities and destinies are controlled by the will of gods. Accordingly, people do not invent, gods do. Even artists do not make new things, and they are only inspired to imitate things that already exist in nature. This idea that creativity is divinely inspired is very similar to the Hebrew Biblical notion of creativity. In this tradition, any creativity beyond the external will of the gods could be interpreted as bad or immoral, and as posing a potential danger to society.

Supernatural creativity as described above was the dominant view in the history of Western thought for a long period of time, probably until the time of the Renaissance and even beyond. During this period, it could be said the most important creative activities in the West were all religious or Church-related. Creative artworks at the time, such as painting, sculpture, architecture, and metalwork, were always based on themes from stories of the Bible or Greek mythology.

The Ancient Eastern View

Supernatural creativity was also the dominant view in ancient Eastern thought (as represented by ancient Chinese thought) similar to the ancient Western notion of divinely inspired

creativity. However, there was a slight difference. For the ancient Chinese, there was no anthropomorphic God analogous to the Western God of creation, although they did believe in a supernatural moral authority and ultimate force they called *Tian* (Heaven). However, *Tian* was largely not personified, and the depersonification was complete when *Dao* (The Way) replaced *Tian* in the Daoist classics of *Dao De Jing* (which contains the teachings of Lao Zi) and *Zhuangzi* (which contains the teachings of Zhuang Zi).

Parallel to the Western Bible in the Book of Genesis, the ancient Chinese classic *Yi Jing* (*The Classic of Changes*) describes the story of creation. The following is my free translation from the original Chinese text.

Dao is manifested in the interaction of *yin* and *yang*.
What follows from *Dao* is good, as what is produced is a realization of the nature of goodness . . .
Abundant production is an achievement, and everyday renewal or renovation is a virtue.

Accordingly, there is an ultimate origin of everything. *Dao*, as represented by the constant changes and interactions of *yin* and *yang*, creates the world and brings everything into being. The nature of the changes of *yin-yang* is the ability to produce all goodness, including moral goodness.

This idea is also tersely expressed in Chapter 42 of Lao Zi's *Dao De Jing*. There are however a number of interpretations of this passage. My free translation of the Chinese text follows one of the meaningful interpretations.

Dao manifests itself holistically as the One or the totality.
The One manifests itself as the Two in *yin* and *yang* forces.
Yin and *yang* interact and manifest as the Three or *yin*, *yang*, and *he* (harmony).
And the Three gives rise to the ten thousand things.
The ten thousand things carry different degrees of *yin* and *yang*.
And this blending allows the achievement of a state of harmony.

East-West Comparison

Thus, it seems that ancient Chinese or more broadly ancient Eastern supernatural creativity shares some similarities with ancient Western supernatural or divine creativity. For both traditions, there is a representation of the ultimate origin of everything, and the nature of this ultimate origin lies in its ceaseless changes and renovations. Creativity was universally believed to come from a supernatural source outside human beings. Human beings do not create, and all creations are by God (gods) or by *Tian* (*Dao*). In addition, since the ultimate origin or *Dao* is good, creativity implies the creating of all goodness. For the Eastern tradition and in the Chinese mind, for example, this defining feature of goodness also includes goodness to the collective being or contribution to the whole society.

Taken together, the Eastern and Western traditions are similar but not identical. Perhaps, there are two noteworthy differences. One important difference is in the source of supernatural creativity. For the ancient Westerners, creativity emanates from an anthropomorphic God (gods), and human beings imitate through divine inspiration. For the ancient Easterners, creativity emanates from nonanthropomorphic

forces, and human beings only need to follow or discover the nature of *Dao*, as there is nothing new to create. Another important difference is that the Western supernatural creativity always involves newness, whereas the Eastern counterpart does not necessarily imply producing newness. In other words, novelty is not necessarily a defining feature in the Eastern tradition.

Human Creativity: Modern Western and Eastern Conceptions

The Modern Western Conception

Human creativity, or the conception of creativity attributable to human beings rather than divine forces or deities, also emerged in ancient Greece. In particular, apart from the belief in supernatural creativity, some Greek thinkers also believed that artists and poets need to bear some responsibility for their works. For example, Aristotle valued the imitation of life or nature by artists and poets, and argued against the assertion that all arts merely imitated the work of gods. In *Poetry*, he described the poets' activity of composition as due to their original aptitude and by a process of gradual improvements. However, the notion of human creativity was believed to be limited to a selected few such as the poets, and was not generally appreciated at the time.

The notion of human creativity took a new turn for renewed emphasis at the time of the Enlightenment. This was the time when people recognized and celebrated their individual rights and abilities to understand the universe and to direct their own destiny. These new thoughts were supported by the achievement of new inventions and new discoveries, and other human success especially in areas of science and technology. More specifically, individual creative ideas and products were now publicly recognized and were even officially honored in some European countries. Great Britain, for example, offered prizes and even patents and copyrights to creative individuals for their solutions to technological problems starting from the earlier part of the seventeenth century. This modern Western conception of human creativity was also reinforced by many important new theories and new disciplines formulated in the nineteenth century, distinguishing clearly the notion of human creativity from that of supernatural creativity. Darwin's theory of evolution and Marx's theory of the history of humanity are good examples of these new formulations.

The elevation of the notion of human creativity or the concept of creativity as residing in the individual is the key to contemporary Western conception of creativity. Shifting from supernatural creativity and limited human creativity, the Western conception now recognizes that creativity can be conceived as an activity that might occur in areas other than poetry, such as in science, art, literature, politics, business, and even daily life. Regardless of the specific domains to which creativity is applied, usefulness and novelty are regarded as the two crucial features of creativity. More importantly, creativity is no longer looked upon as the exclusive property of the selected few, but ordinary individuals can apply or exercise it within the mundane experiences of life, and not just in the formulation of important scientific and artistic accomplishments.

The Modern Eastern Conception

Philosophers in the Eastern tradition, as represented by ancient Chinese philosophers, unlike the Greek philosophers in the Western tradition, rarely mentioned human creativity. This lack of mention may be due to the Chinese respect for tradition or more likely to the view of the ancient Chinese that human creativity need not be distinguished from supernatural creativity. However, it has to be noted that this failure to distinguish human creativity from supernatural creativity should not be interpreted as the Eastern or Chinese tradition of not valuing or honoring individual thinking and creativity. Any discounting of the importance of human creativity would seem to run counter to the notion of a Chinese intellectual striving to achieve perfection in his humanity through self-cultivation or effortful learning.

Perhaps, one plausible reason why Chinese philosophers did not see the need for the distinction is their belief in the unity of man and the universe. This belief is shared by all schools of thought, including Confucianism. For example, Meng Zi, a great Confucian scholar, once said (as recorded in Chapter 7 of his book *Mengzi* or *Mencius*), "a man who knows his own nature will know Heaven," and "all ten thousand things are in me, and there is no greater joy than to find that I am true to myself upon self-reflection." Another great Confucian scholar Lu Jiuyuan is credited to have said this more directly in the statement: "My mind is exactly the universe and the universe is exactly my mind." Thus, in this light, human creativity is to be achieved through experiencing and interacting with supernatural creativity. However, despite the common belief in the unity of man and the universe, different schools of thought in Chinese philosophy have different understandings on how this unity could be achieved. We will discuss the approaches of two representative schools, Confucianism and Daoism.

Confucianism

In the Confucian tradition, it is believed that all human beings are born with the potential to learn and the free will with which to determine their future. The process of self-cultivation through effortful learning to achieve enlightenment or unity with the universe is thus the process of creativity. In the commentaries on the Confucian classic *Daxue* (*The Book of Great Learning*), my free translation of the following passage (Chapter 5) should be illustrative.

The purpose of *Daxue* is to teach the principles that govern things, and to facilitate learners to proceed from what they know to what they do not know, and to do so to the limits of learning. Only by effortful learning will the learner experience enlightenment and a complete understanding of the totality of everything.

It is believed that the universe is inherently good in the Confucian tradition, therefore, human beings are born with goodness, and creative activities will always embrace goodness. In this connection, it is also believed that highly creative people will not only satisfy their own needs as human beings but will also serve other people for the interests of the community.

Daoism

While Confucianism seems to suggest that self-cultivation, a gradual learning process, could be a way to enlightenment and

therefore creativity, Daoism advocates a different path for enlightenment and creativity. Specifically, Daoist teachings call upon people to lose themselves through doing nothing, and to meditate for the achievement of sudden enlightenment. The Daoist path and similar Buddhist path to enlightenment through meditation have also been incorporated into practice in some schools of Confucianism.

According to the Daoist classics, to become enlightened or to become creative is to have an inner apprehension of *Dao*, with the vanishing of all the distinctions between self and nonself (subject and object). The Master Daoist Zhuang Zi captured this in his story of two old men's discussion of losing oneself. My free translation of the passage from Chapter 2 of *Zhuangzi* is as follows.

Nanguo Ziqi sat at his desk, staring at the sky, breathing slowly, and as if he was losing himself, completely unaware of people and things around him. Yancheng Ziyou who was standing in attendance said, "What happened? Could you really make your body like a withered tree, and your mind like dead ashes? The man sitting here now is not the one who sat here before." Ziqi replied, "Good question, Yan. Do you understand that I have lost myself? You might have heard the music of man, but you haven't heard the music of the Earth. Or if you have heard the music of the Earth, you still haven't heard the music of Heaven."

In the story, Ziqi is described as having reached the stage of losing oneself, in which he could actually listen to the sound from Heaven, and the music must have been highly inspirational for him at this stage of harmony or union between man and the universe. Thus, losing oneself starts when people approach the realm of tranquility and enter the realm of nonbeing.

Zhuang Zi in the same chapter of *Zhuangzi* also referred to this losing oneself as "Heaven and Earth and I co-exist, and the ten thousand things and I are one." Zhuang Zi also ended the chapter with the well-known Daoist story of the butterfly dream as the poetic presentation of the realm of nonbeing.

Once Zhuang Zhou dreamed of being a butterfly, dancing freely and not knowing who Zhou was. On awakening, he found himself to be Zhou. It was not known whether Zhou dreamed of being a butterfly or the butterfly dreamed of being Zhou.

Accordingly, through losing oneself in meditation, one is able to connect with the universe, and once connected, all one does will be highly creative. This Daoist notion of losing oneself has had a great impact on Chinese intellectuals and their creative activities throughout Chinese history, especially in poetry and painting. It is said that many great Chinese poets and artists have produced a large amount of truly great works through meditation and self-cultivation, which allowed them to penetrate to the great tranquility and achieve union with the universe.

In summary, in the Chinese view, human creativity and supernatural creativity could be the same, insofar as human beings can live in *Dao* through a lifetime of self-cultivation and/or meditation. Perhaps, the modern Chinese perspective differs from the ancient view in that human beings become more central in initiating and bringing forth the creative process. More importantly, any human beings can produce creative artworks through the practice of meditation and self-cultivation.

East–West Comparison

Modern Western conception of creativity is the result of a complete shift from the ancient notion of divinely inspired supernatural creativity to the notion that creativity resides completely within the individual. This somewhat radical shift was reinforced by the rise in individualism and capitalism, along with major changes in science and technology, which have brought forth new discoveries and new inventions. In this connection, usefulness becomes an important defining feature of creativity in addition to the notion of novelty.

In the Eastern world, the parallel shift however is less complete, with a stronger continuity connecting the ancient view and the modern conception. Human beings have now a more important role in bringing forth the creative process. Rooted in Confucianism and Daoism, the modern Easterners especially the Chinese start to believe that meditation and self-cultivation can lead people to achieve a connection to heaven or greatness, and therefore, to a high level of creativity. In this Eastern tradition, while moral goodness and usefulness in terms of social values to society are stressed, novelty remains not the most important defining feature of creativity.

Contemporary Studies on the Conceptions of Creativity and Creative Performance

Since Easterners and Westerners may have different conceptions of creativity due to their distinct cultural beliefs and heritage traceable to distinct Eastern and Western philosophies, it is of interest to explore the similarities and differences in conceptions among Easterners and Westerners in their contemporary real-life settings. To address this concern, researchers have conducted studies investigating lay conceptions of creativity among people in the East and the West. These lay conceptions of creativity are also called implicit theories of creativity.

On the other hand, since contemporary people in modern Eastern and Western societies tend to have more interactions across cultures, it is conceivable that Easterners and Westerners will come closer on their views of creativity. More specifically, given the more dominant ideology in the West, with its advances in science and technology and its positive valuation of novelty, it is likely that contemporary Easterners could be strongly influenced by Western ideology and even come to adopt the Western perspective in viewing creativity. In this regard, researchers have also conducted studies on the assumption that East–West differences could be investigated on common creativity measures designed for Westerners. We will discuss in the following these two bodies of research to understand East–West differences, studies on the implicit theories of creativity and studies on East–West differences on performance on tasks requiring creativity.

Implicit Theories of Creativity

In the studies of the implicit theories of creativity, laypersons, psychologists, teachers, or experts in different domains are asked about their views of creativity. Typically, participants are requested to describe the characteristics of creative individuals or rate the importance of specific personal characteristics relevant to creativity.

Research with Western populations

Most of the studies in this area are with Western populations, particularly Americans. People's implicit theories of creativity were investigated across different social and age groups, including undergraduate students, teachers, parents, psychologists, artists, managers, and laypeople of different professions. These studies have suggested that people's implicit theories of creativity had a number of core characteristics that included innovation/imagination, intrinsic motivation, independence, risk taking, breadth of interests, intelligence, high activity/energy level, and a sense of humor. Interestingly, people's implicit theories of creativity, intelligence, and wisdom were found to overlap to a certain extent, but the ideal creative person as opposed to the ideal intelligent and wise person could be distinguished by the characteristics of imagination, aesthetic taste, intuition and inquisitiveness, freedom of spirit, and an unwillingness to be bound by the rules of society.

At a more refined level, apart from the distinguishing characteristics of the general implicit theories, studies have also indicated that there might be other additional distinguishing characteristics for implicit theories of creativity in different domains, suggesting that implicit theories could be domain-specific. For example, being logical and willing to experiment could be important for scientific creativity, being expressive and emotional could be relevant to artistic creativity, and being helpful could be necessary in everyday creativity. There is evidence that there could be greater variability of implicit theories among professional groups, such as artists, scientists, teachers, and politicians, than among Westerners in neighboring countries, such as Germany and Austria.

Research with Eastern populations

Research studies on implicit theories of people in the East are fewer in number than those of people in the West, and they were mostly conducted with the Chinese population. Specifically, similar studies on people's implicit theories conducted in the West have also been conducted with people in Mainland China, Hong Kong, Taiwan, and Singapore across different social and age groups that included college students, teachers, and other laypersons. These Chinese participants were found to report, as the American participants in other studies, similar core characteristics of creativity, such as innovative ideas, imagination, intelligence, independence, and high activity/energy level. However, it is noteworthy that aesthetic appreciation and a sense of humor, two distinguishing characteristics of creativity in the West, were not reported among the Chinese. In contrast, three characteristics, being inspiring to people, contributing to the progress of society, and being appreciated by others, reported as salient for the Chinese were not reported for the Americans in Western studies.

Thus, taken together, studies on implicit theories conducted separately in the West and the East with Western and Eastern populations allow some indirect comparison. These studies do suggest that Easterners seem to emphasize the social and moral components of creativity whereas Westerners tend to emphasize individual characteristics such as humor and aesthetic appreciation. This difference might reflect the different worldviews held by people in the East and people in the West.

Studies on East–West Differences on Creative Performance

Apart from the studies on the implicit theories of creativity, another body of research studies aimed to examine East–West differences sought to investigate differences in creative performance and expression among Easterners and Westerners. In this body of research, two distinct approaches could be distinguished. One approach is based on the assumption that the conception of creativity is relatively common across cultures, and differences in levels of performance on tasks reflecting creativity could be assessed using a standardized test that is universally meaningful. The second approach is based on the assumption that the concept of creativity is relatively culture-specific and domain-specific, and any measurement of creativity or East–West differences on creative performance needs to take into account the factors of culture and domain.

Research based on the notion of a common conception of creativity

In these studies, creativity is often assumed to be assessed by divergent thinking using standardized tests such as Guilford's Unusual Uses Test, the Torrance Tests of Creative Thinking (TTCT), and the Test for Creative Thinking – Drawing Production (TCT-DP). TTCT is by far the most widely used divergent thinking test, especially for school-age children.

In general, it was found that Americans performed at a higher level of creativity than did Asians. For example, in one study using TCT-DP with children from eleven countries, children from England, Germany, and the United States scored higher than those from India, Indonesia, and China. While in some studies the level of modernization has been employed to account for the performance differences between Westerners and Easterners living in less modernized societies, the explanation seems to break down when it is applied to East Asians living in more modernized societies in Japan, Hong Kong, Taiwan, and Singapore.

However, there were also studies with results favoring Asians, especially Japanese and Chinese, rather than Westerners. These studies employed the figural form of TTCT, or other divergent thinking tests that required applications of knowledge of mathematics and natural sciences. One explanation is that the figural form of divergent thinking tests would favor East Asian children due to their exposure to the graphical characters of the Asian or Chinese language, which might enhance East Asian children's general spatial ability. Another explanation has to do with the Asian educational system that emphasizes domain-specific knowledge in mathematics and natural sciences, leading to Asians' being more creative in certain domains, for example, the domains of mathematics and natural sciences in China.

Research based on the notion of culture-specific creativity

With the assumption that creativity could not be understood as relatively common or universal across cultures, the use of a standardized divergent thinking test for assessing creativity would appear inappropriate for studies investigating East–West differences on performance on tasks requiring creativity. Therefore, these studies use product-oriented tasks and consensual assessment of creativity. The primary feature of this approach is to ask participants to create a product (a poem,

an art design, or a scientific invention during an experiment), and judges (experts in a specific domain or laypersons) are then asked to evaluate the creativity level and other qualities of each participant's product with those of the products of other participants.

While the product-oriented approach with consensual assessment has been recognized as providing real-life and more authentic assessment to take into consideration domain-specific and cultural-specific creativity, few studies have been conducted under this approach. For example, in a pioneering study with American and Chinese college students, collage making and pencil drawing were judged by American and Chinese judges. American participants were judged to produce more creative and aesthetically pleasing artworks than Chinese participants, and Chinese participants with explicit instructions to be creative were found to perform at a higher level of artistic creativity than Chinese participants not primed to be creative. The findings were interpreted as consistent with cultural differences.

East–West Comparison

The studies on the implicit theories of creativity of Easterners and Westerners seem to suggest that contemporary Easterners do hold similar but not identical conceptions of creativity as Westerners. Thus, far from being universal or common across cultures, the conceptions of creativity are in part cultural-specific, meaning that Easterners and Westerners do share some common views but may also differ on other views. Specifically, Easterners are more likely to view creativity as having social and moral values, and they value the connection between the new and the old more than Westerners do. Westerners on the other hand tend to focus more on the specific individual characteristics of creative individuals.

The studies on comparing the performance of Easterners and Westerners on tasks requiring creativity yielded conflicting results. Easterners or Westerners did not seem to consistently outperform the others. The differences in results favoring Easterners or favoring Westerners might not be due entirely to differences in the conceptions of creativity of Easterners and Westerners. Rather, approaches to assessment, domain-specificity, social values, education, levels of modernization, and many other factors might account for the East–West differences on people's performance on tasks requiring creativity.

Nonetheless, contemporary empirical studies focusing on East–West comparison do suggest that there are real East–West differences. There are probably multiple plausible explanations for these differences. For example, Easterners are said to be more process-oriented, more intuitive in knowing, and more concerned with relationships and interdependence, whereas Westerners are said to be more product-oriented, more logical in knowing, and more concerned with individual self and independence. Very often, the discussion of these differences is included as the discussion on cultural differences, implying that people's cultural heritage could influence their worldviews and their understanding and evaluation of creativity. In addition, it might also be argued that cultural differences could lead to East–West differences in cognitive processes that might at least reinforce the cultural differences in the understanding and conception of creativity. We will now turn to the discussion of these issues.

Basis for the East–West Differences: Culture and Cognition

Individualism and Collectivism

Given the reality of East–West differences in the conceptions of creativity and performance on tasks requiring creativity, researchers have sought explanations of such differences in terms of particular dimensions of cultural variation. Among the different dimensions, the dimension of individualism–collectivism has received the most attention and has been most extensively studied. Some researchers have even suggested that this dimension is the deep structure of cultural differences from which other differences evolved, and the dimension can explain to a large extent differences in creative activity levels for Westerners from individualistic societies and Asians from collectivistic societies.

The essence of the individualism–collectivism dimension is the definition of the self as independent or interdependent with some in-groups (e.g., family, tribe, coworkers, and nation). People in individualistic cultures see the self as stable and the environment as changeable, thus focusing more on the development of self. In contrast, people in collectivistic cultures see the environment as stable and themselves as changeable, and therefore they are more motivated to find a way to fit themselves in with relevant others.

With reference to creativity, in a Western individualistic society, people may be more willing to defy the crowd, which may be central in creativity, because a person's sense of worth is defined largely by what he or she does as an individual. In contrast, in an Eastern collectivistic society, one's sense of worth is determined with reference to the group and may be seen as commensurately reduced if one alienates oneself from that group. Thus, defying the crowd in the East may be seen as less valuable than making contributions to society. Consequently, an individualistic Westerner might see more of the value of personal success with individual characteristics as a creator, whereas a collectivistic Asian might see more of the social and moral value an individual can bring to society. In this connection, one would expect that these differences in values are likely to be reflected in the differences in Easterners and Westerners' implicit theories of creativity.

Along the same line of generalization, one would expect that a collectivistic Asian culture, which tends to encourage interdependence of relationships, and conformity to societal norms and tradition, may be less conducive to the development of creativity. In contrast, the more individualistic culture of the West, which tends to encourage self-exploration and individual achievement, may be more supportive of the development of creativity. Thus, it is no surprise that Westerners may perform better than Easterners on tasks requiring creativity.

However, caution must be exercised in interpreting this generalization. It has to be noted that there are often a great deal of within-group differences in virtually every comparison of East–West differences. It means that despite the significant differences in group averages, it may happen that some individuals within each group are more typical of the other group. For example, some Americans may have strong collectivistic tendencies, and some Chinese may be quite individualistic.

Cognitive Processes: Contextual and Focused Mindsets

Richard Nisbett, in his book *The Geography of Thought: How Asian and Westerners Think Differently and Why*, reports numerous studies showing that Westerners and various groups of Asians (Chinese, Japanese, and Koreans) respond very differently to a wide range of cognitive tasks. He challenges the general assumption that everyone, Asians and Westerners alike, perceives, thinks, and reasons the same way, and argues convincingly that culture influences how Asians and Westerners perceive and think in powerful (and experimentally verifiable) ways.

For example, in one categorization task, participants were asked to decide which two of the three things (e.g., a panda, a monkey, and a banana) go together. Westerners typically categorize by types (animals) where Asians typically categorize by relationships (monkey eats bananas).

In another memory task, Japanese and American students were shown pictures of aquariums containing one big fast-moving fish, several other finned swimmers, plants, rock and bubbles. Japanese students spontaneously recalled 60% more background elements than did American students, and referred twice as often to relationships involving background objects (e.g., the little frog above the pink rock). Japanese students also did much better than American students at remembering correctly whether they had seen a test object before when it was shown in the context of its original surroundings.

These and other experiments by Nisbett and his colleagues have led Nisbett to conclude that Westerners and Asians literally see different worlds through their focal and contextual mindsets, respectively. Accordingly, Westerners attend to the focal object, while Asians attend more broadly to the overall surroundings and to the relations between the object and the field. In other words, Westerners tend to focus with tunnel vision whereas Asians or Easterners tend to see the big picture with a wide-angle lens. Nisbett does not discuss creativity in his book, but the general conclusions are probably as true for creativity as they are for the kinds of cognition he has discussed.

The social structures and sense of self that characterize individualism and collectivism seem to fit well with the respective worldviews and cognitive mindsets of Westerners and Easterners. The individualistic or independent nature of Western societies seems to work together with the Western focus on particular objects in isolation from their context, and is consistent with Westerners' belief that they can know the rules governing objects and therefore can control the behaviors of the objects. Similarly, the collectivistic or interdependent nature of Asian society is consistent with Asians' broad and contextual worldview, and their belief that events are highly complex and determined by multiple factors.

It is likely that the East–West cognitive differences originate in child rearing and social practices. There might be a cyclical

process among social practices, worldviews, and thought processes or mindsets. Thus, the social practices might promote the worldviews, the worldviews in turn dictate the appropriate mindsets, and the mindsets both justify the worldviews and support the social practices. However, people's mindsets seem to be somewhat malleable. Studies examining Asians living in Western societies and Westerners living in Asian societies often find that their mindsets go native. On the other hand, bicultural people who live in two cultures, like those in Hong Kong with its British and Chinese heritage, tend to show mindsets or thinking patterns intermediate between Easterners and Westerners, or at least they can alternate between the two mindsets. These results suggest cognitive modifiability by living for a time in another culture.

Thus, the contemporary East–West differences on the conceptions of creativity and creative performance are real, and there is evidence to support the basis of differences in culture and cognition. However, social interactions across cultures, changing social practices, and greater exposure and experience living in the East or the West in another culture different from one's own might combine to contribute to a shift in mindsets relevant to creativity. East and West are going to meet with each moving in the direction of the other, and perhaps in the convergence, the future blended conception of creativity will contain the best of both cultures.

See also: Confucianism; Cross-Cultural Differences in Creativity; Cultural Diversity and Creativity.

Further Reading

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Relevant Websites

- <http://www.clearlycultural.com/geert-hofstede-cultural-dimensions/> – This site contains descriptions of Geert Hofstede's cultural dimensions, including individualism–collectivism, and information on cross-cultural communication
- <http://culturecognition.isr.umich.edu/progr.php> – This site gives information on the culture and cognition program at the University of Michigan and provides links to similar programs at other research sites

Eccentricity

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Glossary

Curiosity The intellectual intrinsic motivation; the force which drives us to seek new knowledge.

Diathesis Inherent proclivity to a condition, often used to connote vulnerability to a disease.

Idealism An intrinsic motivation concerned with improving the world, upholding justice, and extending compassion to others.

Imagery Sensory impressions, often visual, created by the mind.

Transgression Behavioral acts not in accord with established dictates of social propriety.

Eccentricity is a socially variable concept that encompasses attitudes and beliefs about nonconforming personalities and behaviors that do not easily match the normal expectations of a society. Eccentrics are lifelong creative nonconformists who value their independence of thought over social conventions and display little functional impairment related to their eccentricity.

Historical Evolution of the Term

Eccentricity is not a stable concept throughout history. Various, eccentricity has been taken to mean “insane,” “odd,” “perverse,” or “wild” with any number of intermediary denotations and a host of connotative subtexts. The term itself is derived from mathematical metaphor, and in the physical sciences it is still used to characterize mathematical data that deviates from expectation. Eccentric personalities pervade the creative spheres of both the arts and sciences, providing the archetypes for such stereotypes as the misunderstood artist and the mad genius. Understanding eccentricity requires first acknowledging the fact that it is a plastic concept that depends on shifting social norms for its definition. Beliefs that might be considered odd or bizarre in today’s society might have been conventional only a few generations ago or might be considered normal at some future date. Similarly, behaviors displayed by some cultures, such as a predilection for nudity or a desire to eat raw fish, might be normal in that context but would be considered strange and noteworthy in a different social environment. Miranda Gill provided an excellent summary of the problems inherent in classifying a person or group as eccentric. She wrote:

Contrary to what is often assumed, the meaning of eccentricity is neither timeless nor self-evident. The very synonyms used to define it – bizarre, singular, original, peculiar, odd – suggest the frustration of rationality and the failure of the codes by which social and mental life is interpreted. Indeed, the concept owed its success precisely to its ability to adapt to new contexts. Eccentricity is always defined in relation to something it is not, but the imaginary ‘centre’ (or ‘centricity’) from which it departs is far from stable.

The elusiveness of a single historical definition of eccentricity confounds our view of popular figures to whom we would

attach the label. Simultaneously, however, it is true that an interest in famous eccentrics is largely responsible for our understanding of the term. Eminent artists and scientists have long been the subject of popular inquiries regarding their eccentricity, as famous individuals seem especially prone to retellings of anecdotes regarding their odd behaviors. One does not have to look too deeply to find exhaustive accounts of Albert Einstein’s eccentric penchant for lecturing to his infant nephew, Andy Warhol’s private caricatures of popular media which include a homosexual reinterpretation of the relationships in the Batman comic, or rumors about Nikola Tesla’s mad genius, including designs for an infamous (thankfully unsuccessful) “Peace Ray.”

These stories become part of the legend of great creators and inventors, but they reflect an idealized image of the eminent figure that contributes to the distortion of the historical truth of the person’s character rather than a contribution to the collective understanding of eccentricity. Popular figures do, however, feature in the development of related stereotypes of eccentric behavior, as their definitive example influences others to adopt their behavior.

The Victorian Era

Clearly, public fascination with eminent eccentrics is far from new. However, the roots of its current incarnation are most firmly bedded in English norms and values present just prior to and during the Victorian era. Indeed, it has been argued by Gill and also in some depth by Victoria Carroll that the historical adulation of eccentric personages during the Victorian era, more than any other recent epoch, has molded the expectations of what it means to be eccentric for much of the rest of the Western world.

As Carroll described it, the development of Victorian interest in eccentricity began some decades earlier at the turn of the eighteenth century, when popular interest in the subject fed an explosion in the proliferation of books in the then-new genre of biographies, of which eccentric biographies was a sub-genre. These anthologies detailed, in a fashion similar to modern accounts of eccentrics, noteworthy individuals whose actions were outside the realm of normal morality or behavior.

Though they were extremely popular, these works were not known for their accuracy or integrity. Carroll notes that most were produced using anecdotes drawn from newspapers, magazines, and journals available at the time, and were put together as a sort of “cut-and-paste” collage of unverified stories. Nevertheless, Carroll argued the impact of these biographies with the following:

more than merely being an indicator of the prevalence of a discourse of eccentricity in the first half of the nineteenth century, eccentric biography served, first to propagate this discourse amongst ever diversifying readerships and, second, to popularize new ways of organizing and presenting biographical material about remarkable persons, thus shaping how eccentricity was subsequently understood and represented.

Contemporaneous with eccentric biography was the depiction of eccentricity in popular Victorian literature, the interest in which was driven to a much greater extent in this medium by the phenomenon of transgression. The concept of transgression, developed by Peter Stallybrass and Allon White, posits that acceptable (normal or conventional) behavior involves a complex interplay between standards of propriety and fascination with the forbidden. This included, as Gill puts it “anxiety about the body, filth, and deformity.” In essence, because Victorian social codes were exceedingly strict, the desire to view or experience nonconformist behavior was, at least for the repressed middle class, very great. The obvious parallels to psychodynamic theory serve to underscore the pervasiveness of this effect as well its ability to draw mass appeal. No implication is made that transgression supplied an environmental cause for eccentricity or any other nonconformist behavior during the Victorian era; rather, the theory asserts that transgression provided an impetus for more conforming individuals to appreciate and respond (and perhaps to over-respond) to eccentric behavior as it became, by virtue of its abnormality, to be viewed as increasingly provocative.

During the height of transgressive interest in all things eccentric, the term acquired a broad range of meanings ranging from “exuberant” to “grotesque.” Periodicals, magazines, and etiquette manuals featured sections devoted to “eccentric” topics, but the word was used in ways barely reminiscent of the relatively harmless modern sense. As Gill made clear, in France at the time of expansion in Anglophile Victorian literature, monsters, deformities, prostitutes, and homosexuals were all given the moniker “eccentric” at one time or another. In more tame print, novels featured eccentrics to lend flavor to stories and the meaning of the word in this context was subdued, almost quirky. These characters did cross the lines of propriety, but they did so in small, creative ways. Dickens, especially, was fond of the eccentric older person archetype and featured it in many of his novels. As the public imagination grew weary of forbidden experiences, gradually the term shed its more explosive connotations and settled again to something akin to the current definition.

Modern Era

Popular interest in eccentricity persists for much the same reason that it always has: Entertainment value. Though Victorian compendia of eccentric biographies are largely relegated to the

lonely world of obscure historical texts, the practice of printing anthologies of eccentric notables continues. Today’s eccentric biographies include such titles as *The Reader’s Digest Great British Eccentrics* and Karl Shaw’s *Mammoth Book of Oddballs and Eccentrics*. Among these texts, the one anthology stands apart is Edith Sitwell’s *The English Eccentrics*. This work exemplifies the class of literature as a whole including, unfortunately, the fact that, like its historical forbears, it was poorly researched and contains both factual inaccuracies and gross mischaracterizations. What stands out, however, was the fact that the book was first published in 1933 and, unlike many of its kind, the book bravely refuses to go out of print. As such, it provides clear evidence of a bridge between Victorian era eccentric biographies and the popular works produced today. Additionally, the book garners attention because of the oddness of its author, who was a controversial eccentric figure in her own right.

Scholarly interest in the topic of eccentricity is currently less well formed, a fact that is mentioned, to different degrees, in the independent works of Gill, Carroll, and Weeks. This is understandable, for understanding eccentricity is no easy task. As the development of the term demonstrates, the challenge of comprehending the causes and expressions of eccentricity is only exacerbated by the uncertainty of the term. Scholars who use historical accounts of eccentricity in an effort to understand the phenomenon must not only be vigilant regarding their own perspectives about eccentricity, but also those biases present within the material itself.

Characteristics of Contemporary Eccentrics

Who, then, is an eccentric? In his landmark study of the topic, David Weeks sought to tease out those motivations and factors that would move someone away from normal, well conformed behavior and toward the socially marginal (but arguably much more interesting) world of eccentricity. His methods, as described in his book *Eccentrics* were relatively straight-forward. Using open advertisements, word-of-mouth references, and third party referrals, Weeks was able to compose a group of 789 eccentric individuals (309 men, 480 women). He then interviewed these eccentric individuals and administered to them tests of personality (the 16PF test), IQ (multiple standardized test were used), and mental health (the PSE inventory).

From his interviews, psychological tests, and informal conversations with eccentrics, Weeks composed a series of traits he saw as threads held in common across the diverse tapestry of eccentricity. These traits served, on the whole, to sum up eccentricity as it was expressed by the eccentrics he studied, though it was clear that not all traits were necessarily evident in any one eccentric individual. His description of 25 characteristics published in the previous edition of the *Encyclopedia of Creativity* remains the most comprehensive listing of eccentric characteristics as they are currently understood. They are faithfully reproduced below (note that they are in descending order of frequency as they were observed in study populations):

- Enduring nonconformity
- An enduring and distinct feeling of differentness from others
- Creative

- Strongly motivated by exceedingly powerful curiosity and related intellectual exploratory behavior
- Idealism, wanting to make the world a better place and the people in it happier
- Happily obsessed with a number of long-lasting occupations
- Intelligent
- Opinionated and outspoken, convinced that they are right and the rest of the world is out of step with their ideas
- Noncompetitive
- Not necessarily in need of reassurance or reinforcement from the rest of society
- Unusual in their eating habits and living arrangements
- Not necessarily interested in the opinions or company of other people, or of personal popularity
- Possessed of a mischievous sense of humor, charm, wit, and whimsy
- More frequently the eldest or an only child
- A poor speller, especially in relationship to their above average general intellectual functioning
- Eccentricity noted in at least 36% of detailed family histories of eccentrics, usually a grandparent, aunt, or uncle (it should be noted that the family history method of estimating hereditary similarities and resemblances usually provides rather conservative estimates)
- Eccentrics prefer to talk about their thoughts rather than their feelings; there is a frequent use of the psychological defense mechanisms of rationalization and intellectualization
- Slightly abrasive
- Midlife changes in career style
- Feelings of "invisibility," which means that they believed others did not seem to hear them see them, or take their ideas seriously
- Feel that other people can only take them in small doses
- Feel that others have stolen, or would like to steal, their ideas; in some cases, this is the reality
- Dislike small talk or other apparently inconsequential conversation
- A degree of social awkwardness
- Single.

More than a few of these traits merit further attention, and are discussed in further detail elsewhere in this article, because of their association to other areas of interest, such as mental disorder and creativity, but some stand out because they are vital to understanding the potential causes of eccentric behavior. Specifically, there are traits found in Week's analysis that speak to underlying intrinsic motivators, the existence of which would be necessary to provide a rationale to adopt and maintain the socially marginal, and poorly extrinsically motivated, eccentric lifestyle.

Nonconformity is the foundational characteristic of eccentricity, for nothing so perfectly defines what eccentricity is as a conscious refusal to conform to social norms. Questions of what gives rise to nonconformity and how it is expressed in society are often complex. As Cecilia Ridgeway makes clear, considerations of status, competence, and motivation all influence the interplay between conforming and nonconforming behavior. Status, we must recognize, relates to both perceived status in small groups and, in the long-term, our socioeconomic status. This is a point on which George E Marcus and

David Weeks agree: It's easier to be eccentric if you're in the upper classes. Marcus so closely associates eccentricity and high status that he proposes a theory that eccentricity is nothing more than a defiant, multigenerational display of elite dynastic families, fetishized as a mark of distinction. A full reading of Marcus's work, however, imparts the impression that he has perhaps imbibed too much of the portrayal of eccentrics as they were presented in earlier transgressive eras.

Curiosity and idealism are notable because they have been recognized as basic intrinsic motivators. Weeks acknowledges curiosity as a "human motivation that is primarily intellectual" and refers to it as "the intrinsic motivation." Steven Reiss considered curiosity one of the multidimensional intrinsic factors in his theory of 16 basic intrinsic motivators. He posits that the need for curiosity is derived in humans from a genetic legacy of adaptive animal behavior involved in obtaining food and avoiding predation. Reiss associated curiosity with the intrinsic feeling of wonder. This is compelling because wonder is a potent force in the world of eccentricity. It characterizes the feelings of eccentrics about their world and provides one reason for the eccentric penchant for many long-lasting hobbies and occupations.

Idealism is equally important as an intrinsic motivator, but it is less well understood. Reiss admitted uncertainty concerning the behavioral origin of idealism as it is associated closely with altruism, the existence of which in animal behavior is a topic of debate. Additionally, it seems counterintuitive that some eccentrics display idealistic desires simultaneously with antisocial behavior. When one considers Reiss's assertion that social contact and idealism are unrelated intrinsic motivations and that motivations naturally prioritize themselves, the conundrum partially resolves itself, for while eccentrics may have a motivation to improve the world, it doesn't necessarily imply they place equal value on social engagement.

One final item not included in Weeks' 25 characteristics of eccentrics is their relative happiness and contentment with their lives. In Weeks' own words "eccentrics appear to be happier than the rest of us. This is not to say that they are happy all the time . . . But nearly everyone we met seemed to be pretty contented with his lot in life." Though this is a subjective evaluation of eccentrics and therefore not empirically measurable, the persistence of joy in the character of eccentrics bears some scrutiny, especially in regard to any consideration of eccentricity as a potentially pathological condition.

Mental Disorder and Eccentricity

There is an undeniable similarity between eccentricity and certain mental disorders, especially those along the spectrum of schizophrenia. It is not by accident that early uses of word "eccentric" were polite euphemisms for the word "insane." A glance at the diagnostic criteria presented in the DSM-IV-TR for schizotypal personality disorder, for instance, yields such unfortunate descriptions as "Odd beliefs or magical thinking that influences behavior and is inconsistent with subcultural norms (e.g., superstitiousness, bizarre fantasies or preoccupations)," "Odd thinking and speech (e.g., vague, circumstantial, metaphorical, overelaborate, or stereotyped)" and the damning "Behavior or appearance that is odd, eccentric, or peculiar."

Addressing eccentricity as a phenomenon is, in part, a process disentangling the stigma of madness from the behaviors that eccentricity engenders. Weeks, mindful of this burden, examined mental illness as one part of his study of eccentrics. As part of a series of interviews with 130 of self-identifying eccentrics, he administered the Present State Examination. The PSE is a form of mental-state examination, generally administered as a series of quasi-structural interview questions, used as a component of the diagnosis for mental disorders. His results indicated 8% of the examined eccentrics displayed mild-to-moderate symptoms of either schizotypal or schizoid personality disorder. This is somewhat higher than the generally accepted lifetime incidence for the disorders which, in a recent systematic meta-analytic review of the literature by Elliot Goldner and his colleagues, was shown to be, on average, 1.45% with a variation between two and five fold among studies. While this does give cause to believe that eccentricity might increase the diathesis of schizophrenic disorders, it helps confirm that eccentricity is not by itself an expression of disorder.

Eccentricity Versus Functional Impairment

For a deeper understanding of why eccentricity isn't a pathological condition, we must look at what it means to have a mental disorder. Like eccentricity, the definition of the term mental disorder has undergone a number of historical vicissitudes; however, these fluctuations in meaning are not relative to any one society's view of the condition, but instead indicative of an underlying change in the philosophy of the nature of illness. For the better part of the century, the guiding principle in any attempt to define mental illness has centered around the concept of functional impairment. Spitzer and Endicott, for example, require in their definition of mental disorder for specific demonstrations of "distress, disability, and disadvantage." Wakefield's "harmful dysfunction analysis" theory, which has been a guiding principle of psychopathology since the revision of DSM-III, defines mental dysfunction using very specific terminology, his definition includes not only disability, but "failure of a system to perform as it was designed to perform by natural selection."

A full discussion of the permutations and underlying philosophies involved with the history of these definitions is beyond the topic of eccentricity, but what is hopefully made clear by this elaboration is that each of these definitions rules out any behavior that does not functionally impair the individual or, by contagion, society. In consideration of this, Weeks' observation, mentioned earlier, that the eccentrics he interviewed were happy and content becomes a salient point because it denies the argument that eccentricity meets the functional impairment criterion for mental disorder. Weeks also contributes to the discourse on this topic directly in his observations of the eccentric capacity for mental imagery. He writes:

One common trait of eccentrics is that they often experience mental images that are more vivid than those of normal people. Some extreme eccentrics have visions, which is a not uncommon symptom of schizophrenia. The important distinction is that the schizophrenic has no control over his visions and the voices he hears; they intrude themselves upon him forcibly and give rise to a terrifying sensation of powerlessness. The eccentric, on the other hand, is likely to find his visions a source of delight, and he has much more control over them. The psychotic state severely disrupts

thought processes, leaving the person dysfunctional, whereas the eccentric's brain usually functions perfectly well – it just does so in peculiar and largely unknown (and unknowable) ways.

Creativity, Eccentricity, and Mental Disorder

As creativity is one of the most important, widely seen traits in eccentricity, the degree to which eccentricity, creativity, and mental disorder are related is a pertinent field of inquiry. Daniel Nettle has argued that creative traits share a genetic component with schizophrenia and affect disorder, and that expression of mental disorder is an unfortunate by-product of the otherwise extremely adaptive trait of creativity. The proclivity for creativity, affect disorder, and schizophrenia, according to his theory exist along a continuum wherein epigenetic and environmental factors interact with a variable genetic penchant for all three behaviors. Thus, according to this model, eccentric behavior might be an expression of creative behavior further along the spectrum toward mental disorder. Two distinctions would have to then be made to define the "space" of eccentricity with regard to both creativity and mental disorder. On one end, the degree to which nonconformity separates creativity from eccentricity would need to be determined, and on the other would be a boundary defined by functional impairment. In an similar argument, R. A. Prentky argues that "optimal degree of deviation from normal patterns of information processing is necessary for creative work." Here, we see hints that eccentricity might be a behavioral correlate to the theoretical framework of creative optimization. Alternatively, we might conclude by synthesis of both theories that creativity is itself a protective factor that lowers the diathetical predisposition that eccentrics might otherwise display for mental disorders. Sadly, these positions, though supported in theory by extant literature, have yet to be verified.

To present a contrasting view, we can look at argument wherein the case against the assumption that either eccentricity or creativity are inherently related. Judith Schlesinger recently tackled the topic by way of her critique of the "mad genius" stereotype. In her article, she explained how the concept of the "mad genius" was originally founded on fearful misconceptions of genius and how it was supported, even endorsed, by bad science. She cited self-selection bias, poor research standards, and over-representation of mental illness in historical data as causes for our continued belief in the concept. The most compelling aspect of her argument is the meticulous degree to which she scrutinizes the works of the three modern proponents of "mad genius," Nancy Adreasen, Arnold K. Ludwig, and Kay Redfield Jamison, and the glaring errors she found in their data. In direct opposition to the theories proposed by Nettle and Prentky, she concluded her analysis with the opinion that creativity and mental disorder are not in any way meaningfully related, but rather appear to be correlated through the same means of empirical distortion that originally gave rise to the "mad genius" concept. Further, she argued that self-identification as a "mad genius" or eccentric serves a protective role for creative individuals as it provides them a "semblance of consistent identity in a life full of occupational stops and starts."

Creativity and Eccentricity

If nonconformity describes who an eccentric *is*, then creativity tells us what an eccentric *does*. The products of eccentricity, be they a poem, a particular style of dress, or a way of living, are known for their striking originality, if not their outlandishness. Surprisingly, it is in the area of creativity and eccentricity that the greatest number of opportunities for research still exist. The reasons for this are simple. Both our understanding of eccentricity and creativity have grown enormously in previous decades, and though creativity is widely researched, eccentricity remains a relatively small area of study. Much of the work done in the past decade, though established on valid premises, has used methods that are primarily biographical, autobiographical, or historical in nature, as such the data have not been tested or collected in a controlled fashion. These data still require objective validation in order to prove that the original observations are repeatable and empirically verifiable. Also, the data need to be reviewed in order to explore new connections in our evolving knowledge. The dichotomy of what eccentricity is and does has therefore become a dichotomy between our present understanding and what we hope to learn in the future. The goal of this section is to demonstrate aspects of eccentricity that are known to be interrelated with creativity. Those elements established as more or less valid will be noted as such; gaps in the literature, too, will be identified.

Intellectual Traits

The high level of intelligence demonstrated by many eccentrics, in the range of 115–120 points on standardized measures, is reliably related both to measurements of giftedness and creativity. Often, as the current research makes clear, eccentrics are identified early by teachers or psychologists as being intellectually gifted. This level of intelligence, while shown in many eccentrics, is not a uniform predictor or precondition for eccentricity. Like in any other population, eccentrics display a variable range of intelligence; however, the skew toward higher intelligence on average does suggest a more optimal intellectual capacity for creative thought within the group of eccentrics as a whole. Weeks notes, too, that in regard to convergent thinking tasks, eccentrics generally approached solutions to problems through synthesis, conceptual analysis, symbolism, and constructive modeling.

In addition to being highly intelligent, eccentric individuals display a remarkable capacity for experiencing and consciously directing detailed mental images. The degree to which eccentrics can actively control their mental images not only supplies evidence for their relative lack of psychopathology (an argument seen above), but also correlates to a host of mental capabilities observed in creative individuals. The depth to which eccentrics can imagine is enormous. Weeks contends that the quality of the mental imagery displayed by eccentrics is not only sufficient to allow for near eidetic recall of an image, but powerful enough to allow the eccentric to immerse themselves completely in imaginative creations to a degree not unlike a lucid dream. While deeply imagining, eccentrics may use their ability to transform mental images to generate novel associations between ideas or images. Eccentrics accomplish

this feat either visually by rapidly fusing mental images in successive generations or multi-modally by altering information across the senses, in a manner similar to a transitory experience of synesthesia.

Weeks proposes a shared neurological basis for the mental imagery process utilized by eccentrics and the process by which dream images are formed during REM sleep. To this he contributes the additional observation that eccentrics are also very commonly vivid dreamers. REM is the period of sleep during which dreams are experienced, and it stands to reason that the transmutational effects of dream imagery might closely resemble those put to use by eccentrics during waking hours. Knowledge gleaned from fMRI and PET studies of the brain while engaged in these activities indicate, counterintuitively, that this is actually not the case. In their study of waking mental imagery, D'Esposito et al. found the most reliably activated portion of the brain during imagery exercises to be the left inferior temporal lobe, an area largely involved in processing visual information. Hobson, Strickgold, and Pace-Schott's REM sleep study found alterations in brain activity, not in visual areas of the brain, but in a large number of other areas, including "the pontine brain stem and of limbic and paralimbic cortical structures involved in mediating emotion and a corresponding deactivation of dorsolateral prefrontal cortical structures involved in the executive and mnemonic aspects of cognition." These data suggest that while waking imagery is likely a manipulation of brain areas used in normal visual processes, our dreams use uninhibited primal, emotional processes to form the images we experience during REM sleep.

Surprisingly, what we've learned about REM sleep from PET data may support the existence of an otherwise obscure creative tactic displayed by some eccentrics, an ability described by Weeks as "empathic problem solving." This entails empathy not directed toward another person but to a creative concept or idea. Essentially, empathic problem solving is accomplished by investiture of a certain degree of one's own personality and intellect into a project in order to penetrate the concepts involved. It requires a total immersion in a creative endeavor to the extent that the individual's subjective internal state is modified in order to "get inside the problem." The idea that a greater proclivity in eccentrics to clear, life-like dreams and the emotional and inhibitional freedom this offers makes plausible a thesis regarding the relationship between intense REM sleep and the ability to empathically problem solve, but this concept has yet to be fully developed.

Further validating current observations regarding the impressive mental imagery generating and emotional problem solving abilities of eccentrics becomes a matter of determining the veracity, most especially the degree of hyperbole, inherent in the self-reports and autobiographical accounts current research has made available. Indicators of mental image vividness such as the VVIQ or other diagnostic inventories have not yet been applied to the special case of eccentrics, and so we can not easily conclude that eccentrics do indeed benefit to the degree that they report from mental imagery. As has already been alluded, there are social reasons why self-identifying eccentrics would report dishonest degrees of mental capability. For one, eccentricity is sometimes adopted as a form of social

protection by otherwise creative but unsuccessful individuals. Also, it remains an open possibility that some claim eccentricity as a deliberately constructed identity for reasons authored by certain elite members of society. It seems possible, even likely, that individuals in either category would embroider accounts of their creative abilities in order to better wear the trappings of their eccentric self.

Personality Traits

Flexibility is a trait that bridges both intellectual and personality domains in eccentricity. Intellectually, eccentrics are extraordinarily flexible in the manner in which they approach and carry out creative endeavors. In spite of this, current research makes plain the fact that eccentrics can sometimes prove persistent and intractable to a disadvantageous degree once they've dedicated themselves to an idea or solution. Even in the face of expert opinion, eccentrics are often not dissuaded from their preferred methods. Certain of their own "rightness," eccentric individuals face the peril that, as they grow more frustrated with the failure of an idea, so too, do their inflexible personalities exacerbate the problem. Eccentrics have been observed to engage in sporadic, temperamental outbursts resulting from creative frustrations when they find themselves stuck in a blind alley. Such frustrations perhaps provide a reason why eccentrics prefer, on the whole, to remain noncompetitive, as the rigidity of competition can only exacerbate a frustration with failure.

On the flip side, flexibility is often seen as a positive trait in the personalities of eccentric individuals with regard to playfulness and humor. Humor is a common, understated trait common among eccentrics. Wit and whimsy allow for eccentric individuals to express their divergent views in a playful manner, upsetting expectations in a way that is not only socially appropriate, but socially desirable. The willingness to play with new ideas and to invent playful ways to look at a problem contributes to the childlike nature of some eccentrics. Both humor and play are good candidates for protective factors in the make-up of the eccentric personality. By refusing to take society seriously, the eccentric can, at least in theory, disregard some of the negative regard they might perceive. Similarly, a light-hearted, flexible attitude might allow an eccentric who would otherwise be overwhelmed with bizarre thoughts or ideas to playfully respond to the gestalt. However, the degree to which humor and play may or may not be seen as a protective factor in eccentricity, either from external or internal forces, is as yet unexplored.

The role of curiosity in creativity is relatively well understood, and the important part curiosity plays in motivating eccentrics has already been elucidated. To expand on the relationship, Weeks points to novelty as an expression of creative curiosity. Both creative and eccentric individuals prefer novel associations to a greater extent than more normal populations. Eccentrics are fluent in many different forms of expression, the drive for which originates from their curious, novelty-seeking natures. Weeks' research indicates that as many as 20% of eccentrics demonstrate talent in multiple modes of creative endeavor and most eccentrics retain active intellectual interest in about five separate topics. Certain social factors impact the expression of curiosity in eccentric individuals. Age and gender

perhaps play the largest role, as it's clear that older eccentrics do not report curiosity as much as youths do and that women are more likely to actively display curiosity in social environments than men. Cross-cultural factors, too, impact the heterogeneity in expressions of curiosity, but in a more diffuse manner. Current research seems to point in the direction of creative curiosity being impacted by social and developmental variables, but the degree to which intrinsic and extrinsic factors modulate the development and expression of curiosity and novelty-seeking behavior over the lifespan is not well understood.

No account of eccentric personality traits, especially those considered in regard to creativity, would be complete without mention of the negative social characteristics exhibited by eccentrics. To one degree or another, this has been discussed earlier in relationship to intrinsic motivation, idealism, psychopathology, and flexibility, but there are aspects that fall under none of those topics and so have not received adequate mention. Foremost among these is the eccentric individual's social awkwardness, which can take the form of odd manners of speech that complicate conversations for practical reasons, bizarre manners of dress or maintaining personal appearance, and a general disinterest in common topics or those social elements not related to their intellectual or creative interest. Future understanding in this area must consider not only the traits inherent in the eccentric individual, but what divide exists between that individual and society. No current understanding of eccentricity can accurately describe how eccentric traits develop, but more so with regard to antisocial traits, conceiving the essence of eccentricity will require a broad understanding of what interpersonal competencies (or incompetencies) and interactions have an effect on the outcome of eccentric development.

Fewer connections exist in the current literature linking empirical research to personality traits inherent to eccentricity. In one sense, this is liberating, because it allows us to freely evaluate all of the personality characteristics and behaviors in association with eccentricity to in light of creativity. In another, it introduces the lingering specters of error and bias thereby making these analyses unscientific. A systematic review of Weeks' original 25 characteristics would most concisely put to the test all of the theories inherent in the relationship between creativity and eccentric personality traits, but such an endeavor is, for the time being, a goal yet to be realized.

See also: Conformity; Humor and Creativity; Intelligence (as Related to Creativity); Memory & Creativity.

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Economic Perspectives on Creativity

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Glossary

Benefits Something that increases well-being.

Buying low Pursuing a new or undervalued idea that has growth potential.

Costs Resources expended in producing an output.

Demand Quantity needed or desired of a commodity or service.

Depreciation Loss in value of an asset over time.

Human capital Skills, knowledge, and abilities that people possess and can use in a productive fashion.

Investment Outlay of assets for future income or profit.

Marginal utility Benefit obtained from one additional unit of a good.

Psychic costs Intangible mental or social expenses, such as emotional stress.

Resources Available assets useful for production.

Selling high Releasing a novel production (such as an idea) on the market when it has gained value.

Supply Quantity available of a commodity or service.

Concepts from the investment domain and other economic considerations such as human capital, and supply and demand offer insights into human creative activity. Furthermore, some recent theories consider novelty generation and the creative process to be directly involved in economic growth.

Psychoeconomics of Creativity

Investing in Ideas: The Principle of Buying Low and Selling High

Robert Sternberg and Todd Lubart, in their ‘investment’ theory of creativity, proposed that creative people are like successful investors in the financial marketplace: they buy low and sell high. Buying low in the realm of creativity means pursuing new or undervalued ideas that have growth potential – that may be successful for solving one’s problem. Selling high means releasing a novel idea on the market when it has gained value and not holding an idea so long that others eventually have the same idea. Rather than jump on the bandwagon, producing work that may be good but similar to what others are doing, people who seek to be creative must deviate from the crowd, generating and advancing ideas that may eventually be recognized as new and valuable. Thomas Kuhn observed that for scientific activity, most researchers work within established theoretical or methodological paradigms rather than pursuing ideas outside such paradigms, ideas that have initially a low value but could lead to a paradigm revolution.

The buy low–sell high principle is partly descriptive of what creative people do (naturally) and partly prescriptive of a strategy that people may try consciously to implement to improve their creativity. In other words, people can develop a ‘buy low–sell high’ attitude, similar to the ‘contrarian’ attitude advocated for stock investors. Engaging in ‘buy low–sell high’ behavior may involve an analysis of potential of ideas and of the marketplace for launching these ideas. Thus creators may use strategies similar to market analysts for choosing among several

possible ideas. One strategy is fundamental analysis, in which key elements of a new idea may be evaluated for their intrinsic quality, originality, appropriateness to the problem-solving goal, as well as other qualities such as the aesthetic appeal of the idea or its coherence. This strategy can be seen in some accounts by inventors, in which they debate the strengths and weaknesses of their ideas before fully engaging work on a project. An alternative strategy is technical analysis in which trends in the problem domain may be examined in order to predict where a field is moving and what will be considered by the target audience as novel, appropriate, or aesthetic. This strategy can be observed in some accounts of artistic creativity, including work in fashion design and advertising. According to the buy low–sell high principle, people fail to be creative because they: (a) buy high, pursuing ideas that are already valued or known (perhaps to avoid risk); (b) buy low, pursuing ideas that do not have growth potential; or (c) sell low, exposing an idea before the audience is ready, before the idea has gained in value, or, inversely, hold the idea too long so that it becomes commonplace. Of course, it is important to note that the investment analogy does not map entirely, in all aspects on the phenomenon of creativity.

Human Capital: The Resources for Creativity

Capital refers to assets that enter into the productive process and lead to income. Although we think often of physical capital (e.g., land, machines) or financial capital (money), there is also human capital. Human capital can be defined broadly as the knowledge, abilities, and skills of workers as well as their time and energy. For creativity, the necessary human capital consists of a set of cognitive, emotional, and conative resources. These resources are specific intellectual abilities, cognitive styles, knowledge, emotion, personality traits (e.g., risk taking) and motivations. Individuals vary in the extent to which they possess each resource. For example, one person may be a risk taker whereas another person is rather

risk averse. The resources are hypothesized to develop and change over the lifespan.

A large body of research in psychology has examined the precise nature of the intellectual abilities, cognitive styles, knowledge, emotion, personality traits, motivations, and environmental circumstances favorable to creativity. This work can be synthesized within the economic perspective on creativity: each person possesses a portfolio of resources (skills and traits) relevant to creativity. As Herbert Walberg noted, this portfolio of psychological resources for creativity is part of a person's 'human capital', which may be actively invested in creative projects. From this perspective, the level of creative performance observed depends on: (a) a person's level on each of the resources necessary for creativity; (b) the person's active engagement of his/her resources; and (c) the match between the portfolio of resources that a person has and the profile of resources required for creative work in a domain (or a task) (i.e., the market demands).

With regard to the specific resources for creativity, such as knowledge, Daniel Rubenson and Mark Runco suggested that some fundamental economic principles may account for observed nonlinear relationships between the resources and creative performance as well as lifespan changes in the resources. For example, some studies suggest that a greater and greater amount of certain resources is not always best for creativity. Knowledge and specifically formal education seem to show an inverted-U relationship to creativity, with an intermediate level of education being preferable to a very advanced level. There may be a trade-off between two desirable but conflicting attributes. For example, knowledge is beneficial because it permits an individual to avoid re-inventing existing ideas (which already have a high value) and to avoid errors that others have already made in trying to work on a problem. However, increases in knowledge towards an expert level tend to have a negative effect on another desirable attribute, namely flexibility of thought. Experts often get stuck into using certain techniques for attacking a problem. Indeed, they have spent so much time and energy in acquiring these advanced techniques that it only makes sense to capitalize on their initial investment. In terms of intelligence and creativity, it has often been hypothesized that increases in intelligence contribute greatly to creativity initially, and then less and less, a case of diminishing returns.

With regard to lifespan changes in the resources for creativity, the phenomenon of depreciation may be one of the processes at work. For example, knowledge acquired at a certain moment may become outdated. There is depreciation of the value of the initially acquired knowledge as a field advances. To the extent that a person acquires a substantial knowledge base in their field at their entry to the field, we may expect that their capital in terms of knowledge will gradually become devalued with age. The desire to avoid depreciation of one's existing knowledge may explain results showing that older scientists resist in some cases new theories more than do younger scientists, as observed in a study of the acceptance of Darwin's evolutionary theory by scientists of Darwin's era.

In addition to these explanatory insights offered by the investment perspective, this perspective brings into focus some aspects of creativity more than others (as is the case with any particular point of view). For example, special

attention is devoted to risk taking, part of the personality resource for creativity. Risk taking is generally accepted as a key to investment decisions. Risk taking involves decision making in the face of potential gains or losses when the outcome is uncertain. Greater risks tend to be associated with greater potential gains. Generally, people tend to be risk averse, and studies of schoolchildren suggest that a low tolerance for failure develops starting in elementary school, perhaps because of the importance of obtaining good grades. People may under-invest because the potential rewards of a new idea are somewhat ambiguous as compared to pursuing technically sound but mundane ideas for which the limited rewards are clear. However, work on risk taking in situations framed in terms of losses shows that people would take risks to minimize potential losses. Thus creative ideas may be pursued actively when they represent a possible but risky solution to a bad situation, whereas creative ideas may be avoided when a person faces a choice among options involving potential gains. Some techniques for stimulating creativity help people to frame problems in ways that reduce risk aversion.

Increasing Human Capital

The resources for creativity – human capital – can be also enhanced, at least partially, through training. For example, a person may study creative thinking techniques through a self-help book or by participating in a training program. Most creativity training focuses on enhancing the cognitive resources for creativity. Training is possible with regard to the personality and motivational resources for creativity but this type of training is less common.

An investment in creativity training leads to an accumulation of human capital that can later be put to use. The investment in training depends on the marginal utility (value added) to the individual. Age and occupation are two variables that may influence decisions to pursue creativity training. Younger workers may derive benefits of training for a longer time than would older workers, thus increasing the utility of training for younger workers. Some occupations may demand creativity more than others, thus modulating the marginal benefits of training. The benefits of creativity training, which may vary from person to person, include intrinsic rewards (e.g., personal enjoyment) and extrinsic rewards (e.g., increased job performance, earnings, and opportunities for job advancement). The costs of creativity training include book expenses, tuition for courses, and opportunity costs of work not accomplished during the time spent on creativity training. For some individuals, the costs are reduced because their company sponsors the training program.

The decision to pursue creativity training is based on the marginal utility of each unit of training. A person with little human capital for creativity will benefit more than a person who already possesses many resources for creativity. Each of these individuals, however, can be expected to benefit less and less from each additional unit of creativity training, which is the phenomenon of diminishing returns. At some point, the marginal cost of additional creativity training will exceed the marginal benefit and the individual will not seek further training. With regard to the choice of creativity training versus traditional education, Rubenson and Runco pointed out that

people are more likely to invest in traditional education than in creativity-related education. The former has more predictable, less risky returns than the latter. Thus, even if people think that the effect of creativity training may be potentially more positive than traditional expertise training, the effects of creativity training are less certain than those expected with traditional education.

Similar to traditional economic capital, which enables potential economic productions, creative capital accumulation or enhancement enables potential creative productions. This potential is exploited maximally when productions satisfy some existing or latent needs – in other words, when they find a market.

The Market for Creativity

At the societal (aggregate) level, there is a supply and a demand for creative activity. The supply of creativity refers to the number of novel, useful productions (ideas, inventions, artistic works, etc.) that the members of a social unit (such as an organization or a society) provide. The demand for creativity is the need or desire in a society for creative productions. This demand may vary across domains (art, science, business, etc.) and across time. For example, during periods of political instability or war there may be greater demands for technological creativity than for artistic creativity. In financially tight periods, there may be a greater market for innovations that propose less expensive alternatives than for bold, but costly new products. The demand for creativity also varies from one place to another; some societies value conformity and maintenance of the *status quo* more than others. Sternberg and Lubart characterize environments – markets – for creativity as ranging from those that are bullish, overtly supporting creative activity, to those that are bearish, hindering creativity. A bullish environment can spark creativity by providing financial and social resources for creativity. During the Renaissance, for example, there were patrons who financially supported creative activity. Social interactions between artists of the time and competitions for prizes or commissioned works further contributed to a bullish environment for creativity. We can take the example of bullish markets enhancing the fulfillment of potential for creativity at the end of 1990s with the strong demand for dot-com creative start-ups. The emergence of the internet contributed to the accomplishments of many creative entrepreneurs whose potential would have never been realized in other times. However, some case studies of eminent creators suggest that a bearish environment is not always bad for creativity. A bearish environment provides obstacles that provoke creative solutions, following the motto that necessity is the mother of invention.

Societies may influence the supply of creativity by increasing or decreasing incentives to produce new ideas. These adjustments can be accomplished, for example, through grants to stimulate activity in certain domains, through educational initiatives, or through changes to the patent system. Sometimes, however, the supply and demand become out of balance. First, a society may misallocate its resources for stimulating creativity, as with misguided educational programs. Second, a society may underestimate its need for creativity because it does not adequately take into account the long-term benefits of creative

ideas, instead focusing on short-term, immediate needs. This underestimation of the demand for creativity can result in occasional shortages of creativity, as was perceived in the United States in the 1950s upon the Soviet launch of Sputnik. Of course, societies must balance their need for creativity with other non-creativity related needs such as building roads.

Another dimension of the societal investment in creative human capital is the policy decision of who will receive this investment. Walberg has discussed this societal choice in terms of investing in the education of average children to increase the general level of creativity in the population versus investing in a smaller number of gifted children who could eventually achieve the highest levels in their fields of endeavor. To the extent that a society invests in those who have already succeeded in the past, there is a 'Matthew effect' (from Matthew 25:29 "unto every one that hath shall be given, and he shall have abundance"). Hence, the creatively 'rich' get richer, and the creatively 'poor' stay poor; for example, a grant may be more likely to be awarded to a researcher who already had a grant than to one who is just starting and never had funding. This pattern of investment in human capital increases the probability that investments in creative human capital will yield some returns. However, some authors have argued that a society may derive a greater benefit from enhancing the creativity of the 'average' person (through educational programs) rather than investing the same amount in a restricted group of highly creative people who may show a relatively small increment in their creativity.

Finally with regard to the market for creativity, Sternberg and Lubart's investment approach highlights additionally the social consensual nature of creativity. John Maynard Keynes noted that the value of stocks on the stock exchange or other financial instruments depends on the extent to which those actively involved in the market value and collectively desire a stock. In a parallel way, the value of an idea depends on the audience and the extent to which the audience collectively values the idea. Thus ideas (or productions) can appreciate or depreciate in value with time or with a change of audience. We are able therefore to understand better why some creative geniuses are 'discovered' posthumously and other 'greats' in their day disappear into oblivion.

Depending on whether person's creative activity fits the market it may involve diverse benefits and costs.

Costs and Benefits of Creative Activity

An individual may derive extrinsic benefits such as recognition and financial gains, and intrinsic benefits, such as satisfaction with one's work and a feeling of accomplishment. Also, creative accomplishments can open the door to further opportunities, creating a positive effect of expected future gains. However, there are also costs to creative work. First, there are pecuniary costs such as time and resources expended during the work. Though often considered under the term of constraints, time is surely the most precious of human resources. Second, there are psychic costs such as emotional wear and tear of overcoming the obstacles often encountered in creative work. The initial negative reaction that often accompanies creative work may affect one's self-confidence or task motivation. Psychic costs may furthermore include social

isolation for one's 'deviant ideas'. Peers, whose own work is devalued by the appearance of the new, creative ideas, may seek to punish or ostracize the person who calls established dogma into question, ultimately devaluing it if the novel idea is accepted.

There are opportunity costs as well: the individual could have been pursuing other projects that may have provided some positive results themselves. Finally, there are transaction costs – costs that the creative person pays to a third party to facilitate the exchange with the audience. These transaction costs may be tangible, such as a commission paid to art gallery owners for displaying an artist's work, or intangible, such as limitations that one places on one's thinking to express ideas within the implicit rules of a discipline. In addition to the costs already mentioned, there are 'taxes' that are collected after a creative success. For example, following a creative success a scholar may be asked to review grant proposals or articles, serve on administrative committees, or give presentations summarizing previous work, which all take time from future creative work.

Parallel to the level of individual creators, there are also costs and benefits to creative work at the societal or macroeconomic level. The benefits of creativity include an enhanced quality of life for the society in general, as well as possible stimulation in the economic sphere. Each creative idea may have a trickle-down effect in which new supplementary products and services result from an initial idea. For example, the invention of the microcomputer fostered the emergence of many new computer-related services that have enhanced economic growth in recent times. The costs include direct financial costs and the use of physical and human resources. The opportunity costs refer to foregone advancements on other activities of the society (e.g., maintenance of roads). Opportunity costs also include the foregone advances on alternative creative domains. For example, given limited societal resources, if scientific creativity is promoted then artistic creativity may suffer a lack of advancement. Some historical analyses suggest that the value of creative work varies across disciplines and societal domains, over time. For example, political creativity may be valued during the emergence of a new society or religion, but less valued afterwards, scientific and technical creativity may be valued during times of war or facing a lack of environmental resources, requiring new technologies.

In this first part of the article, we reviewed some economics concepts that shed light on creativity. In the next section, we review some economic theories that incorporate creativity as a basis of economic activity.

The Economics of New Ideas

Endogenous Growth Theory

In the 1950s, a theory of economic growth was proposed in which technological change and innovation was the main factor – growth residual – explaining the permanent per capita growth since the industrial revolution. Specifically, it explained the paradox that from the 1870s to the 1950s the growth rate of capital and labor accounted for only about 10% of the growth rate in per capita output. Essentially due to the difficulties of mathematical formalization, this growth theory did

not consider the nature of the innovation factor, postulating instead that it is determined by inputs external to the economic system (e.g., research in universities); it became known as *exogenous* growth theory.

In the late 1980s, a new, *endogenous* growth theory was advanced; this theory emphasized the critical role of technological change and innovation but viewed them as determined by inputs internal to the economic system and not external to it. Endogenous growth theory seeks to explain how economic systems' or countries' internal choices relevant to technological change and innovation (e.g., regarding investment in R&D) account for the variation among these systems on the rate of the growth residual.

According to Paul Romer's 'economics of ideas' version of endogenous growth theory, new ideas embedded in technological change and innovation are the main factor of economic growth and the unbounded amount of potential new ideas is a main reason why growth after the industrial revolution has been constant and may continue to be so in the future. To illustrate this proposal, the 'factory' metaphor used traditionally in neoclassical growth theory is replaced by a 'computer' metaphor. Take for example, growth in agricultural output. Viewed through the 'factory' metaphor, this growth could come from an increase in 'raw materials' (arable land) and in 'equipment' (agricultural equipment, fertilizers). However, viewed through the 'computer' metaphor, this growth could come from new 'software' (methods of farming and farm management and methods to produce better equipment and fertilizers) rather than from an increase in amount of 'hardware' (arable land, agricultural equipment, and fertilizers). This metaphorical shift allows Romer to change the common view of the main growth factor and of growth itself. In the 'factory' metaphor, instructions are provided and fixed by the external state of technological knowledge and nonproduction workers are considered as overhead; growth may come only from increases in 'raw materials', 'equipment', and 'production workers'. In this metaphor, because of the scarcity of the latter inputs, growth is viewed as limited. In contrast, in the 'computer' metaphor growth comes from inventing and accessing new and better 'software' – new ways to combine raw elements to create valuable things; because of the unbounded amount of potential new 'software' and because of the minimal costs for producing an extra 'software' copy, growth is seen as unlimited.

It seems that human creativity can be postulated as part of the core of economic growth and its nature is thus of much relevance.

Homo Creativus: The Economic Agent for Endogenous Growth

The creative process, at the heart of endogenous growth, is conceived as a function of the resources (in particular, human capital) devoted to research and development (R&D). The relation may be linear and continuous, or discontinuous with research effort leading to occasional leaps in change and innovation. Creative ideas may result from a combinatorial discovery process; new ideas are combinations, hybrids of existing ideas or elements. This view is specially appealing to endogenous growth theorists because the combinatorial dynamics of possible new ideas evolve faster than the

exponential dynamics of potential diminishing returns of the two other production factors – capital and labor. However, only a fraction of potential new ideas is transformed into useful, actually implemented ideas, and resources are required for this transformation. Thus the growth residual depends on resources devoted to generating possible idea combinations, selecting the best among them, and then developing and implementing them.

Based on psychological studies of creativity, we can postulate that certain cognitive, conative, and affective resources will foster the generation of new ideas, the selection of potentially useful ideas and the development and implementation of these ideas. For example, Isaac Getz and Todd Lubart found that emotional information is a key resource in the preconscious process of concept combination; furthermore, task-specific, domain-relevant knowledge will help a person to recognize and use chance combinations and events as sources of ideas, and perseverance will contribute to implementation. Thus, *Homo Creativus* possesses a set of specific characteristics, a psychological profile, with an economic value that can vary from one sector of activity to another, and over time. These individuals include those whose economic activity involves, by its nature, creative thinking, or more generally designing. Examples are writers, scientists, engineer-inventors, musicians, artists, designers including industrial and architectural designers. Richard Florida proposed that this creative class prospers under conditions that provide a diversity of fields of creative activity (talent), access to technology to exchange and develop ideas, and tolerance (to reduce the psychic costs of novelty production). However, according to Isaac Getz and Alan Robinson, any individual, in any profession can be creative provided the appropriate organizational environment.

Some evolutionary economists have suggested that the societal value placed on creativity and the development of creative people is part of an evolutionary need for growth and change and, at least in the technological sector, a desire for convenience (reduced physical labor, enhanced quality of life). Thus, novelty becomes a goal in the economic action plans of individuals, organizations, and institutions. The individual agent who introduces the novelty into the economic system is the entrepreneur. Entrepreneurs may be *Homo Creativus* themselves but more often they connect novelty generated by another *Homo Creativus* to the economic matrix, leading to a market reaction, incorporation of the novelty in the economic sphere and the following evolution of the market.

Overall, the availability of such psychological resources as well as physical and financial ones means that people *can* engage in the creative process of developing new ideas, not necessarily that they *will* select and pursue potentially creative ideas. The engagement of resources will depend on individual's perceived costs and benefits of pursuing creative work, including opportunity costs of other uses of their resources. However, not only societal level but also organizational level economic theories can be useful to illuminate the phenomenon of creativity.

Organizational Economics

Acknowledging that many organizations have tremendous cognitive and emotional resources for ideas, and thus a high

creative potential, research shows that very few put in place a set of managerial practices to lead people to express and implement their ideas. An idea management system, as described by Getz and Robinson, allows every employee to express, implement, and be recognized for his or her ideas. First, employees are encouraged to express their ideas, thus increasing the likelihood that one employee's ideas will be known by others. Second, because employees are encouraged to implement their ideas by themselves, the likelihood of cooperation around the ideas of several employees, and thus of their combination, is increased. Finally, because employees are encouraged to consider that 'good is never good enough', the likelihood that one employee's implemented idea will be further improved with an idea of another employee is increased. This increased likelihood of combining employees' ideas has important implications for endogenous economics: the assumption of a steady flow of ideas, in general, and of their combination, in particular, can be made only for some – excellent – companies, but not for entire industries or economies. Finally, it shows that the assumption of a small fraction of generated ideas being actually implemented is paradoxically true for companies who do little to facilitate their employees' creative ideas; it is wrong, however for the companies with excellent idea management systems in which most ideas are, on the contrary, implemented – up to 99% in certain cases.

Organizational economists have also explored what organizational forms are best for economic productivity and innovation. For productivity, the multidivisional form, the matrix form, the network form and others have been studied. Concerning innovation, internal hybrids – a mix of a typical organizational hierarchy with market mechanisms and other practices have been investigated. For example, companies may introduce market mechanisms to create an internal 'market for ideas' in which employees' most useful, and in many cases innovative, ideas are put in place, instead of remaining untold or unimplemented in a typical hierarchical structure. The hybrid character remains because the 'buyers' of ideas, those who listen to, evaluate and authorize the implementation of ideas, are still in the hierarchy. 'Hybrids', however, prove to be unstable, the hierarchy often reclaiming the authority it left out to market forces within. Brian Carney and Isaac Getz explored an organizational form, they called *Freedom Inc*, which is completely opposite to traditional hierarchical forms with all employees completely free and responsible to take initiatives they, not their bosses, decide are best for the company. This organizational form – that Getz called the F-form – provides an ultimate, ideal environment for people's creative potential to be fulfilled and the companies who built them consequently found themselves at the top of their industries.

In general, the question of organizational level institutions most appropriate for economic growth and human fulfillment is a part of a larger question of society level appropriate institutions.

Institutional Economics

This field of economics examines how institutions shape the capabilities and behavior of economic actors, and thus influence economic productivity, including heightened

innovation. Historically, the scale of institutions studied has varied. Research has examined:

1. whether a market economy or a planned economy is best for innovation and productivity;
2. specific institutional aspects that influence productivity;
3. how businesses are structured and the financial and labor market systems supporting them, such as Total Quality as an institutional factor for superior productivity and innovation; and
4. start-ups, venture capital, and fluid labor markets that influence innovation and productivity.

'Innovation systems' proposed by Richard Nelson is an example of an institutional economics theory focused on innovation; it explores how companies are imbedded in and supported by a variety of nonmarket institutions, leading to corporate innovation. A typical example is universities funded by the government to undertake research and training in fields relevant to an industry thus supporting the latter's companies' innovation. Another example, offered by Amar Bhidé, is consumers' willingness to try new things that support corporate innovation. Finally, Edmund Phelps investigated what kind of society-level institutions are appropriate to both higher initiative, and hence growth, and increased human fulfillment, or in classical terms, happiness.

Conclusions

To summarize, we have examined how economic concepts are relevant to creativity in an effort to expand our understanding of this complex psychological phenomenon. The economic perspective treats creativity at the microeconomic and macroeconomic levels of analysis. Microeconomic phenomena include the investment in ideas that are unknown and/or undervalued, human capital as an input in the creative process, the notion of actively increasing human capital through creativity training, and the costs and benefits of creative work for the individual. Macroeconomic phenomena include the market for creativity, the supply and demand for creativity, societal policies toward investing in creativity, and the costs and benefits of creativity at the aggregate level.

Economic approaches such as endogenous growth theory, organizational and institutional economics enrich research on creativity by extending and deepening the understanding of the person, process, product, and press (environment) components of the phenomenon of creativity. For example, institutional-level economic analyses of creativity and innovation suggest that most innovations acquire their full market usefulness through a – an often decades' long – string of complementary useful inventions building up an 'eco-system' for innovation; the study of validity criteria should view the initial idea's usefulness not as something given but evolving, based

on further inventions that enhance it. For example, the first PDA, Apple's Newton, invented in the early 1980s, has been seen as a market failure. However, the spread of the PC, and a possibility to synchronize the PDA with it, increased the PDA's usefulness and the internet has increased even further the possibility for the PDA to access and download a variety of data and software. All those posterior inventions increased the PDA's usefulness to the level at which it became fully recognized by the market. Institutional economics highlight how environments relevant to creative organizations involve an array of aspects beyond the context of home, work, and local cultural settings, such as funding bodies, public research, and even consumers open to trying new things. Another implication for creativity studies is that, in addition to past and present environmental aspects, future ones may be critically important, as they may add value and bring to fruition initial seminal creative work.

See also: The Creative Sector and Class of Society.

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Education and Creativity

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Glossary

Cognition Faculty within the mind which allows for the processing of information, applying stored knowledge, and adapting to various situations and events.

Collaborative learning Learning which takes place in any kind of group setting. This type of learning can comprise learning in pairs or small groups (although these two are often considered distinctly in the research literature). The group context is emphasized in this type of approach, and roles among group members, as well as how interactions among individuals, comprises the nexus of foci and interests.

Convergent thinking Concept introduced by Guilford which indicates a student's ability to provide a predetermined correct answer.

Creativity myth Widely circulated belief that society and educational spheres subscribe to concerning creativity.

Divergent thinking Process of learning in which students are encouraged to produce as many possible

solutions to a problem as possible, so they can have a plethora of material to consider in their analysis of a problem.

Problem-based learning An instructional approach which focuses on students working in collaboration to solve problems posed to them. The problems are typically practical in nature, and teachers facilitate learning in these contexts.

Schema Concept related to educational psychology proposed by Jean Piaget, which asserts that individual possess mental structures which correspond to existing elements in the world. These structures are organized according to existing idea sets within an individual's mind. The structures are also classified based on a particular theme or element which is then impacts how that individual uses information and knowledge in processing abilities.

Self-efficacy A student's belief in his/her capacity to fulfill on a particular learning objective.

The Complex Nature of Creativity Within Education

Creativity is a primary concern within education for a number of reasons. Business leaders, both nationally and internationally, stress the importance of innovation, and many leaders from all walks of life stress the importance of being able to solve problems creatively, either in individually or in small, diverse teams. Others note the importance of creativity in the arts or in everyday life. Some scholars even make a strong case that an emphasis on creativity in a community has a number of important cultural and economic benefits. Furthermore, it can be argued that learning is not just related to creativity; rather, the construction and use of new knowledge is a special case of creativity.

Given these benefits and the strong relationship between learning and creativity, it is natural to turn to formal education in an attempt to encourage and foster creativity – where better to reach the most people at a young age? Yet the relationship between creativity and schools is, in most countries, a complex, tenuous one. This is due to the widespread belief, even among educators, that creativity cannot be enhanced. Add this belief to the prevalence of test-focused education systems in many countries, and the reasons for little emphasis on innovation in schools become clear.

Despite these concerns, literally hundreds of techniques have been developed to teach creativity. Indeed, in both the early 1970s and later 1980s, Torrance classified over a hundred creativity enhancement studies into nine categories of strategies for teaching children creativity. In approximate order of effectiveness, they included Creative Problem Solving (CPS) programs based on the Osborn–Parnes model; other

'disciplined approaches,' such as training in semantics and conducting research; creative arts programs; media and reading programs; packaged programs for creative thinking; modification of testing conditions; use of motivation, reward, and competition; teacher–classroom variables, including level of control and classroom climate; and curricular and administrative arrangements to facilitate creativity–fostering conditions. Other scholars have reviewed the creativity education literature and arrived at similar classification schemes.

Torrance and others have found that research support on the effectiveness of individual techniques is generally lacking – although prepackaged creativity programs are supported by more robust evidence of effectiveness. However, the vast majority of the conducted research has used divergent thinking as an outcome variable, suggesting a narrow focus in program intent and desired outcomes. Indeed, several techniques may actually harm creativity: for example, research on brainstorming questions its efficacy as the technique is traditionally applied in educational settings.

In this entry, the focus is placed on larger, systemic approaches to educating for creativity, especially those models that have been or are meant to be implemented in traditional K-12 education and higher education settings.

Approaches to Creativity in Education

SOI-Based Approaches

In 1968, J. P. Guilford addressed the then somewhat controversial proposal that creative performance in individuals could be enhanced. As he observed, much of our problem solving in

everyday life involves divergent thinking. However, educational practices predominantly encourage students to seek conventional answers. He proposed that more attention be given to development of skills in divergent thinking and also that we show more tolerance of outcomes of divergent thinking. Guilford further stressed that the belief creativity could not be learned had hampered educational cultivation of this trait, and further, that the somewhat unpredictable characteristics of some creative students could frequently be discouraged by teachers, based on the dominant goals of education.

Guilford created the Structure of the Intellect (SOI) model, in which he expanded and reconfigured E. L. Thorndike's classifications of intelligence, and proposed five major functions and processes associated with the ability to think. He broke down thinking abilities into the following categories: (a) cognition – the ability to discover or know, and to rediscover or recognize figural objects, their properties, and also, symbolic objects and other types of meanings; (b) retention – or the numerous abilities associated with memory; (c) convergent thinking – or thinking which produces a single, 'correct' answer; (d) divergent thinking – a process which involves searching that could result in numerous answers; and (e) evaluative abilities – these involve our capacity to distinguish suitability, adequacy, and success of information, memories, and products of thought. He further described various ways that these abilities could be tested and developed in ways which could help transform how teachers view learners and even, according to Guilford, how people view the process of learning itself. The SOI model presents a way by which the discontinuities he observed in the educational system could be rectified by revolutionizing the skills and abilities emphasized by schools and encouraged in educational institutions and settings.

Mary Meeker elaborated on Guilford's theories by further applying his model to educational settings and conditions. As cofounder of the Structure of Intellect Institute, she developed SOI exercises that were designed to help both children and adults enhance their performance in the various types of cognitive abilities conceptualized in Guilford's model. In Guilford's model, these dimensions are the operations in which it is employed, the content with which it is involved, and sort of product which results from it. In 1968, Meeker systematically moved through the figural, symbolic, and semantic dimensions of each of the cognitive functions identified by Guilford, and then she provided examples of tests which could be used to evaluate this ability in students. She designed curriculum exercises and activities that could be used with students of all ages, from pre-school up through adults. The SOI Institute curricula were among the first attempts at a systematized approach to teaching creativity in school settings.

A similar approach was introduced in the early to mid-1970s by Joseph Renzulli and his colleagues in their *New Directions in Creativity* series. These five manuals served as a curriculum that focused on the divergent thinking axis of the SOI model, with activities devoted to each of the various manifestations of divergent thinking as classified in the model, with emphasis on the standard divergent thinking dimensions of fluency, flexibility, originality, and elaboration. Each manual contains a series of 48 reproducible worksheets, with each worksheet addressing one cell in the SOI model. Renzulli

stated that the curriculum, which was revised and updated in 2000, was an effort to provide educators and students with a range of strategies for increasing creative potential, and the series was initially well-received and remains in print.

Torrance's Influence

Perhaps the individual most responsible for elevating the discussion about the proper place of creativity within education was E. Paul Torrance. Torrance's creativity work focused on the 4 'P's' of creativity: the creative person, the creative product, the creative process, and the creative press. He delineated several characteristics of creative people. Positive characteristics of creative people, in Torrance's findings, include being intelligent, independent, energetic, having a strong sense of humor, being artistic and open-minded, and perceptive about one's environment; negative traits included the potential to be egotistical, impulsive, argumentative, childish, absentminded, neurotic, and hyperactive. Furthermore, Torrance proposed the idea that creativity processes are suprarational: this term means that creativity involves, not only intentionality and cognitive factors, but also depends upon nonrational tendencies, including the predilection to be playful, fanciful, illogical, farfetched, or even emotional. These factors also encompass a person's motivation to engage in innovative approaches and thinking.

Torrance describes creativity as a process which consists of steps similar to those in the scientific method, and he proposed that people: (a) become sensitized to difficulties, gaps in information, or missing elements; (b) establish theories about these shortcomings; (c) test the theories and reformulate them; and (d) circulate the results of their findings. Torrance engaged in considerable efforts to strengthen the relationship between research conducted on creativity, and implementation of activities in classrooms and other educational settings. He reviewed 142 studies describing efforts to teach creativity, and he concluded that various creativity enhancement exercises did increase student creativity within educational settings, including those associated with divergent thinking, training in the Creative Problem Solving model, being trained in creative art or writing, the importance of sustaining a creative climate, and using various workbooks or programs. As a result of this work, he proposed that creative thinking be rewarded in schools because it allowed students to understand how better to achieve her potentialities. Torrance also believed that creativity served psychotherapeutic goals, allowing students to work through emotions and other psychological issues which could not be alleviated in a traditional classroom environment. For example, he suggested that creativity allowed students to develop more comprehensive self-concepts and to be able to engage in more accurate and more effective self-evaluations.

Torrance identified particular characteristics of educational environments which could successfully prepare students for lives of proactive citizenship. He proposed that environments should not be inhibiting, that teachers should remain aware of the considerable impact their approach, attitude, and evaluation had on students. Torrance also gained widespread notoriety by proposing that children experience a drop in creativity at two points in the educational system: during kindergarten, when students learn about rigidity associated with rules and expectations, and again in the fourth grade, when students

become susceptible to increased social pressure from peers, and also, increasingly self-conscious about identity and social status. He felt that both creativity roadblocks were avoidable.

Torrance also conceived of the Incubation Model of Teaching, which uses three steps to encourage collaborative learning: (a) students become aware of a dilemma, challenge, or problem, and cultivate a curiosity about it; (b) they accept their need and desire to learn more about it; and (c) they incorporate the new knowledge they've received into their existing schema. Ultimately, this model represents a dynamic and active process, which allows for productive debate instead of fostering a factionalizing approach; it also does not presume any sort of prior expertise.

The Schoolwide Enrichment Model

In the mid-1970s, Joseph Renzulli developed the Enrichment Triad Model (ETM), a gifted education model that focuses on helping students learn the creative process as it occurs in the real world. Students move through three stages of enrichment, in which they initially become exposed to unusual topics outside traditional school curriculum subjects (Type I). They then broaden their horizon of familiar contexts by cultivating a broad range of thinking and feeling processes, including cognitive and affective thinking, 'how-to-learn' skills, advanced research skills and reference material usage, and fostering written, oral, and visual communication skills. These abilities, in turn, assist them as they embark upon independent research or artistic study, with the ultimate goal of producing their own knowledge or other creative contribution. Given that the ETM is based on Renzulli's observations of real-life, adult creative achievement, the fact that some educators consider ETM and subsequent, related programs (e.g., the Schoolwide Enrichment Model, developed with Sally Reis) to be models for creative education is not surprising. Research on the model has demonstrated its efficacy with high-level students and student populations from widely diverse ethnic and socio-economic backgrounds.

Creative Problem Solving

One of the most common and useful models for integrating creativity into education is the Creative Problem Solving model (CPS). The model was created in the 1950s by Alex F. Osborne and further developed by Sidney Parnes and other researchers associated with the Creative Education Foundation, and it is still in wide use today. The model consists of six distinct stages: (a) mess finding – locating a problem needing a solution (which is sometimes omitted); (b) fact finding – examining what you already know about the problem; (c) problem finding – selecting a specific problem definition; (d) idea finding – brainstorming; (e) solution finding – evaluating ideas; and (f) acceptance finding – implementing ideas. Osborne and Parnes' work has been revised and expanded by a number of educators and researchers, including Treffinger and Isaksen, in order to increase the model's efficacy for teaching creative problem solving.

Isaksen and Treffinger's modifications included the addition of the extra first stage (mess-finding), the broadening and renaming of the data-finding stage (previously labeled

fact-finding), the acknowledging of the need for both divergence and convergence, and also, expanding the 'scope and methods for solution development and implementation planning' (in the solution-finding and acceptance-finding stages) (Treffinger, 1995: 303). In addition, they also articulated a more precise conception of the term 'problem' as it can be applied in the CPS model. Specifically, they identified problems as potential opportunities which could foster positive outcomes by allowing students to work through changes and engage in constructive action; further, a 'problem' could be any "important, open-ended, and ambiguous situation for which one wants and needs new options and a plan for carrying a solution successfully" (Treffinger, 1995: 304). The important step of viewing a 'problem' in this context greatly expands the ways that creativity can be conceptualized as a potential skill to solve a broad spectrum of problems (and not simply those traditionally associated with 'creative' disciplines like the arts). By extension, these revisions further ensured that the CPS model could also be used in many more settings and situations than might have been previously thought during its earlier inception.

Teachers and Creativity

According to Plucker, Beghetto, and Dow in 2004, four persistent myths limit progress in studying and applying creativity. These include that people are born creative or uncreative, creativity is intertwined with negative aspects of psychology and society, creativity is a soft, fuzzy construct, and creativity is enhanced in a group. Teachers are not immune to these misconceptions or myths about creativity. As Guilford and Torrance predicted many decades ago, recent research provides evidence that teachers employ a variety of definitions of creativity, some of which that do not align with expert opinion (i.e., they conceptualize creativity as a negative influence in the classroom).

For many teachers, an ideal student does not have highly creative characteristics. When asked to select characteristics of their ideal or favorite student, many teachers do not select items such as being courageous or curious, which experts list as highly creative. Teachers prefer qualities such as doing work on time and being courteous or good-natured, some of which may not be indicative of creativity in many classroom contexts. This however may not be true for teachers of gifted students whose descriptions of an ideal student more closely align with the expert opinion of highly creative people.

Sternberg has provided a theoretical model for these observations in his work with thinking styles. Teachers may not approve of students in their classrooms who are legislative thinkers which is characteristic of creative thinking and problem solving. Subsequently teachers tend to prefer and promote executive thinking, which emphasizes following rules and protocols. This results in curriculum that includes more closed-ended rather than open-ended questions and activities. Recent research with prospective teachers suggests this may be changing, at least with educators who plan on teaching in lower grade levels. When Beghetto asked whether teachers would prefer student responses in classroom discussions to be relevant or unique, prospective middle school teachers tended to favor unique responses compared to their peers planning on

teaching in high school. The only subject area distinction was in math, with prospective math teachers favoring relevant responses because unique responses may be distracting. These and related data suggest teacher education may be transitioning to a more progressive view of creativity in the classroom.

The research suggests that there are a variety of ways teachers can promote creativity in their classrooms. First, they should recognize the myths surrounding creativity and acknowledge that all students have the capacity for creativity. Second, Sternberg suggests teachers should take a careful look at curriculum and personal preference for certain intellectual styles. If schools want to promote creativity, they need to promote legislative thinking in addition to executive and judicial thinking. Finally, research in higher education suggests promoting creativity among students requires teachers to encourage independence, treat students as individuals, and act as creative role models, all of which apply equally well to elementary and secondary education.

An Alternative Model

Based on the history of efforts to enhance creativity in students in educational spheres and settings, Plucker and his colleagues proposed a new model of creativity enhancement that seeks to explain how creativity can be effectively and efficiently enhanced in P-20 education. More specifically, they were troubled by the growing body of research suggesting that traditional creativity education efforts – which focused on teaching students how to use specific creativity techniques – were not effective. Their new, alternative model has multiple stages that form an iterative process for improving creativity-related attitudes, beliefs, and skills. Similar to the work of Renzulli, the model attempts to build on research and observations of adult creators in real-world settings.

The model is based on three primary criteria: a focus on schema change, especially schema related to how the individual defines and understands creativity; the need to assist students in identifying their strengths and weaknesses regarding creativity; and an emphasis on both personal and external factors that impact and catalyze creativity development. These principles stand in contrast to other models for teaching creativity, in that the alternative model places much less emphasis on ‘creativity techniques’ than other models and curriculum. This de-emphasis on specific techniques is based on the belief that techniques are not useful to people who do not believe, for example, that creativity can be enhanced. In order to dispel this and other student misconceptions about creativity, problem-based learning activities are used to cultivate cognitive changes in students by highlighting inconsistencies in their current beliefs.

Throughout the problem-based learning tasks, the teacher and students discuss the various external factors that play a role in both hampering and developing creativity in individuals and groups. Rather than overemphasize the role of the environment in creativity, however, the model promotes a balanced approach to cultivating creativity, with an emphasis on the individual’s ability to shape the environment, and vice-versa. The model has been implemented and evaluated numerous times at the university level, with promising results.

Assessment

The Torrance Tests

The most common assessments of creativity used in education are the Torrance Tests of Creative Thinking (TTCT). Although the TTCT is roughly half a century old, it is still in current use – the TTCT probably remains the most popular creativity assessment in education settings around the world. The TTCT was influenced by Guilford’s extensive work with divergent thinking activities, although Torrance refined and standardized the administration and scoring of divergent thinking tasks to create his assessment battery.

The battery includes Verbal (Thinking Creatively with Words) and Figural tests (Thinking Creatively with Pictures) that each include a Form A and Form B that can be used alternately. Each form contains multiple subtests, with three subtests on the Figural forms and seven subtests on the Verbal forms. The original test produced scores in the traditional four DT areas, but the streamlined scoring system introduced in the 1984 revision made significant changes to the available scores. Under the streamlined system, the Figural tests can be scored for resistance to premature closure and abstractness of titles in addition to the familiar scores of fluency, elaboration, originality. Flexibility was removed because those scores tended to be largely undifferentiated from fluency scores. In general, reliability and concurrent validity evidence is positive, but evidence of construct validity is less convincing.

Product Evaluation Strategies

Another area of creativity assessment that has potential value in education focuses on creative products. Although a number of high-quality product assessments have been developed, including the Creative Product Semantic Scale by Besemer and O’Quin and the Student Product Assessment Form by Reis and Renzulli, the most active area is that of the Consensual Assessment Technique (CAT) developed by Amabile and her colleagues. The CAT is based upon the belief that people know creativity when they see it, a view supported by extensive studies on people’s implicit theories of creativity. When using the CAT, expert judges are asked to evaluate a product’s creativity, with the scores averaged across judges. The CAT’s relative simplicity and approximation of real-life assessments of creative products are appealing to teachers, although finding appropriate expertise for judging can be problematic. Although the CAT is associated with considerable evidence of reliability, validity evidence is not as comprehensive, and considerable debate exists over how ‘expert’ and expert needs to be to judge, for example, the creativity of essays or poems written by fourth graders.

Conclusions

Our recommendations concerning the best ways to enhance creativity in the educational system revolve around the initial step of addressing the misconceptions people harbor about creativity: these misconceptions could be focused on their own selves, other people, and creativity itself as a construct.

We believe one of the most important steps to take involves encouraging students' sense of self-efficacy concerning creativity. By fostering creative self-confidence in students, they will be more amenable and willing to engage in the risk taking necessary to be innovative. In order to accomplish this task, we believe it is crucial to design activities that demand an individual's or a group's attention. Such activities should also excite, stimulate, and increase people's curiosity about the world.

Developing this kind of curiosity then encourages people to develop an intrinsic motivation to be creative, which is an integral component of their being able to enhance their own creativity. This goal can also be achieved by supplying students with information about strategies and creators which proves both useful and interesting. Similarly, if teachers capitalize on teachable moments such as current political, cultural, and community events, students will be further encouraged to foster a sense of curiosity about their environment and community.

Another important aspect of enhancing creativity involves cultivating group awareness of its own learning process, or developing a sense of group meta-cognition. The best way to foster this capacity is to present groups of students with problems which must be solved both individually and in groups. In these types of learning situations, teachers should avoid making assumptions about students, as individuals vary tremendously in their abilities, preferences, and attitudes. This structure also allows students to exhibit their distinctive abilities more easily, and to allow all group members, as well as teachers, to understand that diversity is a critical element of creative production, when it happens both individually and in groups.

This approach also introduces the necessary component of variety into creativity enhancement efforts. A multi-faceted, multi-dimensional setting best helps the unique preferences and interests of participating students and individuals become fostered. This method also promotes diversity in student approaches to identifying and solving problems. It can also provide either skills and/or information that will more easily generalize to other settings, and thereby reinforce and expand the participants' capacity for creativity ability enhancement. To achieve these goals, we advocate that it is extremely important to consider the efficacy and usage of well-established programs that address multiple components of creativity, and which have already been field-tested and refined.

The Future of Creativity in Education

The emphasis on formally applying creativity to education and schooling is roughly 50 years old, which begs the questions of what creativity in education will look like in another 50 years. The future is always difficult to predict, but certain trends appear likely to continue. First, an emphasis on environmental influences will continue to pervade creativity education, although this emphasis will probably be tempered by an understanding that people and environments interact to produce creative behavior, and that focusing on one or the other is likely to prove ineffective.

Second, the growth in technology and access to technology in formal and informal education settings will continue to change education profoundly. For example, distance education

greatly increases the chances that students will have access to a wide range of learning opportunities. However, many of these distance education offerings are rather passive or linguistically focused, raising questions about the ability of such teaching and learning systems to enhance creativity meaningfully. Indeed, the pervasiveness of instructional technology in many countries calls into question whether one can predict how any aspect of education will be designed and implemented in even the mid-term.

Third, countries that emphasized memorization over knowledge production and creativity (e.g., China and many other emerging economies) will continue to transition to problem-based, creativity-friendly instruction and curriculum. However, the transition will almost certainly take longer than anticipated, due to the difficulty in overcoming cultural norms and ingrained memorize-and-test educational traditions.

Fourth, many developed countries, which have done relatively well fostering creativity in their students, may continue to overreact to the economic pressures from developing countries and begin to emphasize knowledge acquisition over knowledge production. Policymakers observe growing economic competition from developing countries and assume that education in those countries is responsible for the new competitiveness; to the contrary, the improvement in developing countries' economies is often due to those nations converting their policies and institutions to models that parallel those in developed countries, and education is not an exception. If developed countries learn the wrong lessons from developing countries about the need to transition to creativity-fostering economies and education systems, the irony will be that the developing countries learned to move to an emphasis on creativity and innovation by watching developed countries make that transition roughly 50–60 years ago.

Finally, looking ahead as far as possible, we remain optimistic that educators and policymakers will strike a productive balance between knowledge acquisition and knowledge production, between testing and learning, and between formal and informal education. Given all that is in flux with the world today, it is likely that the creativity education models that will guide these efforts have yet to be created, but they will almost certainly be based on the models highlighted above.

See also: Consensual Assessment; Creative Products; Divergent Thinking; Exercises; The Four Ps of Creativity: Person, Product, Process, and Press; Heuristics: Strategies in Creative Problem Solving; Implicit Theories; Incubation; Play; Teaching Creativity; Testing/Measurement/Assessment.

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- <http://www.education.com/reference/article/creativity-education/> – Information Centers Guide.

Albert Einstein 1879–1955

Theoretical Physicist, Philosopher

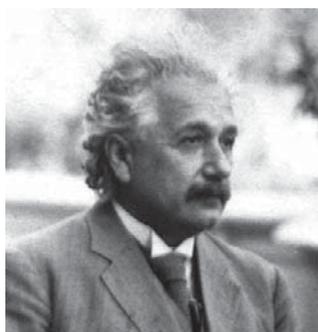
Discoverer of Special General Theories of Relativity; Light Quantum; Theory of Brownian Motion; Fundamental Criticisms of Quantum Theory

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ALBERT EINSTEIN (1879–1955) is one of the greatest scientists in the history of scientific thought and an icon of the 20th century. His name is synonymous with genius, and exploring his scientific creativity is extremely important toward understanding extraordinary minds.



Albert Einstein. Used with permission from AIP Emilio Segrè Visual Archives.

Early Years

Albert Einstein was born 14 March 1879 in Ulm, Germany, where his father Hermann, age 32, owned a featherbed business; his mother Pauline (née Koch), was age 21. As a child Albert entertained himself, doubtless due in no small part to difficulties with language learning. He did not speak well until 2 1/2 years and showed no early precocity. Albert's sister, Maja, born 1881, later recalled that "those around [Albert] were afraid he would never learn to talk." Einstein's teachers considered him only moderately talented, apparently owing to the length of time he needed to mull over a problem. For the most part, during his childhood Albert was a solitary child, preferring private games that required patience and perseverance, like building elaborate houses of cards.

Einstein had more than moderate success with the violin which he began at age 6, and really started to enjoy at age 13 or 14 when he discovered Mozart's violin sonatas. Until then he had to tolerate teachers who emphasized mechanical or rote learning, a mode of learning that Einstein detested. Although playing Mozart's sonatas was beyond his technical competence as a teenager, Einstein practiced them repeatedly, but not systematically. He also stopped violin lessons at this time.

Einstein began his school career in 1886 at a public school in Munich where his parents had moved in 1880. In 1888 he entered the Luitpold Gymnasium, Munich, where the curriculum focused on rote learning of, for example, classics in Greek and Latin read in those languages.

About age 13 or 14 Einstein demonstrated the ability to solve difficult mathematical problems posed to him by his paternal uncle Jakob Einstein. These diversions, in addition to insightful recognition of young Einstein's talents by a medical student who boarded in the Einstein household, were necessary counterbalances to the disastrous situation he faced at school.

Some years later Einstein described his entire student career as a "comedy." The humor was found only in retrospect. Einstein recalled that the "teachers in the elementary school seemed to me like sergeants and the teachers in the [Luitpold] *Gymnasium* like lieutenants." These remarks were aimed at the rote learning demanded by authoritarian teachers. In what few science classes were available Einstein would sometimes ask a question that Herr Professor could not answer. Instead of admitting this, praising the student for asking such a question, and then promising to come back the next day with a reply, the teacher kept on trying for a solution, thereby exacerbating the situation. In the meanwhile the young Einstein sat with an ever-widening grin. A teacher of Greek told Einstein that he would never amount to anything—he never did in Greek. Another time the same teacher scolded him severely for something he was not at all involved in, asserting that "your mere presence in class destroys respect for me of the other students." Even though he was among the top students at the Luitpold *Gymnasium* in mathematics and physics, this tongue lashing was the last straw. Moreover, the prospect of military service was impending, which Einstein dreaded. If Einstein did not emigrate before age 16 then, according to German citizenship laws, he would have to serve in the army or be declared a deserter.

The electrical business owned by Einstein's father at this time failed and the family moved to Milan, Italy, where business prospects seemed better. (The feather bed business had failed some years earlier.) They left Albert behind in Munich to complete his *Gymnasium* education. The parents' move gave Einstein the idea to resolve both the *Gymnasium* situation and the army problem. Einstein obtained a doctor's certificate to the effect that he was nervous and depressed. On 29 December 1894 at age 15, Einstein withdrew from the Luitpold *Gymnasium* without a diploma. He joined his parents in Milan as a high school dropout. The Luitpold *Gymnasium* was destroyed during World War II. Ironically, it was rebuilt and renamed the Albert Einstein *Gymnasium*.

Until the fall of 1895 Einstein traveled through northern Italy. As had been the case for Goethe some hundred years before, the Italian sunshine and landscape impressed the young Einstein, freeing him of the *sturm und drang* of the Munich years. During this period, however, Einstein did not

neglect his love of science. By this time he knew integral and differential calculus, self-taught at about age 13. In the summer of 1895 Einstein wrote his first scientific essay, which he sent to his maternal uncle Caesar Koch. The essay demonstrates that Einstein was conversant with advanced topics in electromagnetic theory. Even so, there are no signs of genius in the essay. Yet in retrospect the perseverance and self-discipline needed to teach oneself difficult subjects is an indication of things to come. Einstein was an autodidact.

The influence of uncles and aunts is not to be overlooked. As we know these family members hold a privileged position with children at an impressionable age. Being siblings of the parents they can be seen as representing the nonautocratic and so exhibiting the more outgoing side of the parents' psyche. Bertrand Russell recalled an uncle who "did a great deal to stimulate my scientific interests."

As Einstein had promised his parents prior to withdrawing from the Gymnasium, he prepared himself for the entrance examination to the Eidgenössische Technische Hochschule (ETH), Zurich. Einstein failed the entrance examination to the ETH due to deficiencies in foreign languages, biology, and historical subjects, all of which require rote learning. Owing to Einstein's excellent grades in the mathematics and physics portions of the entrance examination, one of the school's most eminent professors, Heinrich Friedrich Weber, encouraged Einstein to attend his lectures if Einstein stayed in Zurich. Instead Einstein decided to take the advice of another professor to spend a year at a preparatory school in the Swiss canton of Aarau, in order to correct the deficiencies that had caused him to fail the entrance examination.

The strong impression made on Einstein by the cantonal school was due to its unpretentiousness and to its seriousness which was in no way dependent on a teacher's authority. The school also emphasized the power of visual thinking, a mode of thought to which Einstein found himself disposed. Sometime during his sojourn in Aarau during 1895–1896, Einstein realized a thought experiment in highly visual terms over which he would ponder tenaciously until, in 1905, he realized that it contained the "germ of the special theory of relativity." The experiment concerned the experiences of an observer who is trying to catch up with a point on a light wave. By 1905 Einstein was able to frame the observational-theoretical situation as a paradox whose resolution concerned his realization that time is a relative concept. Einstein flourished in Aarau, passing out with the highest grade average in his class and gained admission to the ETH.

University Years

Einstein's educational experience at the ETH during 1896–1900 was bittersweet. Almost immediately difficulties arose. The role of visual thinking was deemphasized and the outdated physics curriculum focused on applications. Einstein liked neither the subject matter nor being coerced to memorize large quantities of what to him was unessential material. So at home in the evenings and during cut classes, he studied the masters of theoretical physics like Ludwig Boltzmann and Hermann von Helmholtz. From them he learned the kind of physics not taught at the ETH, as well as the importance of visual thinking in the making of a scientific theory.

Einstein's independence of thought was not appreciated by the professors at the ETH, particularly not by the eminent Professor Weber, with whom Einstein had many intense personality conflicts. The upshot was that Weber, the man who had encouraged Einstein to pursue studies at the ETH, tried to prevent him from graduating. Having failed, he refused Einstein any letter of recommendation upon graduation. Einstein was the only one of four students in his class who passed the final examination to be refused a position as *Assistent* to a professor at the ETH. Einstein recalled that it took him a year to recover from the ETH and to reacquire his taste for scientific research.

During 1900–1902 Einstein had only intermittent employment and was denied positions as assistant to several major physicists. He was convinced that somehow Weber was behind this situation. As Einstein wrote to his girlfriend and wife to be, Mileva Maric, on 4 April 1901, "Soon I will have honoured all physicists from the North Sea to the southern tip of Italy with my offer." He persevered. In 1901 Einstein submitted a doctoral thesis to the University of Zurich which was rejected, but he succeeded in publishing his first paper in the prestigious German physics journal *Annalen der Physik*.

Finally, through intercession of the father of a college friend, Marcel Grossmann, Einstein obtained a position as technical expert third class (provisional) at the Swiss Federal Patent Office, Bern. In reply to someone's comment that he might be bored in this position, Einstein wrote to Mileva in February 1902, "certain people find everything boring—I am sure that I will find it very nice and I will be grateful to Haller [the Director of the Patent Office] as long as I live." And he was. Einstein's personal life was even less settled. In 1902 he married Mileva, with whom he had a tumultuous love affair since 1899. Their unpublished love letters attest to the passion of the relationship. Unfortunately, by around the time they were married the relationship had begun to cool down. They were divorced acrimoniously in 1919. Later that year Einstein married his cousin Elsa with whom he had a liaison for some time. Einstein's love life is a complex and highly interesting topic, but this much seems to be the case—Einstein's liaisons may well have been an inspiration to his research, just like in the lives of artists, musicians, and writers. What other scientist can you think of whose love letters have been published?

Bern Period

Einstein's Bern period (1902–1909) was the most creative of his life. While working at the Patent Office eight hours a day, six days a week, he published on the order of 50 papers. Although during 1901–1904 he had published five papers in the *Annalen*, there was no forewarning of Einstein's creative outburst in 1905. After all, in 1905 Albert Einstein was a 26-year-old middle-level junior civil servant with an academic record that was distinctive in retrospect only by its lack of distinction. His score on the cumulative final exam at the ETH was 4.91 out of 6, good but not superlative. He had failed once to obtain a Ph.D., and was denied letters of reference from his undergraduate school. To make ends meet for his wife and child Einstein gave private classes in physics. Yet at eight-week intervals, starting in March 1905, Einstein submitted

three papers that were published in the September 1905 volume of the *Annalen*. The third one contains the special theory of relativity. Later in 1905 Einstein published a fourth paper in the *Annalen* which contained a result he had overlooked in the relativity paper: the equivalence of mass and energy, $E = mc^2$. These four papers changed the course of physics in the 20th century, not to say life itself on our planet.

Later Years

Einstein's early research results were at first appreciated, mostly for the wrong reasons, if at all, including the 1905 paper on special relativity. That Einstein had an *annus mirabilis* in 1905 became clear only in retrospect from the 1920s when *all* of his contributions from that year were duly acknowledged. Special relativity was not recognized as an achievement until 1911. By this time Einstein had resigned from the Patent Office (6 July 1909) to take up a position as Associate Professor at the University of Zurich. During 1911–1912 he was professor at the German University in Prague. Einstein's reason for leaving was an offer he could not refuse. His old undergraduate school, the ETH, offered him a professorship. In 1914 he moved to the University of Berlin as a Professor with no teaching duties. There he remained until forced to leave in 1933. From 1933–1955 he was a Professor at the Institute for Advanced Study in Princeton, New Jersey. In 1915 Einstein had a second *annus mirabilis* when he formulated the generalized theory of relativity. As was the case with the 1905 special theory of relativity, one of Einstein's key revelations came in the guise of the following thought experiment: Someone jumps off the roof of a house and also drops a stone. They fall side-by-side

even though stone and person are accelerating toward the ground. Einstein's understanding this apparently "simple" phenomenon requires thinking of what it means for the falling person to imagine himself and the stone to be relatively at rest even though they are both accelerating toward the ground. This necessitates assuming the equivalence of acceleration and gravitation, a monumental step. Owing to experimental verification in 1919 of one of the spectacular predictions of Einstein's new theory—the bending of light in the vicinity of massive bodies—his name became worldwide known literally overnight, and synonymous with genius.

Although after 1915 Einstein spun no more grand theories, his contributions, for example, to quantum theory, remain of the deepest importance, spanning physics and its philosophy. His correspondence on scientific, philosophical, and social matters remains of the greatest interest today. And his creativity remains to be fathomed.

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Eminence

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Glossary

Creative achievement scale An instrument designed by Arnold Ludwig to score eminent creators according to the magnitude of their contributions. This score considers such factors as originality, universality, versatility, influence, transcendence, and virtuosity.

Cultural configurations The tendency for eminent creators to cluster into particular periods of history. The creators who constituted the Golden Age of Greece and the Italian Renaissance are classic examples. These periods of creative fervor are separated by others with much less creativity, at times descending into a Dark Age, in which eminent creators disappear altogether.

Space measures The objective technique of assessing eminence in terms of the amount of space devoted to the creator in standard reference books, such as encyclopedias, biographical dictionaries, and histories.

Unit replicability Samples of eminent creators have the asset that the same subjects can be repeatedly studied by different researchers, allowing the possibility of exact replication of a given set of empirical results.

Zeitgeist The German word for the 'spirit of the times.' The term indicates the broad milieu in which creativity takes place, such as the political, economic, social, and cultural environment. The zeitgeist appears to be responsible for the clustering of eminent creators into cultural configurations.

Significance

One of the most urgent problems in the scientific study of creativity is precisely how to define the phenomenon. By what criterion does a researcher identify one subject as creative? The published literature is replete with rather diverse operational definitions. Most often, however, individuals are said to display creativity when they score sufficiently high on a so-called creativity test. Yet clearly, such identification only begs the question: How do we know that the psychometric instrument actually measures creativity? Obviously the test must undergo some type of validation. For instance, the test might be validated by determining if those who score high on the measure can generate products or ideas that are judged creative by others. But this merely sweeps the problem under yet another rug. Who shall we rely on to perform these judgments?

One reasonable resolution to this measurement quandary is simply to say that individuals who have received broad acclaim for their creative contributions can be safely deemed creative. Such a definition seems sound on prima facie grounds. In the parlance of psychometrics, an eminence measure of creativity has 'face validity.' Note that creative eminence also solves a host of other methodological niceties as well. For example, another difficulty in the investigation of creativity is how to define different types or levels of the phenomenon. How does the researcher distinguish artistic from scientific creativity? How does the investigator gauge the magnitude of creativity? From the standpoint of the eminence criterion, the response to both questions is direct. Individuals who attained distinction for contributions to the arts are artistic creators, whereas those who earned applause for contributions to the sciences are scientific creators. Therefore Picasso exemplifies artistic creativity, whereas Einstein exemplifies scientific creativity. Similarly, the higher the level of fame achieved, the greater the presumed level of creativity displayed.

By this judgment, accordingly, Johann Sebastian Bach is deemed more creative than, say, Gebel, his exact contemporary and compatriot.

As the foregoing discussion suggests, the eminence criterion of creativity may be employed two distinct ways:

1. In the simplest usage, eminence is adopted as a sampling criterion. Individuals who exhibit sufficient excellence in a creative domain are selected for inclusion in the researcher's sample. For instance, when Ann Roe wished to understand the basis for scientific creativity, she sampled a group of 64 eminent scientists. Sometimes the eminence criterion is also used to single out subjects for the control group. A good example is the approach taken by researchers at the Institute for Personality Assessment and Research at the University of California at Berkeley. Wanting to understand the basis for creativity in architecture, the investigators recruited the participation of some rather renowned members of that profession. But the researchers also obtained the participation of far less successful colleagues who could provide the basis for comparison.
2. The other role of eminence is as a continuous variable used to measure individual differences in creativity. Just as the amount of creativity may vary from person to person, so may the amount of eminence exhibit considerable cross-sectional variation. To the extent that the fame of creators is founded on the magnitude of creative achievement, the degree of distinction should be directly related to underlying creativity. Such an eminence indicator of creativity is employed three major ways in the published literature. First, the eminence measure may be studied alone. The researcher may focus on the degree of variation, the distribution, the stability across time or cultures, and so forth. Second, the eminence measure may be adopted as a dependent variable in a prediction equation. In such cases the

goal is to identify the factors that predict historic creativity. This constitutes the most common use of this type of creativity measure. Third, but less frequently, eminence may be used as an independent variable, especially as a moderator variable in a regression equation testing for interaction effects. For example, one study looked at whether the curves defining the relationship between age and creative productivity varied according to how illustrious were the creators. The interest was not in predicting eminence but in determining whether the same career trajectories held for all individuals regardless of the magnitude of accomplishment.

Measurement

What are the ways that researchers go about assessing the eminence of creative personalities? What are the psychometric properties of the resultant eminence assessments? These are the questions answered next.

Assessment Techniques

Once the investigator decides to use eminence in a particular study, the first issue that must be addressed is how to best assess the eminence of the individuals under investigation. Sometimes a purely informal procedure suffices. For instance, most psychobiographical studies of creative individuals select a particular case for study precisely because that person is obviously famous (and at the same time interesting in some other way). Thus, when Sigmund Freud did his analysis of Leonardo da Vinci, he felt no need to justify the choice of subject. The artist's eminence would be obvious to all. Similarly, when Howard Gardner selected the seven subjects for his book *Creating Minds*, he simply picked a twentieth-century luminary who represented each one of the seven intelligences according to his theory of multiple intelligence. The resulting sample consisted of Albert Einstein, T. S. Eliot, Pablo Picasso, Igor Stravinsky, Martha Graham, Sigmund Freud, and Mahatma Gandhi. Even though someone else might pick a different set of representatives, the distinction of these seven figures is beyond doubt.

One difficulty with such informal sampling methods is that they permit the potential introduction of bias. Because there is so much latitude for subjectivity, it can happen that the eminent are unconsciously selected to be consistent with some perspective or hypothesis. An interesting illustration is the sample that Abraham Maslow collected to study self-actualizing personalities. Because, as a humanistic psychologist, Maslow believed that creativity was associated with superior mental health, it cannot have been mere accident that there are no cases of truly 'mad geniuses' among the creators in his sample. Sometimes the avoidance of the psychopathological made him sample the less famous rather than the more famous. Why else would Maslow choose Camille Pissarro rather than van Gogh or Franz Joseph Haydn rather than Beethoven?

To avoid the potential introduction of bias, many investigators adopt more systematic and objective strategies for sampling eminent creators. Sometimes the researcher will study those individuals who have attained sufficient acclaim that they have biographies written about them or at least articles under their

name in major reference works, such as encyclopedias or biographical dictionaries. Other times the investigator will rely on peer nominations. Experts in a particular domain will be asked to nominate those contemporaries who have made the most creative contributions. Still other researchers will adopt the criterion of the creator having received a major honor, such as the Nobel or Pulitzer.

So far the focus has been on the application of the eminence criterion as part of a sampling procedure. Yet as pointed out earlier, eminence often figures prominently as an individual-difference variable in its own right. Even among the notables of a particular creative domain, the variation in reputation can be quite substantial. The question then becomes how to best capture this dispersion in terms of reliable scores on some eminence measure. One of the oldest and most common solutions is to use standard reference sources to define some type of space measure. For instance, the investigator might count the number of pages or lines devoted to each creator in a biographical dictionary, encyclopedia, or history. Alternatively, the researcher might count the number of books or articles written about each individual in the sample. Such archival indices of eminence have the advantage of being highly reliable and objective.

However, some investigators prefer eminence assessments that allow more room for subjective considerations. A good example is the creative achievement scale devised by Arnold Ludwig. This instrument requires assessments of an individual's contributions in terms of originality, universality, versatility, influence, transcendence, virtuosity, and so on. These assessments are based on biographical and historical information available about each eminent creator. Another approach is simply to ask experts to rate eminent creators on the global level of creativity realized. Sometimes such global assessments are carried out in the form of rankings.

In any case, these subjective measures have certain advantages over the objective measures mentioned in the previous paragraph. For one thing, the subjective indicators can help the researcher understand better what exactly is being assessed, especially when the components of creative eminence are made explicit in the design of the measurement scale, as is the case in Ludwig's instrument. In addition, the objective measures sometimes have biases that are not necessarily present in the subjective measures. For instance, archival assessments of eminence based on space measures often favor some forms of creativity at the expense of other forms. It is much easier to describe in words the contributions of writers and philosophers than it is to give a verbal account of the contributions of painters and composers. As a consequence, encyclopedias tend to devote more space to eminent individuals whose creativity took a verbal form than to those whose creativity required nonverbal means of expression. Fortunately, statistical procedures do exist that permit the introduction of the appropriate corrections, but these procedures necessarily make the data analysis more complicated.

Psychometric Features

It should be pointed out that eminence measures have been shown to have highly desirable properties from a psychometric perspective. In the first place, indicators of individual

differences in creative eminence display quite impressive reliability coefficients, which signify that the amount of measurement error is relatively small. In fact, eminence measures are just as reliable as other, more commonplace measures in psychology, such as scores on intelligence tests. Second, alternative techniques for assessing individual differences in eminence yield quite comparable results. Not only do the diverse kinds of objective measures correlate highly with each other (and the various types of subjective measures intercorrelated highly as well), but in addition the objective and subjective assessments are in substantial agreement as well. Hence, a consensus exists on the relative eminence of creative individuals. Finally, this strong consensus on differential eminence is highly stable over time. Researchers have examined eminence ratings separated by a century or more and still obtain respectable correlations. Indeed, there appears no pronounced tendency for the agreement to decline as the temporal separation between two measures increases. This transhistorical constancy of eminence suggests that differential fame is tapping into some stable individual differences in creative accomplishment. If Mozart is consistently rated as more famous than one of his contemporaries, such as Türk, this contrast no doubt reflects to a very large extent their comparative creativity.

Admittedly, the correspondence between eminence and creativity is by no means perfect. Exceptions to the general rule do exist. Sometimes creators die before they receive the recognition they deserve (e.g., Gregor Mendel), whereas other times creators received far more contemporary fame than they will be granted by subsequent generations (e.g., Trofim Lysenko). Yet these occasions are too few and far between to seriously undermine the reliability and stability of eminence indicators.

It must also be confessed that it is the fairly irreversible fate of every luminary that his or her fame will decline with time. After all, as more and more creative products are added to the cultural store, the competition becomes ever more fierce. Each year there are more paintings to hang on gallery walls, compositions to perform in the concert halls, plays to be produced, books to be reprinted, and so forth. Accordingly, even the most illustrious creators are fated to see their market share gradually diminish. Yet that decline by itself does not attenuate the significance of eminence as a gauge of exceptional creativity. So long as the relative positions of eminent creators remain constant over time, the stability of eminence will persist. Hence, in the theater Shakespeare may have had to yield some ground to Shaw and other more recent playwrights, but so did Marlowe, Jonson, and other Elizabethan contemporaries. Despite the increased competition, Shakespeare's differential standing survives unscathed.

Determinants

Once eminence is accepted as a criterion of creativity, the researcher is tempted to ask: What are the predictors of creative eminence? How do famous creators differ from their less distinguished colleagues? And in what ways do creative luminaries contrast with the rest of us? These questions will be answered by giving an overview of some of the central empirical findings.

Individual Differences

The following four factors are most likely to differentiate the eminent from the noneminent as well as distinguish the comparative degree of eminence among those who have attained some acclaim.

Productivity

The single most important predictor of achieved eminence as a creator is the total lifetime output of creative products. At the very minimum, of course, it takes at least one successful creative achievement to secure a lasting reputation, but many creators are guilty of seeming overkill, creating hundreds if not thousands of works. Thomas Edison, for example, still holds the record for the number of patents granted to any one person by the United States Patent Office. Of course, such massive lifetime output is not really superfluous. A positive relationship exists between the total number of creative products and the magnitude of eminence attained. To be sure, some perfectionists attain fame on the basis of very few works, whereas some mass producers generate tons of totally forgettable creations. But these two classes of creators represent only a very small proportion of the population. In fact, quality (or creativity) of output is a positive function of quantity (or productivity) of output. Those creators who generate the most successful works also, on the average, produce the most unsuccessful works.

Two additional features of this lifetime productivity deserve mention. First, the total lifetime output is typically attained by beginning the career early, continuing the career until late in life, and maintaining exceptional annual rates of productivity. In other words, eminent creators exhibit productive precocity and longevity as well as being highly prolific in any particular unit of time. Second, the cross-sectional distribution of creativity is highly skewed, a small percentage of illustrious producers accounting for a lion's share of the total output. Often those creators who are in the top 10% in lifetime output will be responsible for 50% of all products generated in their fields. This lopsided distribution departs greatly from the normal curve that so often characterizes individual differences.

Intelligence

It was Francis Galton who first argued that creative eminence had a firm foundation in individual differences in natural ability or intelligence. The first empirical study to address this issue directly was conducted by Catharine Cox in her 1926 book titled *The Early Mental Traits of Three Hundred Geniuses*. After first using biographical data to calculate IQ scores for eminent creators and leaders, she then showed that (a) creative geniuses have higher IQs than average and (b) higher IQs are positively associated with the level of eminence attained. Subsequent investigators have replicated these findings, but only after imposing a serious qualification: intelligence tends to operate as a necessary but sufficient factor underlying creative eminence. This means, first of all, that a certain minimum intellectual power is required to support the knowledge and skills that generate creative contributions. Yet a high, and even a genius-level intellectual capacity (i.e., IQ 140) by no means guarantees that an individual will exhibit any creative ability.

Moreover, as intelligence increases beyond this threshold level, the potential for creative achievement increases, but again without any assurance that the full potential will be realized. Thus, an individual with an IQ of 200 has the potential of being more creative than an individual with an IQ of 130, but it may in fact be the latter person who turns out to attain the more impressive creative eminence. The lack of precise correspondence between intelligence and eminence simply reflects the fact that creativity has a great many determinants, intelligence alone only playing a small part.

Personality

Among those additional factors, of course, are individual differences in certain personality traits. Highly eminent creators tend to exhibit a distinctive character profile in comparison to the less eminent colleagues or to control groups of noneminent professionals working in the same domain. The most important components of this profile are motivational in nature. To obtain a conspicuous degree of distinction in a creative activity requires an exceptional amount of energy, enthusiasm, determination, and persistence. The most eminent creators usually must struggle courageously to overcome obstacles in their path, nor are they discouraged from pursuing their creative visions by sporadic setbacks and failures. Along with this drive comes a host of other traits that largely shape how eminent creators interact with their fellow human beings. For example, they tend to be introverted, original, independent, nonconformist, and sometimes even bohemian. In general, the profile seems to consist of traits that would best permit an individual to devote the considerable effort necessary to produce a profusion of original ideas.

Psychopathology

One particular dispositional characteristic of eminent creators deserves special attention. For centuries thinkers have speculated on the possible connection between madness and genius. The general consensus favored the existence of a positive relationship, a relation that was thought to be especially strong for creative genius. The only major dissent from this opinion was that voiced by Maslow who, as noted earlier, thought that eminent creativity was associated with superior mental health. Nonetheless, more systematic investigations that have employed a variety of methods reveal that creative eminence bears a conspicuous link with mental illness. To begin with, the incidence rates of psychopathological symptoms are higher among eminent creators than among the general population. In addition, eminent creative contemporaries score higher on the clinical scales of various diagnostic instruments (such as the MMPI or the EPQ). Furthermore, higher psychopathology tends to be positively correlated with higher degrees of attained eminence. Finally, eminent creators are more likely to come from family pedigrees in which the incidence of mental illness exceeds that found in the general population.

The general conclusion that genius and madness are related must be tempered by four qualifications. First, eminent creators appear to exhibit subclinical levels of psychopathology. That is, their symptoms are usually higher than average without being so high as to cause debilitating distress. Second, the psychopathology is counterbalanced by other traits, such as ego strength and intelligence, which serve to lessen the adverse repercussions.

Third, the magnitude of expected psychopathology varies according to the specific domain of creative activity. On the average, for example, eminent artists display more severe symptoms than do eminent scientists who, as a group, may demonstrate a similar degree of psychopathology to the general population. Fourth, it is not entirely clear what are the causal linkages between illness and creativity. It may be that certain levels of psychopathology support the cognitive style and behavioral disposition necessary for creative activity. Yet it may also be that a highly creative life is much more challenging than an ordinary one, and that these challenges themselves can stimulate mental and emotional breakdowns. Even worse, these two possibilities need not be mutually exclusive, nor are other causal relationships yet ruled out.

Development

Eminent creators tend to come from rather distinct biographical backgrounds. The following six circumstances have perhaps received the most attention in the empirical research.

Family pedigrees

Galton's 1869 classic *Hereditary Genius* was the first systematic study of the tendency for creative genius to run in family lineages. He specifically showed that eminent creators were far more likely to come from families that featured close relatives who attained distinction in the same general domain of creativity. Although others have replicated Galton's finding, the best substantive interpretation is more elusive. Galton believed that this showed that genius had a genetic foundation, but such speculation goes well beyond the data. Especially problematic is the fact that the inheritance appears to be so domain specific. It is very unlikely that a gene or set of genes exists that enables people to do creative science, for example. Hence, the relevance of family pedigrees may reflect more nurture than nature. Parents and relatives are more likely to provide support for talent development in domains in which a family history of distinction exists. Certainly such successful lineages will provide ample models for emulation by developing creative talents. The biological portion of the inheritance, in contrast, may be limited to much broader capacities, such as general intelligence and high energy levels. In line with what was said earlier, another component of this generalized genetic endowment may entail a certain proclivity toward psychopathology.

Childhood precocity

Prior to adulthood, the concept of precocious development is intimately related with that of intelligence. Indeed, the intelligence quotient, or IQ, was originally conceived as a ratio of mental to chronological age. Those who are highly accelerated in intellectual development exhibit higher than normal ratios and thus earn higher than average IQ scores. This linkage is evident in the IQs that Cox calculated for her 301 eminent personalities, because the scores were based on comparing their intellectual capacities in childhood and adolescence with what is normally expected of youths at the same age level. Nonetheless, it should also be pointed out that Cox's assessments were actually much broader than are found in the typical IQ test, such as the Stanford-Binet. The most weight was given to precocity directly related to the domain of

adulthood achievement. Mozart, for example, was credited with a high IQ owing to his phenomenal musical precocity, both as a performer and as a composer. Yet musical ability is not even evaluated by a standard IQ test. Hence, Cox was assessing domain-specific precocious development far more than generalized intellectual precocity. In any case, subsequent investigations, using different samples and techniques, have arrived at the same conclusion: eminent creativity is strongly associated with early manifestations of precocity within a particular domain of creative activity. For example, notable composers are far more likely to begin music lessons at a young age, to begin composition very early, and to experience their first genuine success early as well.

Birth order

In 1874, Galton was the first behavioral scientist to investigate whether ordinal position in the family bore any connection with eminence as a creator. His discovery that firstborn children are overrepresented among eminent scientists has been replicated many times since then. This robust finding is consistent with other studies showing that firstborns exhibit higher than expected frequencies among doctors, lawyers, professors, and other professionals. However, subsequent research also suggests that birth order is most relevant as a determinant of the domain and style of creative eminence. Firstborns are most likely to gravitate to those areas of creativity that impose greater constraints on the creator, whereas later borns are more prone to enter creative activities where the constraints are fewer and conformity to norms less expected. Within science, for example, revolutionary scientists who overthrow traditional paradigms are more likely to be later borns, whereas firstborns have a higher likelihood of making contributions that fit within the received scientific paradigm or tradition. Similarly in the arts: where later borns are overrepresented among creative writers, firstborns are predominant among composers of classical music. Interestingly, this pattern occurs among eminent leaders as well. Firstborns exhibit a propensity for becoming status quo or establishment leaders, whereas later borns display an inclination for becoming revolutionaries. This birth order distribution holds for both political and religious leaders.

Early trauma

Eminent creators do not necessarily emerge from happy, stable, conventional home environments. On the contrary, they tend to suffer more than their fair share of trials and tribulations during childhood and adolescence. Their families may experience big fluctuations in financial well-being, and many grow up in minority or immigrant homes that must overcome prejudice and discrimination. Often future creators have had to surmount some intellectual, emotional, or physical disability, as well as endure extreme loneliness and isolation. But probably the traumatic event that has received the most attention in published research is the experience of parental loss or orphanhood. Eminent people in general, and famous creators in particular, seem to have suffered this type of trauma at incidence rates noticeably higher than what is seen in the overall population. The parental loss rates are especially high for literary creators. At present we do not know how traumatic events contribute to creative development. Three main explanations

have been offered. First, these experiences may disrupt the standard socialization process, and this disruption leaves enough freedom for the emergence of an independent, even iconoclastic intellect. Second, such encounters help the young talent to develop the robustness necessary to overcome the many obstacles and setbacks faced by adult creators. Third, such trauma may produce a 'bereavement syndrome' to which creative achievement serves as a form of compensation or adjustment. It is hoped that once researchers discover exactly how trauma contributes to the development of creative genius, they will also learn why some distinguished creators do indeed manage to grow up in totally normal and pleasant home environments.

Role models and mentors

It is difficult if not impossible for creative talent to develop without a role model or mentor. To a very large extent creativity is a form of expertise that requires the imitation and emulation of other creators who have already made a name for themselves within a particular domain. This social learning process takes two main forms. First, a promising youth may assume a student, apprentice, or discipline relationship with an older teacher or master. This direct influence entails both instruction and modeling. Second, a developing talent can be actively influenced by creators at a distance, an indirect effect that involves modeling only. Not only may these influences not be known personally and only admired at a distance, but in addition these models of creativity may be deceased. The most dramatic illustration of this latter effect is the way that the artists of the early Italian Renaissance were inspired by the rediscovered masterworks of classic antiquity.

It should be pointed out that role models and mentors need not invariably have positive effects on the emergence of eminent creators. The influences can be negative as well. For instance, a student or apprentice may imitate a teacher or master too closely and thereby becomes an intellectual clone incapable of original ideas. For this reason, creators are more likely to attain higher levels of eminence if they take inspiration from multiple models and mentors.

Formal education and training

The instruction may be more formal than what we have so far described. Besides working in a studio or laboratory, developing creators can actually enrol in regular courses at an academic institution or special school. Such formal education and training has a somewhat ambiguous relationship with the attainment of distinction as a creative person. On the one hand, a certain minimal amount of domain-specific knowledge and skills is essential for creativity, and a good proportion of this requisite may be acquired from formal coursework and instruction. On the other hand, excessive formal training and education can severely narrow an individual's expertise, with negative consequences for the capacity for original thought. As a consequence, eminent creators are not necessarily outstanding students in terms of scholastic performance, nor are they always prone to seek the highest degree or diploma available in their field of creative activity. Indeed, sometimes the relationship between level of formal education and creative eminence may be described as a curvilinear, inverted-U function. At the beginning formal education enhances the

development of creative talent, but after a certain optimum level, further amounts of education may undermine the emergence of creative potential. The precise location of this peak depends on the specific type of creativity. For the arts and humanities the optimum may be only a couple of years of undergraduate instruction, whereas for the sciences the optimum may appear in the first few years of graduate or professional school.

Sociocultural Context

One of the recurrent issues in the study of creativity has been the relative importance of individual and situation. How much is creativity a matter of genius, and how much is it a matter of the zeitgeist? Are so-called creative geniuses simply persons who were lucky enough to be born at the right place at the right time? Perhaps the most striking evidence for the causal significance of the larger milieu is the fact that eminent creators are not randomly distributed over history or across cultures. Rather, creators cluster into cultural configurations. That is, at particular times and places, certain peoples may exhibit an emergence or renaissance of creative activity, ascend to a Golden Age of achievement, only to descend into a Silver Age before disappearing into a Dark Age. This story of the rise and fall of civilizations and creative traditions is centuries old, and shows no evidence of ending in the future. Such culture-wide cycles in creative activity suggest that the appearance of eminent creators is very much affected by massive societal forces. For convenience, we may divide these forces into the political, economic, cultural, and ideological.

Political

The creativity of even the most independent genius must take place in a particular political milieu, making it susceptible to some of the dramatic events that sometimes characterize the world of politics. Among the most conspicuous of such influences is international war, a circumstance that has been shown to depress creative output in a diversity of creative activities. Interestingly, even areas that are supposed to be encouraged by warfare are actually harmed. In particular, overall technological innovation is harmed, apparently because the war effort channels resources toward the development of military inventions, to the detriment of other technologies.

The effect of war is immediate, affecting the output of eminent creators during their active careers. Other political effects operate only after a considerable delay. The time lapse occurs because these circumstances determine the environment in which a talented youth grows up. Some of these long-term developmental effects are positive, such as the benefit of growing up under circumstances of political fragmentation. This is the condition in which a civilization area is divided into numerous nation-states, as was the case during the Golden Age of Greece and the Italian Renaissance. Closely related to this relationship is the beneficial impact of nationalistic rebellions and revolts. On the other hand, some developmental effects are quite detrimental to the eventual emergence of eminent creators. The best case in point is political anarchy, when the power elite is torn by internecine strife – when assassination, conspiracy, and coup d'état become the order (or disorder) of the day. The next generation will suffer the

adverse consequences, at least in terms of the absence of eminent scientists, philosophers, and writers.

Economic

A certain level of material well-being is a prerequisite for the appearance of historic creative activity. Creative genius rarely emerges in impoverished nations. In fact, a creative florescence in a civilization usually occurs when the economy becomes prosperous enough to generate sufficient surplus wealth to support creative inquiry, invention, and imagination. However, although economic prosperity is necessary, it is not a sufficient cause of creative eminence. Greece under the Byzantine Empire was far more prosperous than the Greece of Periclean Athens. Yet with the exception of Byzantine achievements in architecture and mosaic, it is the Classic Age that boasts the most impressive creative achievements.

Cultural

Earlier it was pointed out that creative development is dependent on the availability of role models and mentors. Stated in generational terms, the number of eminent creators in one generation tends to be a positive function of the number of creators in the previous generation. One consequence of this intergenerational influence is the clustering of creative genius into cultural configurations – the periods of Golden and Silver Ages separated by Dark Ages. However, this generational continuity also raises a critical issue: If creative development is contingent on the availability of creative models, how do these cultural configurations get started in the first place? Somehow creativity has to get a booster shot to establish the basis for modeling and mentoring. One answer to this problem involves the influx of ideas from outside the nation or civilization. Research has found that when creativity stagnates in any given culture, it experiences rejuvenation if the culture opens itself up to the scientific and aesthetic ideas from foreign cultures. For instance, it was the Greeks' exposure to the culture of Persia, Egypt, and elsewhere that helped set the stage for the Classic Era of Greek civilization.

This alien input explains why eminent creators can begin to appear. But what happens at the other end of the cultural configuration? Once a civilization reaches a climax, the number of available role models reaches a maximum. So why does the level of creative activity decline rather than continue to increase indefinitely? Why must Golden Ages yield to Silver Ages and the latter to Dark Ages? Evidently, the answer lies in the fact that a given culture at a given time is usually confined to a particular paradigm, style, or ideology that sets the pattern for all creative endeavors. Eventually that cultural pattern becomes exhausted, making it ever more difficult to come up with good creative ideas. Decadence and decay eventually appear. It is interesting that the most eminent creators of a given cultural growth tend to appear when the civilization is experiencing an ascent, whereas those who appear after the climax has passed, being left with the residue or 'cultural dregs,' tend to be much less eminent.

Ideological

The general philosophical and moral zeitgeist plays a major role in the coming and going of eminent creators during the

course of history. To begin with, creative activity in any civilization is more likely to appear during times of ideological diversity rather than during times when one single dogma monopolizes thought. In addition, the intellectual milieu helps shape the type of creative achievement that is most likely to appear in a particular time and place. For example, periods dominated by materialism, empiricism, determinism, and individualism tend to be more favorable to scientific eminence than periods dominated by idealism, rationalism, free will, and collectivism. Sometimes the prevailing ideology actually prevents certain kinds of creative talent from appearing at all. A good example is the way that Confucianist ideology – which maintains a very hierarchical view of the place of women in society – has been shown to be antithetical to the appearance of eminent female creators in Japanese culture.

These ideological influences are closely linked to political and economic circumstances. For instance, threatening conditions tend to encourage the emergence of authoritarian ideologies, which in turn favor the appearance of superstitious and occult activities at the expense of scientific rationality.

Evaluation

Besides the face validity of the eminence definition of creativity, this approach has many unique assets. In the case of psychometric studies of eminent contemporary creators, one of the most important advantages is the ability to examine the extreme upper tails of the distribution of creativity. Famous creators are the intellectual analogs of the athletic champions, such as the Olympic medalists, and as such represent the best the human mind can achieve. Historiometric studies of deceased creators take this scrutiny one step further by examining those who have attained even more elite heights, the best of the best, the individuals whose creations have survived the tests of time.

However, the eminence definition of creativity also has three major drawbacks.

1. By conceiving creativity in terms of an eminent elite, research on creators becomes far removed from more everyday forms of creative activity. A person does not have to be famous to engage in creative problem solving. Moreover, it is highly likely that the vast majority of creative acts take place at this lower level, where creativity is personal and anonymous. Yet how does the researcher know that what is found for exceptional creators also holds for more mundane forms of the phenomenon? One answer to this objection is to point out that there does appear to be some degree of continuity from the noncreative to the everyday creative to the eminent creative. That is, they seem to represent different points on an underlying individual-difference dimension. The relationship between psychopathology and creativity provides a good illustration. Everyday creators seem to have a higher level of symptomatology than noncreative individuals, but they also seem to have a lower level than seen in the eminent creators, who in turn fall below the level seen in institutionalized patients. Hence, insofar as there exists such dimensions, the study of eminent creators can shed light on the determinants of creativity.

2. Sometimes research on eminent creators suffers from inferior data quality. Historiometric studies, for example, are invariably retrospective and archival in nature, and therefore must rely on the biographical and historical record. This record may not always be up to the desired task. For instance, when Cox wanted to estimate IQ scores for creative geniuses of the past, she found it necessary to delete several important personalities due to the lack of sufficient data about early childhood and adolescence. Among the figures so omitted was William Shakespeare! Even psychometric studies of eminent personalities must contend with a large number of problems. It may be difficult to obtain the participation of eminent creators, and those who are willing may not constitute a representative sample. In addition, the retrospective information about early developmental experiences may be no more reliable for eminent contemporaries and for historic creators.
3. Eminent creators are not as easily studied as, say, schoolchildren or college students. Investigations into eminent contemporaries often require considerable expenses for travel, food, and lodging, and the logistics of interviewing even a relatively small sample of creators can be extremely difficult. Although historiometric studies of historic creators do not suffer from these problems, they have their own. Often it takes a considerable amount of time to gather all the biographical, historical, and content analytical data necessary for a given study. The statistical analyses required to control for the many potential artifacts in correlational research can also be quite laborious. Such labor may discourage many investigators from studying famous creators, past or present.

Because of the above disadvantages, research on eminent creators will never dominate the literature. The vast majority of participants will always be taken from everyday populations, such as college students. Nevertheless, such studies will always provide an essential component of any complete understanding of creativity.

See also: Consensual Assessment; Economic Perspectives on Creativity; Families and Creativity; Genius and Greatness; Historiometry; Intelligence (as Related to Creativity); Mad Genius Controversy; Prodigies; Self-Actualization; Testing/Measurement/Assessment; Zeitgeist.

Further Reading

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Emotion/Affect

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Glossary

Affect A broad set of events and processes that includes moods, emotions, feeling states, and cognitive–affective structures.

Divergent thinking The ability to generate a variety of associations to a word or solutions to a problem.

Mood induction Refers to research techniques that stimulates a specific feeling state in the individual.

Pretend play Play involving make-believe, the use of fantasy, and treating one thing as if it were something else.

Primary process An early, primitive system of thought that is affect-laden and not logical, such as in dreams.

Definitions of Emotion and Affect

Concept of Creativity

A useful distinction in the conceptualization of creativity is that of the creative product as opposed to the creative process. The creative product is the output of the individual. The output is then judged according to criteria in a particular field as to its creativity. There is a consensus in the field that for a product to be judged as creative it must be (a) original, unique, novel and (b) useful – that is, adaptive and aesthetically pleasing according to the standards of the particular discipline.

Given these two criteria for a product to be judged as creative, the question is often asked, “Can children be truly creative?” Although children can generate new and useful ideas and products, the products are usually not at a level of sophistication necessary to truly contribute to an area. However, if one considers whether or not a product is new and good for that age group, then children can be considered to be generators of creative products. Even though a discovery or idea may have already occurred in a field, if it is new to the individual, then it is a creative act. Ruth Richards has called this kind of creativity ‘everyday creativity.’ Therefore, children and many adults demonstrate creative acts on a daily basis, even though the creative products are not making major contributions to a discipline like art or engineering. This is an important point because it implies that we can study creativity in children and in normal adult populations.

The creative act, which generates a creative product, can involve a number of underlying processes. A major question in studying creativity is “What are the processes that are part of the creative act?” What cognitive, affective, and personality processes are involved in the creative process and increase the likelihood that an individual will generate a creative product?

Concept of Emotion/Affect

It is important to define the terms *emotion* and *affect*. Affect has been described as a broader concept, with emotion as a subset of affect. Emotion is defined as a state of aroused feeling or agitation. Affect has also been viewed as a broad set of events that includes emotions and drives, and involves feeling states that are pervasive. Emotions have been described as interrupting events that are more specific in terms of stimuli and

behavioral responses than are broader feeling states. Moods are often defined as being of longer duration than emotions without a clear trigger or object. The term affect is used throughout this article, rather than emotion, because affect is the more inclusive concept. Affective processes refer to the different dimensions of affect, or types of affect events, that occur within the individual. Most theorists think that cognition frequently is involved in the affective processes, although they differ as to whether affect is always involved, the degree of involvement, and the type of involvement.

Types of Affective Processes

Five affective processes have emerged that are important in creativity based on theory and the research literature. The five affective processes, briefly defined, are as follows:

1. **Openness to experiencing affect states.** This is the ability to feel the affects and specific emotions as they occur. Tellegen and others have found that different types of affect states can be classified as positive affect or negative affect. Individuals differ as to how much they can experience positive and negative affect states. These specific feeling states seem to function differently in the creative process.
2. **Access to affect-laden thoughts, images, and fantasy.** This is the ability to think about ideas, images, and fantasies that include affect. Thoughts involving affect themes such as aggression, sex, affection, or anxiety illustrate this blending of affect and cognition. The psychoanalytic concept of primary process thinking, to be discussed in a later section, is an example of this type of affective process.
3. **Affective pleasure in challenge.** This process involves the excitement and tension that comes with identifying a problem or mystery and wanting to immerse oneself in the task. A combination of positive and negative affect could be involved.
4. **Affective pleasure in problem solving.** This is the tendency to take a deep pleasure in solving a problem or completing an artistic production.
5. **Cognitive integration and modulation of affect.** This is the ability to control, think about, and regulate the affective events one experiences and not be swept away. Although this process is probably more cognitive than affective,

it warrants inclusion because it involves both cognition and affect and it is important in the creative process.

Three other types of affect systems important in creativity are often referred to as broad motivational systems. The whole area of motivation subsumes needs, drives, and affective processes. Drive refers to both primary and acquired drives. Three major motivational systems found to be important to creativity and that include affective components are intrinsic motivation, curiosity, and conflict-resolution and self-expression.

6. **Intrinsic motivation.** This is the motivation that comes from within the individual to perform a task rather than coming from sources external to the individual, such as rewards or evaluation. Amabile has carried out a research program that has found intrinsic motivation to be especially important in creativity. Positive affect is an important part of intrinsic motivation, as Amabile and Henessy have pointed out.
7. **Curiosity.** Curiosity is a motivational state found to be important in creativity. Berlyne has written extensively on this issue. He wrote in 1966 about his view of curiosity as reflecting the organism's striving to maintain an optimal level of arousal.
8. **Conflict-resolution and self-expression.** This is the motivation that comes from the need to resolve an internal conflict or distress or to express intense emotions. In the case of conflict-resolution, a psychoanalytic concept, the individual expresses emotion through creative outlets in an attempt to resolve the problem. Sublimation occurs if the personal conflict is channeled into a specific creative endeavor and is transformed into a more universal issue. In the case of self-expression, there are many anecdotal accounts of individuals using the arts as a form of therapy to deal with emotional problems or daily stresses.

These different affective processes and motivational states work in different ways in different areas of creativity and for different types of creativity tasks. As a field, we are just beginning to learn about the role of these processes.

Theories of Affect and Creativity

Different theories of affect and creativity focus on different types of affective processes and different types of creativity. There is no one comprehensive theory that accounts for all variables and all research findings.

Psychoanalytic Theory

Historically, the first theory of affect and creativity was psychoanalytic. The key concept in the area of psychoanalytic theory and creativity is primary process thinking.

Primary process thinking

Sigmund Freud in 1915 first conceptualized primary process thought as an early, primitive system of thought that was drive-laden and not subject to rules of logic or oriented to reality. A good example of primary process thinking is the kind of thinking that occurs in dreams. Dreams are illogical, are not oriented to rules of time and space, and frequently include affect-laden content and images. Affect is a major component of primary process thinking.

Access to primary process thought has been hypothesized to relate to creative thinking because associations are fluid and primitive images and ideas can be accessed and used.

According to classic psychoanalytic theory, primary process thinking is characterized by mobility of cathexis – that is, the energy behind ideas and images is easily displaced.

In this mode of thinking, ideas are easily interchangeable and attention is widely and flexibly distributed. Therefore, access to primary process thinking should facilitate a fluidity of thought and flexibility of search among all ideas and associations. Flexibility and fluidity of thought are characteristic of two of the most important cognitive processes involved in creative thinking.

Divergent thinking and transformation abilities are the major cognitive processes that are unique to the creative process. Divergent thinking refers to the ability to generate a variety of associations to a word or solutions to a problem. A typical item on a divergent thinking test would be "How many uses for a brick can you think of?" A high scorer on this test would generate a high number of different, acceptable uses for the object. Individuals who can use primary process and the fluidity of thought and breadth of associations inherent in it, should be highly divergent thinkers. They should also score high on a second important cognitive process, transformation ability. This involves the ability to transform or revise what one knows into new patterns or configurations and to be flexible and break out of an old set. Again, the broad associations and flexible thinking characteristic of primary process should facilitate transformation abilities.

Regression in the service of the ego

An important point in psychoanalytic theory is that it is controlled access to primary process thinking that is facilitative of creative thought. The concept of regression in the service of the ego postulates that creative individuals could regress in a controlled fashion and tap into primary process thinking. The creative individual could go back and forth between early, primitive primary process thought and more mature, rational, secondary process thinking. The creative individual could be distinguished from the individual with a thought disorder in that the creative individual was in charge of this regressive process and could critically and logically evaluate the loose, primitive associations and images.

Recently, a number of theorists have proposed that the concept of regression may not be necessary in understanding the relationship between primary process and creativity. Rather, we can think of primary process as a separate cognitive-affective process that one can have access to that then facilitates divergent thinking and transformation abilities. A separate ability to cognitively integrate and modulate primary process thinking would be important in the critical evaluation stage of creative thought.

In summary, the psychoanalytic model of primary process and regression in the service of the ego stresses the importance of two types of affective processes in creativity: (a) access to affect-laden thoughts and images; and (b) cognitive integration of affective material. These processes are important in the facilitation of creative cognitive processes.

Empirical evidence

Primary process has been found to relate to creative cognitive processes in the research literature. Most of the research has used the Rorschach inkblot test as a measure of primary process. In general, as psychoanalytic theory predicted, the ability to give good responses to the Rorschach that contained primary process content was significantly related to measures of divergent thinking and flexibility in problem solving. Using a different approach, good artists were found to have more primitive primary process content than poor artists and top ranked creative architects had more libidinal (sexual) primary process content than lower ranked architects.

Similar results have been found with children, although age, gender, and specific scores emerge as important factors. Primary process on the Rorschach significantly related to divergent thinking and to flexibility in problem solving for boys, but not for girls, independent of intelligence. These gender differences occur throughout the research literature with adults and with children.

In summary, affect-laden primary process thinking is related to cognitive processes important to creativity for males. For females, the results are mixed. A few studies found that pure access to primary process was related to creativity in females. One possible explanation for these sex differences is that females do not have as much access to primary process thought because of cultural taboos and socialization processes. Another explanation could be that the Rorschach is a more valid measure of primary process for males than for females. Indeed, when measuring primary process in children's play, Russ found that primary process related to divergent thinking for both boys and girls. There are many questions remaining to be answered in this research area.

Conflict resolution and self-expression

From a different perspective, psychoanalytic theory has stressed the importance of unresolved conflicts and unfulfilled wishes in motivating the individual to engage in creative work. For example, unrequited love will be expressed in a poem or drawing. Resolving the loss of a loved one will occur as a result of composing a song. The motivating force of transforming one's own pain into artistic creations that have universal appeal is thought to be an important factor in creative work. Although there is little direct empirical evidence for this theory, there is indirect evidence from clinical vignettes from therapists and from descriptions from creative individuals. In addition, Pennebaker's research found that expressive writing can have beneficial effects on mental and physical health.

Cognitive–Affective Models

A more recent approach to affect and creativity has been within a cognitive–affective framework. Research has investigated very specifically how affect influences cognitive processes important in creativity. Much of the research within this framework has used a mood induction paradigm. A specific mood state is induced by having participants watch a film, receive a gift, or think about a memory that is happy or sad. Mood induction provides a way of altering affect states so that the effect on cognitive processes can be observed.

A growing body of research has found that induced affect facilitates creative thinking. Alice Isen has carried out a series of important, carefully controlled studies in the mood induction area. She and her colleagues found that positive affect induction resulted in more creative problem solving when compared to control groups. Other researchers found similar results with a variety of creativity measures. Isen concluded that the underlying mechanism is that positive affect cues positive memories and a large amount of cognitive and affective content. This process results in defocused attention and a more complex cognitive context. This, in turn, results in a greater range of associations and interpretations.

What about negative affect? In general, induced negative affect has had no effect on creative problem solving. As the researchers pointed out, it is possible that the negative affect that was aroused (e.g., by a film of the Holocaust) was too extreme, and that less extreme conditions of negative affect should be explored. A few studies suggest that milder forms of negative affect could facilitate some kinds of problem solving tasks. Different types of affect may have different effects on various dimensions of problem-solving.

In a recent meta-analysis of 25 years of mood-creativity research, Baas, DeDreu, and Nijstad concluded that a number of variables are involved in this complex area of mood and creativity. Specific mood types (not just positive and negative) and aspects of those moods must be considered. They concluded that positive moods do produce more creativity than neutral moods. But this is true for positive moods like happiness that are activating and associated with approach motivation. It is not true for positive but deactivating mood states like relaxation. They point out that an interesting practical implication of this finding is that relaxing in a bathtub or on the beach may not be conducive to creative thinking. How the task is framed is also important. Positive moods lead to more creativity when the task is framed as enjoyable and intrinsically rewarding and to less creativity when the task is framed as serious and extrinsically rewarding. As for negative affect, in general, deactivating negative mood states like sadness were not associated with creativity, but activating negative moods like fear with avoidance motivation were associated with lower creativity. However, there are individual studies like those by Kaufmann that do find positive relationships between negative affect and creativity. Bass, DeDreu, and Nijstad concluded that research should continue that investigates very specific mood states on specific types of creativity tasks under various conditions. We need to learn about the underlying mechanisms that account for the mood–creativity link.

An interesting theoretical model that explains how affect could influence cognition was provided by Isaac Getz and Todd Lubart in 1996. In an emotional resonance model for generating associations, they described *endocepts* that represent emotions attached to concepts or images in memory. These emotional memories are partially interconnected and can activate one another. Endocepts attached to concepts resonate with one another. Endocepts that are stimulated trigger other memories and associations and influence creative problem solving.

The emotional resonance model is consistent with other cognitive affective models such as Bower's associative network theory. In this model, emotion is conceptualized as a memory

unit that has a special node in memory. The activation of the emotion unit aids in the retrieval of events associated with it. It primes emotional themes for use in free association. When activated, it spreads activation through memory structures.

Primary-process thinking might also be conceptualized as mood-relevant cognition, occurring when emotion nodes are activated. Primary process memories could be stored in emotion nodes. Primary process content has been proposed to be content around which the child had experienced early intense feeling states (e.g., oral, anal, or aggressive). Current primary process expressions could reflect these early encodings of emotion. Access to primary process material would activate emotion nodes and associations, thus resulting in a broad range of associations for creative work and problem solving.

Intrinsic Motivation

Intrinsic motivation is conducive to creativity. Intrinsic motivation is defined as having to do with the intrinsic value of attaining a creative solution. Research has found that conditions extrinsic to the task, such as reward, evaluation, being watched, and restricted choice, all have detrimental effects on creativity. Intrinsic motivation is important for task persistence, for seeing a project through, and for ensuring exploration of solutions.

Intrinsic motivation is also accompanied by positive affect. The love of the task is an important component of creative work. Love of the work has been mentioned as crucial by most creative individuals. More research is necessary to explore the positive affect and intrinsic motivation link.

Tension and Creativity

Tension as an important factor in creativity has been conceptualized by Mark Runco. He presented a variety of ways in which tension could be involved in the creative process. The anticipation of the resolution of tension could be an important motivating force in creative problem solving. The tension could be an internal conflict, similar to psychoanalytic theory's idea of conflict resolution. For example, several researchers have found that creative individuals have come from families with problems or have themselves felt marginalized in the society. Tension could also develop from identifying a problem or sensing a gap in an area. Problem identification is important in creativity. Creative individuals could use the tension experienced in seeing the problem as both a cue and a motivator.

Affective pleasure in challenge could also be part of this process. There could be a mix of negative (tension) and positive affect in identifying a problem. The anticipation of the positive affect involved in solving the problem may act as a motivating force. However, there may be an inherent excitement in seeing the ambiguity in the situation that leads to problem identification, which is itself pleasurable. It may be similar to the pleasure that some children feel in discovering "what is wrong with this picture?"

The concept of optimal challenge is relevant here. An optimal amount of challenge is necessary for the experience of flow to occur. Flow is a total involvement in the activity, a deep sense of enjoyment, and optimal challenge. Creative activities involve this sense of flow. Perhaps optimal challenge involves

the best mix of tension in seeing the problem and the anticipated pleasure of the creative act.

Curiosity

Although it is not clear whether or not curiosity has affective components beyond arousal, it is a motivational system important in creativity. Curiosity may be viewed as reflecting the organism's efforts to maintain an optimal level of arousal. Subjective feelings of pleasantness have been associated with the growth of the curiosity drive as a function of increasing stimulus intensity and arousal of the positive reward system. Curiosity may interact with anxiety to determine approach or avoidance behavior.

Curiosity is important to creativity because interest in novelty and exploration aids in problem identification as well as task persistence. Also, the highly curious and risk-taking individual is more likely to gain a wide variety of experience that would add to his or her knowledge base.

Integrative Model of Affect and Creativity

An integrative model of affect and creativity identified the connections among affect, cognitive, and personality processes important to the creative process. This model was based on the research and theoretical literature and attempted to be comprehensive and reflect the current state of knowledge (see [Figure 1](#)).

In this model of affect and creativity, the major cognitive abilities that emerge as unique to and important in the creative process are linked to related specific affective processes and to global personality traits. In some cases the personality traits are behavioral reflections of the underlying affective processes. One assumption of this model is that these specific affective processes and personality traits facilitate creative cognitive abilities. Reciprocal interactions probably occur as well.

This model summarizes all of the affective processes discussed in this article. Because there is no one comprehensive theory of affect and creativity, a variety of theories and underlying mechanisms are represented in this model. At this time, it appears that different mechanisms underlie different components of the creative processes. For example, access to affect themes and affect states facilitates a breadth of associations. Intrinsic motivation should help the individual keep on task and explore alternative solutions. Good cognitive integration of affect should aid the critical thinking process necessary in the evaluation stage of creative work. An important point is that in any creative act, different processes and different mechanisms could be involved.

Future research should add to the empirical base for this model and answer the questions of what specific affective processes are important in creativity and how they are important. It is possible that a larger number of affective processes are involved than are currently recognized or that several of these processes are really the same process. For example, are affect-laden thoughts and mood states different dimensions of affect or are they really the same process? Do they function in the same or in different ways? Can the motivational systems of intrinsic motivation and curiosity be broken down into several affective components? (In this model, because of their global

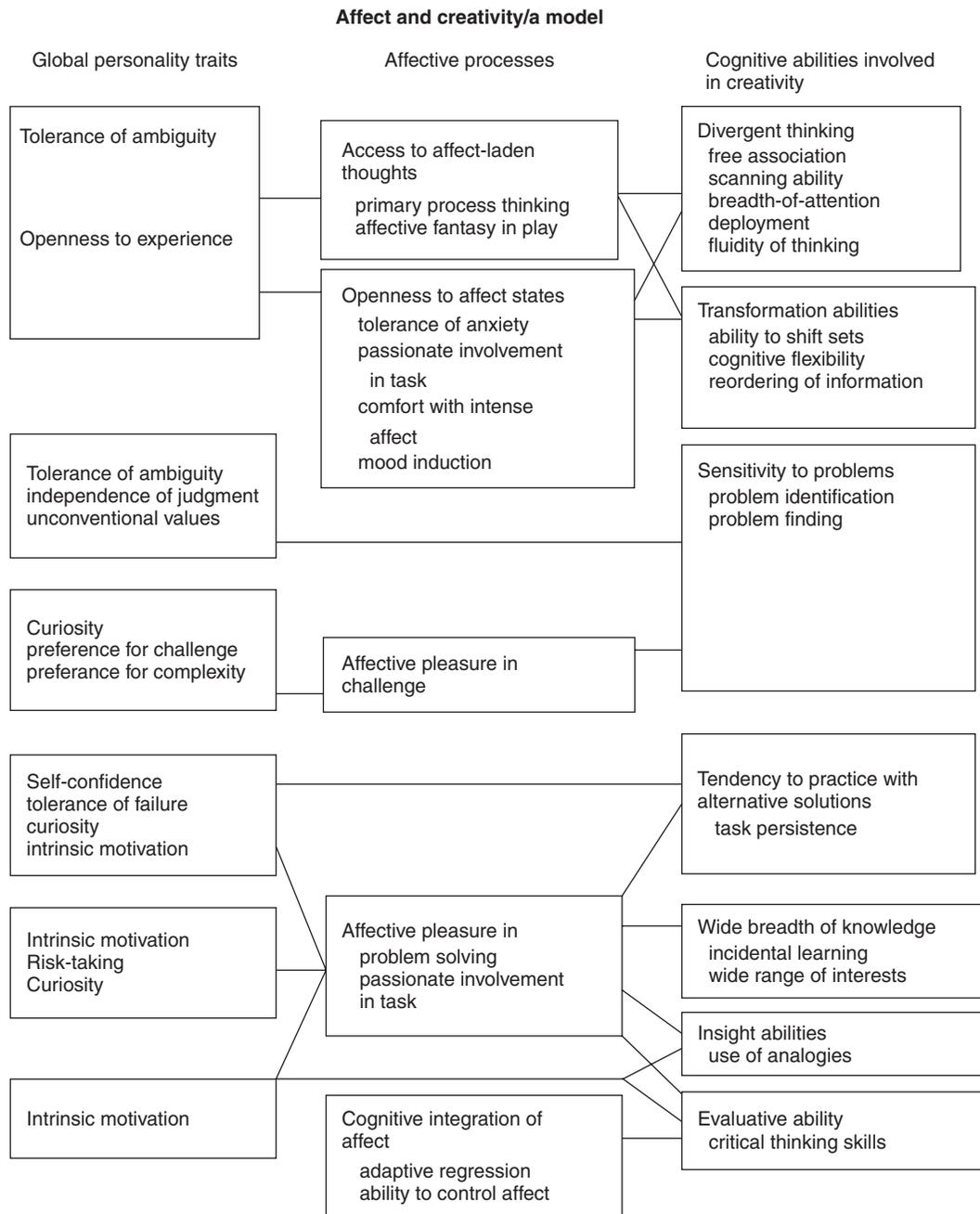


Figure 1 Affect and creativity model. In this model of affect and creativity, the major cognitive abilities that emerge as unique to and important in the creative process are linked to specific affective processes and to global personality traits. In some cases, the personality traits are behavioral reflections of the underlying affective process. One assumption of this model is that these specific affective processes and personality traits facilitate cognitive abilities. From Russ, S. (1993). *Affect and Creativity: The Role of Affect and Play in the Creative Process*. Hillsdale, NJ: Erlbaum.

nature, both were classified under personality traits). Future research will answer these important questions.

Play, Affect, and Creativity

Play is important in the development of many of the cognitive, affective, and personality processes important in creativity. The type of play most important to the area of creativity is

pretend play. Pretend play involves make-believe, the use of fantasy, and treating one thing as if it were something else. Pretend play frequently involves affect. Children express both positive and negative emotion in play. In 1987, Fein proposed that the affect is represented in an affective symbol system. Information about affect-laden events and relationships is coded and stored in these symbols. These symbols are reflected in pretend play and are especially important for creative thinking. From a psychoanalytic perspective, play is

a place where primary process thinking as well as other kinds of affect can be expressed.

Research Evidence

Research supports a relationship between affect in play and creative thinking that is independent of intelligence. A positive relationship has been found between playfulness (that included the affective components of spontaneity and joy) and divergent thinking in kindergarten children. Similarly, a relationship has been found between the amount of affect expressed in play and divergent thinking in several samples of first and second graders and in preschool children as well. In a longitudinal study, affect in play in young children predicted affect in play stories in older children. This longitudinal study suggests that affect in fantasy is a trait that has some stability over a four year period.

It is important to note that both positive and negative affect in play relate to creativity. In play, negative affect is well-controlled in most children and is pretend, after all. The negative affect is not intense and is often enjoyable to the child.

Play has been found to facilitate creativity in children, but there is no conclusive evidence that it is the affect expression in play that is the causative factor. That question continues to be investigated.

Affect, Creativity, Adjustment, and Psychopathology

Research has found that creativity relates to both adjustment and psychopathology. How can both findings be true? If we conceptualize creativity as evolving from a configuration of cognitive, affective, and personality processes that set the stage for creative acts to occur, then the propensity for adjustment could go either way depending upon the mix of processes. If creative individuals are good divergent thinkers, have diverse associations, have access to primary process in a controlled fashion, are open to affect states, and are good critical thinkers, then one would expect them to be sensitive but relatively stable individuals, perhaps with periods of emotional instability. Some research studies are supportive of the hypothesis that creative individuals are adaptive and well-adjusted. Many of the psychological traits that are related to creativity are also indicators of positive mental health.

Other researchers have found a relationship between creativity and psychopathology. In a study of British artists and writers, 38 per cent of the sample sought treatment for mood disorders. Ruth Richards, based on her research, offered three major conclusions about creativity and mental health. She concluded (a) mild psychopathology may contribute to creativity (mild mood swings especially may carry advantages for creativity), (b) intermediate levels of variables may be most optimal for creativity, and (c) affect is important in creativity. She stressed the importance of positive affect for creative accomplishment.

Artistic and Scientific Creativity

Affective processes play different roles in different domains of creativity. In general, scientists have been found to be better adjusted than artists. A higher than normal proportion of artists have been found to have mood disorders. Research with scientists paints a different picture. A number

of researchers have concluded that creative scientists may be a more emotionally stable group than creative artists.

Why would this be so? The personality differences between creative artists and scientists may reflect the differences in the domains of creativity and the cognitive and affective processes that are involved. There are similarities. Divergent thinking is important in scientific problem solving as well as in artistic production. Breaking out of a set and creating new configurations is also important in both types of creativity. Affective process would be expected to function in similar ways for similar creative tasks in artists and scientists.

One of the main differences between artistic and scientific creativity may be the importance of getting more deeply into affect states and thematic material in artistic creativity. This in-depth involvement in the affective processes themselves may not be so necessary in scientific problem solving. Some theorists think that artists incorporate early traumas and conflicts into their artistic productions. Scientists do not usually have to face into and incorporate affect-laden material into their scientific problem solving. For the scientist, good divergent thinking ability, transformation ability, and a flexible cognitive style may be sufficient for creative work to occur. For the writer, the musician, or the artist, the need to get to basic and deep emotions, primary process material, and affect-laden memories and images may be necessary in order to be able to express universal truths that transcend the individual and speak to others.

One often hears artists and writers describe the need to have this kind of experience. One can see how the need to live in that emotional state and to control that process may at times be disruptive, resulting in emotional instability and some personal agony. Writers in particular describe anxiety at uncovering primary process material.

On the other hand, interviews with creative scientists indicate that scientists often feel very strong emotions during the creative process. In a study that gave artistic and scientific problems to art and science students and had them rate their intensity of emotions, art and science students experienced the same intensity of affect before and during insight, but art students reported more positive emotion after insight than did science students.

It is logical to assume that each specific artistic and scientific domain will have cognitive and affective processes that are especially important in that area. Different creative profiles should emerge for different fields. A dynamic (not static) mode of affective-cognitive interaction has been proposed for artistic creativity. Creativity and psychopathology are ever changing continua with a mixture of affect states. Only a dynamic model can capture the complexities of the interactions.

Neurological Processes, Affect, and Creativity

As research on affect and neurological processes becomes more sophisticated, we are learning about the interaction between affect and cognition. With the development of the CAT scan, PET technology, and fMRI technology, we can map cerebral activity and obtain a picture of brain involvement during problem solving. Eventually, we should learn about the actual neurological processes involved in creative problem solving.

Research by Klaus Hoppe has shown that the mutual interaction of the left and right hemisphere is important in creativity. The corpus callosum is involved in exchanging information between the hemispheres. The symbolization and visual imagery in the right hemisphere is available to the left hemisphere in creative functioning. Cognitive representation of emotion occurs in both hemispheres.

Research on the neurological processes involved in affect processes has addressed several important questions in the area of emotion that have implications for the affect and creativity area. It has been concluded that different emotions have different neurological and physiological activity. It appears there are different brain systems that mediate different emotions. Therefore, we need to investigate specific emotions. This conclusion is consistent with the findings in the affect and creativity area that different emotions have different effects on cognitive processes.

It has also been proposed that different emotions are represented in memory. An important point is that these emotions appear to be stored in the amygdala. This is a different area of the brain than that which stores nonemotional memories, the hippocampus. Research suggests that emotional memories are organized differently than are nonemotional memories. The emotional can act independently of the cognitive system. It has been suggested that these precognitive emotions are functional in infants during the early formative years. Behavior is effected, but we have no conscious memory of the event.

The concept of emotional memories functioning as a separate system is consistent with some theoretical explanations about why affect should facilitate creativity. If affect stirs a network of associations and emotion-laden memories, which in turn effects cognitive processes, then the organizational system of those emotional memories becomes very important. The rules that govern how this emotional memory system functions still await discovery. These principles should help us understand the mechanisms that underlie the complex relationship between affect and creativity.

Conclusion

During the past 25 years, there has been a resurgence of research in the affect and creativity area. As it should be in

any science, the research is theory driven, theories are being developed and tested, measures and methods are being refined, and new lines of investigation are opening. The field is interdisciplinary and what we learn in one field informs another. For example, what we learn about affective processes from neurophysiological research will be applied to affect and creativity research. Key concerns for the future in the affect and creativity area are: (a) identifying specific affective processes that are most important for creativity tasks; (b) discovering the underlying mechanisms that account for the relationships between affect and creativity; (c) exploring differential effects of various types of affect, such as positive or negative affect, on creativity; (d) understanding how affect and creativity relate to psychological adjustment and psychopathology; and (e) understanding the developmental processes involved in affect and creativity. As research paradigms and measures of affect continue to be developed, we will continue to learn about this exciting area.

See also: Bipolar Mood Disorders; Brain and Neuropsychology; Play.

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Enhancement of Creativity

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Glossary

Cognitive processes Actions taken by the human mind to process information. At a relatively simple level, includes attention, perception, rehearsal, and encoding. More complex processes include higher-order thinking skills such as problem solving.

Constructivism Learning and cognitive theories that posit that knowledge is constructed, either individually or by groups.

Discretion Process by which potential actions and subsequent outcomes are identified, evaluated, and differentiated.

Functional fixedness Reliance on traditional techniques and strategies for problem solving, even when conditions surrounding problem diverge considerably from previously encountered conditions. Also, inability to consider alternatives when faced with problems, especially alternative uses for traditional problem-solving tools.

Information stores In the traditional two-store model of human memory and information processing, the

locations where bits of information are stored either temporarily (working memory) or permanently (long-term memory).

Metacognition An individual's analysis of his or her own cognitive processes or, more colloquially, thinking about one's own thinking.

Rigidity Lack of flexibility in the application of cognitive processes, especially problem solving. This inflexibility is reinforced by the effects of prior experience.

Schema The organizational framework for information found in long-term memory. Schema theory posits that more complex schema are associated with more efficient recall and information processing.

Self-efficacy Belief in one's own ability. Usually applied to a specific subject area or task, such as mathematical or reading self-efficacy.

Social constructivism Subset of constructivist learning theories that represent knowledge as being socially constructed, either within one's immediate environment or within the broader culture.

Can Creativity Be Enhanced?

In the not-so-distant past, the belief that creativity could not be enhanced was widespread. This notion about the unchanging nature of creativity could be found in academic circles as well as the media and popular press. Although perceptions have changed slightly over the past 20 years, a great deal of controversy still surrounds the nature–nurture issue as applied to creativity.

The relationship between nature and nurture is better conceptualized as a continuum and not as an either–or proposition. Those holding a radical nativist view assume that creativity cannot be enhanced. The extreme nativist view is rare, however, and current consensus holds that potentials can be fulfilled and maximized. It may be analogous to one's height: each of us inherits a *range of reaction* within which our experiences have their impact. One person might inherit a range of potential height between 5 foot 6 inches and 5 foot 9 inches, and given specific developmental experiences (e.g., exercise, vitamins), end up being 5 foot 10 inches. This idea about a range of potential also applies to psychological constructs such as creativity and intelligence. Hence, in response to the question “Can creativity be enhanced?” the best answer is yes, because potentials can be fulfilled. Efforts to enhance creativity will not expand one's in-born potentials but can insure that potentials are maximized.

The broad range of definitions of creativity has traditionally confused discussions about creative enhancement. For example, if one defines creativity as divergent thinking, and another person defines it as both divergent and convergent thinking, the proposed approaches to enhancement will likely be quite different. For the purposes of this entry, we use the comprehensive definition proposed by Plucker, Beghetto, and Dow, which encompasses most definitions and conceptions of creativity: “the interaction among aptitude, process, and environment by which and individual or group produces a perceptible product that is both novel and useful as defined within a social context.”

What Exactly Can Be Enhanced?

When an attempt is made to enhance creativity, what is the exact focus? To answer this question, the multifaceted nature of creativity must be recognized with its cognitive, affective, attitudinal, interpersonal, and environmental components. Taken both collectively and individually, these aspects of creativity suggest targets for enhancement efforts.

Recent theory and research support the inclusion of such diverse components in models of creativity. Although each component has separately been the subject of significant theoretical and empirical investigation, the importance of collectively considering these aspects is reinforced by the recent

predominance of systems, interactionist, and interdisciplinary (e.g., psychoeconomic) theories of creativity. We discuss enhancement by focusing on each of the components.

Cognitive Components

Cognitive components are by definition intellectual. They reflect information-processing models and problem solving. Models of information processing generally include cognitive processes, transfer operations, information stores, and meta-cognitive components, all which are important to consider when attempting to foster cognitive aspects of creativity.

Certain process strategies are very useful when looking for original ideas. As a result, creative process strategies for enhancing creativity are quite numerous and include teaching people to use cognitive heuristics such as lateral thinking, brainstorming, SCAMPER (substitute, combine, adapt, magnify/modify/minify, put to other uses, eliminate, reuse), analogical reasoning (e.g., synetics), and creative problem solving. Other frequently mentioned strategies include identifying and overcoming blocks to creativity, balancing the use of reflection and tinkering, encouraging playfulness, creativity imagery or visualization, assuming multiple perspectives, questioning assumptions, and looking for patterns. Perhaps the most popular techniques of the past 50 years have involved the teaching of divergent thinking and general problem-solving heuristics.

The role of information stores has received considerably less attention during discussions of creativity than that of cognitive processes, but the role may be no less important. Expert problem solvers tend to have better working and long-term memory skills than novices, although this distinction only applies to the memorization of situated knowledge (i.e., information that can be placed into an expert's existing schema) and not tangential or random knowledge. In addition, general knowledge may be very important during the creative process, and such knowledge depends on memory and information storage. Without well-organized information stores (i.e., schemas), knowledge becomes difficult to use and recall during the creative process. Constructivist approaches to learning, in which individuals construct their own schemas based on their personal experiences, should prove especially useful when helping people learn to retain, recall, and apply knowledge during the creative process. Jean Piaget, the well-known psychologist, titled one of his monographs, *To Understand and to Invent*, implying that true understanding depends on personal constructivism. Very often it is beneficial for students to relate new information to prior knowledge (i.e., existing schema), and activities should be based on realistic problems that require application of prior knowledge and new skills. Much new work on divergent thinking and creative problem solving relies on realistic problems.

The importance of prior knowledge can, however, be easily overstated. An individual or group that is embedded in a particular field of study or interest area may be reluctant to consider ideas and solutions that are uncommon, unpopular, or even antiparadigmatic within that context (or within one's personal experiences). This phenomenon is referred to as functional fixedness or rigidity. As a result, creative contributions in a given area are often made by individuals who are not

necessarily experts within that field. A case in point is the numerous early paleontologists who had primary training in the arts. When painting and drawing illustrations of dinosaurs, they realized that the existing knowledge base was quite superficial and provided inadequate answers to many important questions. Their fresh perspective allowed them to move beyond existing paradigms and field-based constraints to make creative contributions to paleontology. Other examples include experts who retain flexible strategies while maintaining their expertise in certain domains.

Although many people believe that exponentially increasing complexity of most disciplines has led to creative contributions to these fields, it is probably an overstated belief. The ability to apply processes and use information from areas of interest other than one's own area of interest is clearly important. The tension between different areas of interest may stimulate creativity as well. When participating in creativity enhancement exercises, people should thus be encouraged to look across fields of study and areas of knowledge for potential solutions to their problems. This act of looking beyond the established parameters to obtain a solution to a problem has popularly become known in business circles as thinking outside of the box and psychology as insight, moving beyond the problem space, or problem finding and redefinition. Other specific strategies in this area include forcing someone to assume a different viewpoint or perspective on an issue, which can be facilitated by a debate or role playing.

Experts tend to exhibit a greater degree of meta-cognition during problem solving than do novices. In this context, meta-cognition involves monitoring one's own cognitive processes in order to manage time effectively, assess progress accurately, and attempt problem-solving efforts efficiently. Suggested strategies for helping students develop metacognitive abilities include providing a variety of creative and problem-solving strategies in a low-risk, constructive environment, encouraging self-assessment of the steps taken to solve a problem, and modeling metacognitive skills.

Affective Components

The affective component of creativity refers to one's emotions. Affect is quite important because creative work very likely has personal meaning. A technique used to enhance creativity should provide more than just a new strategy – it should provide a practical use for the strategy. Benefits to individuals or society should be communicated, and intrapersonal and interpersonal incentives described.

Care must be taken, because – in contrast to the potential of incentives – the positive relationship between intrinsic motivation and creative behavior is well documented in the theoretical and empirical literature. But the question of whether external motivation (especially when created by external evaluations) is detrimental to creativity has yet to be answered. E. Paul Torrance suggested that freedom from evaluation during practice with a creative strategy resulted in more proficient use of that strategy over time, but he found this to be less true with older, late elementary students than with younger students. Other researchers have called into question whether extrinsic motivation is truly detrimental to creativity,

with a few theorists going so far as to say that constraint and external motivation are essential for creativity to emerge. Very likely both are potential influences, with the contribution of each varying across individuals and tasks.

Given the controversy surrounding external motivation, recommendations regarding evaluation and creativity can only be made hesitantly. At this point in time, it seems practical to expose people to reasonable amounts of evaluation, but only when the evaluators are trained in how to provide constructive criticism.

Attitudinal Components

The individual's attitude toward creativity is very important, especially his or her creative self-efficacy. One's belief in his or her ability to create, defined broadly, forms the psychological foundation of creative achievement. Creative self-efficacy can be fostered by providing genuine praise and feedback about a person's creativity and avoiding discouraging statements (e.g., "You can't do that, you're not creative"). But some people may be challenged by competitive statements, again stressing the value of constructing enhancement efforts on a case-by-case basis.

The attitudinal enhancement of creativity may also involve modeling, which can be accomplished in a variety of ways. Individuals can be exposed to information about unambiguously creative individuals, perhaps via biographies or case studies. These can provide a glimpse into the more personal aspects of creativity and provide evidence that even eminent creators "are just human, like you and me." This kind of information can be reassuring and even inspiring, though it does not suggest specific ways to be creative. It is informational in the literal sense, providing factual rather than procedural information about creativity. In a similar vein, teachers, managers, parents, and others who are attempting to foster creative self-efficacy in others should model a can-do, enthusiastic attitude when confronted with problems and tasks that require creative solutions. By explaining their thought process as they tackle the problem, the creative process may be further demystified and made more accessible to the observer.

In order to change perceptions, recently six myths of creativity have been identified. They are as follows:

- **Myth 1: People Are Born Either Creative or Not Creative.** As previously discussed, research suggests that individuals may enhance their own creativity, but this often times is not believed by the individual.
- **Myth 2: There Is Limited Time to Be Creative.** (Aging diminishes creativity.) An oft held conception of creativity is that it is an ability that most children tend to possess. Much research suggests that older adults actually demonstrate the ability to be creative.
- **Myth 3: General Creativity Does Not Exist.** While there are data suggesting creativity is specific to an area, recent theory and supporting data suggest that some types of creative methods move across domains while others may be more limited within domains.
- **Myth 4: Creativity Is a Touchy-Feely Phenomenon.** Many seem to believe that creativity is this magical and mystical

ability; only attained when one is not really trying to find it. Creativity can and has been studied using rigorous methods with well-conceptualized operational definitions.

- **Myth 5: Group Creativity Works Best.** Both group and individual creative strategies have advantages and disadvantages. These differing values are described in the next section of the article.
- **Myth 6: Constraints Hinder Creativity.** Although constraints may sometimes hinder creativity they may also help provide positive guidelines that promote creativity.

These myths also represent a critical part of the framework for creativity enhancement programming via attitudinal change to be discussed later in the article.

Interpersonal Components

Two types of interpersonal skills appear to facilitate the creative process; the ability to gain acceptance for one's creativity and the ability to work with others during the creative process. Although there is considerable debate about whether gaining acceptance for creativity (i.e., persuasion) is a vital component of everyday or only eminent creativity, the ability to market personal or group creative products can be a positive attribute. Students should be encouraged to share their creative work with others. It is hoped that they will receive and benefit from this positive and perhaps even mild negative feedback. This may help them to develop the ability to convince an audience of their creativity.

Working with others can both foster and inhibit creativity. Groups can serve as a detriment to creativity when members are simply told to 'do well,' when group goals are lacking, and when members do not have the freedom to work as individuals within the larger group. Conversely, groups tend to enhance creativity when members are socially comfortable with each other, when both the group and individual members are held accountable for clear performance standards, and when group tasks are meaningful. Recall also the potential impact of evaluation, which can also be interpersonal.

A seldom mentioned aspect of group creativity is the intergroup interaction as each group solves similar problems. By allowing group members to interact with other groups, the informal sharing of information and ideas can help members of a group overcome any functional fixedness that has developed. This perspective, which is based on the work of social constructivists, suggests that intergroup communication should be encouraged.

Problem-based and situated learning is also relevant to the discussion of interpersonal components of creativity. These constructivist-inspired strategies, which allow students to learn content and process skills through the solving of real-life problems, place a strong emphasis on the application of information rather than on simple memorization. Additionally, the realistic nature of problem-based and situated enhancement efforts fosters intrinsic motivation, which can be beneficial for creativity. Although situated learning makes sense in light of constructivist learning theories, situated approaches pose certain problems for the enhancement of creativity. Constructing knowledge and developing creative process

skills may be more applied in a situated context, but they may be constructed and developed in a way that promotes functional fixedness. Problem-based learning activities should be designed so that students are required to apply factual and procedural knowledge in a variety of contexts, to interact with others as part of the learning process, and to engage in some abstract thought (i.e., non-situated thought, which is frequently mentioned as a cognitive characteristic of creative individuals).

Environmental Components

The assembled research from the past 50 years paints a clear picture of the characteristics of a creativity-enhancing environment. The key characteristics are tolerance, moderation, and availability of resources. Although these concepts may seem antithetical, they are (like many aspects of creativity enhancement) more applicable than they first appear. For example, a stimulating environment should be created, with a multitude of diverse materials (i.e., resources) available to stimulate ideas and create solutions. But the common tendency to provide predominantly verbal materials should be avoided. Many individuals prefer to express their creativity through several domains, thus varied input (e.g., visual) should reflect this diversity of expression. In addition, given the importance of problem finding, it may be desirable to expose people occasionally to open stimulus environments, in which stimuli must be sought and problems need to be identified.

The environment should allow and even encourage reasonable risks to be taken, but irresponsible and physically dangerous risks (e.g., consumptions of drugs) should be discouraged. Everyday uses of creativity and problem solving are fostered by the management of risk, not simply by taking any risk that presents itself. In more general terms, the creative environment fosters the use of creative discretion, which separates originality from psychotic ideation.

Deviance and ambiguity are tolerated in the creativity-enhancing environment. Individuals should be encouraged when they think outside of accepted procedures and customs, and not criticized for ignoring cultural and experiential limitations. However, the environment should encourage self-regulation of creative processes so that even the most exhilarating dead ends can be self-identified and put aside. Divergent thinking needs to be linked with convergent thinking in the creative environment.

In general, the environment should be marked by balance: a mixture of structured and unstructured tasks that require divergent and convergent thinking, independent and group work, and procedural and declarative (factual) information.

Increasing Creativity Test Scores

Several researchers have investigated the possible impact of environmental conditions on creativity test scores. Conditions include practice with heuristics before administration, game-like conditions, manipulation of instructions (e.g., telling students to be original when completing a divergent thinking (DT) test, verbal versus nonverbal instructions), allowing students to take the tests home to be completed, different types of tasks (i.e., abstract versus real-world, interesting vs. uninteresting),

timed versus untimed tests, presence of model before or during administration, stimulus-rich versus barren environments, high versus low structure, individual versus group completion, and playing musical or comedic recordings during administration. In general, test-like conditions appear to be associated with the most convincing evidence of reliability and validity, although actual performance effects vary considerable across age and grade levels. For example, although instructions to be original probably result in increased originality and decreased fluency scores on DT tasks regardless of a person's age, working with others appears to produce higher creativity scores than working alone for children after the age of 6 but not earlier.

Drug Use

Conventional wisdom posits that the use of certain drugs (e.g., alcohol, marijuana, LSD) enhances personal creativity. Although certain aspects of creativity (e.g., affective, cognitive, interpersonal) may be positively influenced by drug use, research over several decades provides convincing evidence that – at best – moderate drug use has a negligible effect on long-term creative production and heavy use has a detrimental effect. Even in specific situations where a positive drug effect has been documented, the drug does not appear to encourage creative production. For example, several researchers have observed that alcohol consumption tends to lower a person's inhibitions, which is assumed to result in more flexible thinking and, therefore, greater creativity. However, this research has also shown that the disinhibition does not lead to enhanced creative production, rendering the effect of the alcohol most with respect to long-term creative productivity.

Programs Designed to Enhance Creativity

Over the past few decades, several creativity training programs have been used to help people maximize their creative potential. These programs usually incorporate strategies that address multiple components of creativity.

Two types of programs have been designed to enhance children's creativity. The first involves modifications of the regular school curriculum, such as the Schoolwide Enrichment Model and Mentor Connection, the Talents Unlimited Model, the Cognitive–Affective Interaction Model, the SOI system, and the Purdue Creativity and Enrichment Models. The second includes extracurricular programs that may or may not be affiliated by educators attached to a child's school, including the Odyssey of the Mind and Future Problem Solving programs and numerous local, regional, and national invention programs. However, the distinction between these two types of programs is not universal, and programs frequently and successfully transverse this rather artificial boundary.

Within the business community, programs for enhancing creativity are quite popular. The increasing popularity of creativity in the business sector has led to an explosion in the number and type of programs aimed at this audience. In general, the components mentioned previously in this article are included in these programs, with predictable changes in terminology.

Plucker and his colleagues at Indiana University have recently developed and evaluated a new approach to enhancement, one

that focuses on attitude change as the precursor to enhancement. The model for the curriculum includes (a) changing schemas, (b) identification of personal strengths, and (c) acknowledging personal and external factors that may affect creativity, all addressed through a series of problem-based activities. The developers created two courses: an entry level course titled Debunking Myths and Enhancing Innovation, and Applied Creativity Seminar, a capstone class for undergraduates. Pre- and post-course data suggest that students are able to overcome initial misconceptions and begin to change attitudes about creativity. This was particularly strong for the beliefs that creativity can be enhanced, that creativity can be defined, and constraints may enhance creativity. Although further testing of this model is needed within the framework of the courses or similar courses at other universities, initial evidence suggests that focusing on attitude change rather than specific cognitive skills or behaviors may be a fruitful approach for enhancement programs.

Conclusions

Must all of the components be present in an effort to enhance creativity? As mentioned earlier, aspects of each component have been studied individually; similarly, intervention efforts occasionally focus on only one or two components. Research is mixed with respect to evaluations of the effectiveness of narrowly focused strategies in a manner similar to the way that many people describe different therapies: if you think a specific technique works for you, it does.

However, because each of the components is a necessary but not sufficient condition for creativity, enhancement efforts that consider the components collectively should be more effective than narrowly focused strategies. For example, if a person was to choose one component to exclude from enhancement efforts, which would it be: creating a supportive environment in which people are encouraged to take sensible risks, encouraging people to monitor their creative processes, or stressing the importance of interpersonal skills to creativity and the creative acceptance process? Each is clearly important and overlooking any of them (or any other aspect of creativity) would be difficult in light of the assembled research and theory. Although efforts to foster creativity need not focus on each and every component (and cannot do so effectively), well-designed programs consider all of the components and their interactions.

With the ideal that all facets of creativity should be represented in enhancement efforts, the following general guidelines appear to be reasonable.

1. Consider addressing misconceptions people have about creativity. For example, if a student does not believe she is creative and believes creativity cannot be increased, the best instruction for creativity enhancement will probably have little impact on that student's creativity.
2. Design activities that demand an individual's or group's attention. Capitalize on teachable moments such as current political, cultural, and community events.
3. Supply information about strategies and creators that is both useful and interesting. Information on the difficulties in building a canal or on intricacies of Einstein's general theory of relativity may not appeal to a group of marketing

specialists, but stories about Einstein's struggle to get his ideas accepted or about the political creativity involved with constructing sky-scrapers may appeal (and appear more pertinent) to this group.

4. Provide either the skills and information that will generalize to other setting (e.g., the home, school, workplace) or opportunities to apply the introduced skills and information to different settings and problems.
5. Remove excessive evaluation and supervision from the creative environment. Micromanaging is just as disruptive to young students as it is to corporate managers.
6. Attempt to alter attitudes about creativity and originality and encourage creative confidence (i.e., creative self-efficacy) and risk taking.
7. Design activities that excite, stimulate, and increase curiosity and help people develop the intrinsic motivation to be creative.
8. Require problems to be solved individually and in groups. Have groups critically examine their own processes and attitudes (i.e., develop group metacognition) during and after the creative process.
9. Avoid making assumptions about students. Recent theory and research on intelligence, motivation, personality, and thinking and learning styles provide evidence that individuals vary tremendously in their abilities, preferences, and attitudes. This diversity appears to be a critical element of creative production.
10. Similarly, introduce variety into enhancement efforts. This capitalizes on individual preferences and interests and promotes diversity in one's approach to finding and solving problems.
11. Consider the use of well-established programs that address multiple components of creativity and have already been field-tested and refined.

See also: Climate for Creativity; Creative Environments, Conditions, and Settings; Divergent Thinking; Emotion/Affect; Expertise; Group Creativity; Heuristics: Strategies in Creative Problem Solving; Memory & Creativity; Metacognition; Play; Substance Abuse and Creativity; Teaching Creativity.

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Entrepreneurship

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Glossary

Ambidextrous organization An organization in which exploration and exploitation are separate units with coordination from senior executives.

Demographic diversity Differences in group members in terms of characteristics such as age, gender, or ethnicity.

Entrepreneur A person who has a new business, organization, product, service, or idea and is highly motivated to pursue his/her vision and to succeed in the face of any adversities.

Entrepreneurship The process of creating new businesses, products, services and/or a state of mind that thrives for innovations that have the potential to improve the lives of many people/customers.

Environmental scanning Careful monitoring of a firm's external and internal environments to detect signs of opportunities and threats.

Exploration versus exploitation The variation in creative activities from the explorative generation stages to the development activities of the implementation stage.

Informational diversity Differences in knowledge bases that are job-related, such as educational and functional backgrounds.

Innovation The implementation of a new idea that leads to a change or reorganization in how society works or performs certain tasks.

Innovative entrepreneur A person whose new venture or idea has a unique capability.

Opportunity recognition The process by which a new entrepreneurial idea is identified.

Teams Collaboration of two or more individuals who work together on common goals. They typically have complementary skills and are dependent on one another for the successful completion of the goal.

Team reflexivity The ability to adjust team processes based on changes in circumstances and feedback.

Transactive memory The knowledge among team members of the unique skill or talents possessed by the various team members.

Transformational leaders Leaders who inspire group members by their vision and support and encourage innovative thinking.

Characteristics of Entrepreneurs

An entrepreneur is a person who becomes immersed in an innovative entrepreneurial endeavor, defined as the process of starting a new business, organization, product, or service that fulfills a vision. In this article, we consider only entrepreneurs who innovate in some way. To recognize the characteristics of successful entrepreneurs, we first need to understand the cycle that most entrepreneurs go through and the challenges encountered at each stage of the process. The entrepreneurial process or cycle starts with identifying an opportunity for a new business/product/service. Opportunity identification is one of the most important steps in the entrepreneurial process. Cognitively, it consists of a search process for new opportunities for a market, industry, or customers. The search process can be either active or passive. In the active case, one seeks out information from a variety of sources (personal contacts, specialized publications, etc.). In the passive mode, also called alertness, one recognizes opportunities on-the-fly, from daily encounters and happenings. In both cases, a very important characteristic for the identification of novel entrepreneurial opportunities is the ability to connect apparently unrelated concepts in a novel and useful way. This process requires the same skills as creative or divergent thinking. Indeed, many relationships between creativity and entrepreneurship have been found.

The second phase of the entrepreneurial process is opportunity evaluation. An idea must be evaluated for its potential to be implemented and to lead to a successful enterprise. Typical characteristics of a good idea are: technologically feasible, novel, it satisfies the need of a large enough market, and is financially sound. A business plan and a vision are usually generated in this phase. The vision is a description of what the entrepreneur wants to achieve with the new idea over the long haul. Opportunity identification and evaluation are the shortest stages in the entrepreneurial process, but also the most important ones. A good idea needs a solid business plan as a foundation for the short-term goals of starting up and a clear vision describing the long-term goals and dreams.

The third phase is the implementation in which necessary resources are gathered and a new organization/product/service is created. The last stage is the growth stage, when the new enterprise is expanded and the original vision is realized. These last two stages involve uncertainty, high-risk, scarcity of resources and unexpected changes. Most of these variables are external, depending on social and economic factors outside the control of the entrepreneur. But some of them are internal and depend on the ability of the entrepreneur to attract resources/customers, to manage an ever-growing organization and to continue to innovate and stay ahead of the competition. While creativity is necessary in the opportunity identification stage and for continuous innovation in the implementation

and growth stages, other characteristics such as tenacity, perseverance, self-efficacy, risk-propensity, stress tolerance and the ability to make rapid decisions in an uncertain and constrained environment become essential in later stages.

The characteristics of successful entrepreneurs have implications for understanding the role of entrepreneurship education on future entrepreneurial intentions and behavior. Before the 1990s, research on the effect of general personality traits on business success and business creation found little or no relationship. More recently, specific traits have been related to various aspects of the entrepreneurial process. For example, need for achievement and risk-propensity have been among the most studied characteristics of entrepreneurs, and these do relate to economic outcome and business performance. Also, entrepreneurs have a higher need for achievement and risk-propensity than managers. Self-efficacy (i.e., task-specific self-confidence) seems to have a particularly significant role. High levels of self-efficacy in entrepreneurs relate to business creation and business success and growth and in students to entrepreneurial intentions. Innovativeness, stress tolerance, need for autonomy, proactivity (i.e., initiating actions to change one's environment) are all moderately related to business creation or business success. Other relationships between traits and venture growth have been found for the ability to communicate the vision of an organization and high goals for the venture. More interestingly, some traits cannot be related directly to an entrepreneurial outcome such as business success or growth but are related to other traits that in turn affect entrepreneurial success. For example, passion, tenacity and the ability to manage new resources and skills affect vision, goals and self-efficacy, which in turn affect business success and growth. Perceived learning experiences from formal entrepreneurial education, previous entrepreneurial experience, risk-propensity and entrepreneurial intentions are related to self-efficacy, with the strongest correlation coming from perceived entrepreneurial training. Highly proactive and creative students manifest high entrepreneurial desire and intention. The picture revealed by research on entrepreneurial traits is that of many direct and indirect relationships between traits and the entrepreneurial process, traits and business outcomes, traits and entrepreneurial intentions, and among traits themselves. Models of entrepreneurial intentions imply that there is a direct relation between entrepreneurial intentions and future entrepreneurial behavior such as business venture formation. Some of these traits, such as entrepreneurial self-efficacy, can be affected by entrepreneurial education.

Creativity and Innovation in Entrepreneurship

Entrepreneurship, creativity, and innovation have a natural affinity. Innovative entrepreneurs are able to identify new business opportunities and are motivated to pursue them to their completion. To start a new venture, entrepreneurs need a good idea that is technologically feasible, novel, satisfies the need of a large enough market, and is financially sound. The idea or the vision of the new business is what drives entrepreneurs and what can potentially determine its success. It is the most important part of an entrepreneurial cycle and the most creative one. For example, Google's idea of creating a new way of

implementing web searching by extracting information from the structure of web links was novel, it was technologically feasible by implementing a new algorithm for indexing and ranking of web pages on a large computer and storage network, it satisfied the needs of practically everyone with a computer connected to the internet or a business with a web-presence, it was financially sound because of its novel advertising scheme. Similarly, the idea by Jeff Bezos of using the internet as a means to sell books in 1994 practically started the e-commerce field. It was a new idea providing an improved experience of searching and buying books, technologically feasible (the internet usage was increasing 2300 per cent a year), it had a large supply (publishing industry) and market demand.

In contrast, a good idea that was not technologically feasible and/or did not have a large demand until two decades later was that of a mobile phone. It could have been implemented in the 1960s because radiotelephony was widely used in marine and military communication since the 1930s, and cellular technology was invented in the 1960s. But the market demand and the implementation of the large infrastructure were realized only in the 1980–1990s.

Discovering new business opportunities or ideas requires the ability to synthesize information from different sources, to identify gaps in existing products and services and the ability to envision new concepts in the form of new products/services. The cognitive process underlying the identification of a novel business opportunity has the same characteristics as creative thinking (problem identification and construction, gathering of relevant information, idea generation, idea evaluation, and selection). Creativity is defined as the production of novel and useful ideas and products, which uses exactly the same cognitive process underlying the opportunity identification phase.

A cognitive model of opportunity recognition based on pattern recognition proposes that business opportunities are emergent patterns that form dynamically by discovering new links between apparently unrelated concepts. Many visionary entrepreneurs developed their ideas by connecting different concepts. For example, Niklas Zennstrom and Janus Friis, co-founders of Skype, envisioned the internet as a provider of a free global phone communication service. They made the connection or analogy between internet and the phone. Research in Motion, founded by Mike Lazaridis, developed the BlackBerry, a smart phone that could send/receive e-mails by accessing internet using wireless cellular networks. This idea connected the cell phone industry with the internet.

Cognitive factors likely to have critical roles in opportunity identification are active search or alertness and a rich prior experience and knowledge. Comparisons between novice and experienced entrepreneurs show that they might use different search modes. They may focus on distinct factors: novices put more weight on the novelty of an idea whereas experts emphasize business success factors such as cash flow and markets. This framework suggests that education in opportunity identification should train students to focus on factors that are likely to have a role in the success of a new venture such as searching for apparently unrelated links and exposure to a range of business experiences and opportunities (e.g., case studies and internships). Ideation and divergent thinking is higher in successful entrepreneurs. Entrepreneurs who started more than one business have higher ideation fluency (i.e., generate

more ideas) than those who only started one company. Creativity has been linked to entrepreneurial intentions in students. A higher level of self-perceived creativity is associated with increased entrepreneurial intent (e.g., desire to own a business). These findings suggest that entrepreneurial education should address students' entrepreneurial desirability and creativity, not only the technical and business aspects of entrepreneurship.

Entrepreneurs' creativity is associated with firm-level innovation, and the strength of the relationship is higher in a highly dynamic environment. There is a positive relationship between creativity and radicalness of innovations, not the sheer quantity of innovations. Moreover, the relationship between creativity and firm-level innovation is stronger in a more dynamic environment. The role of innovation in entrepreneurship and business success has been researched extensively. It is generally assumed that innovation creates a competitive advantage that positively impacts business success, but empirical research is somewhat mixed. Studies have shown there is a small but significant effect of innovation on business performance.

Innovative entrepreneurs like to challenge the status quo, defined as a desire to change the way things are done or to create something entirely new. They recognize opportunities. For example, Michael Dell of Dell Corporation had a vision to offer affordable personal computers, unavailable at that time. Sergey Brin and Larry Page wanted to change the way web searching was done. Innovative entrepreneurs often engage in activities that allow them to come up with such transformative ideas. They use what-if and why questions to challenge the status quo. Michael Dell asked why a computer cost six times more than its parts. Dean Kamen, the inventor of Segway, asked what if a wheelchair could climb stairs and invented one that did just that. Entrepreneurs observe everything that happens around them in day-to-day experiences (i.e., passive search for opportunities). For example, Howard Shultz, the founder of Starbucks, observed coffee bars in Italy for weeks and noted what people enjoyed about them. Entrepreneurs like to experiment, learn and explore new things. They often engage in idea networking with people of diverse backgrounds. Innovative entrepreneurs engage in these type of activities more often than managers.

Creativity in Entrepreneurial Teams

Although the image of the lone entrepreneur is a popular one, most entrepreneurial activities involve small teams. Teams are typically small groups of individuals with differing but complementary skill sets who depend on each other for the successful attainment of the team goal. These may be the team of founding members or teams formed for specific aspects of entrepreneurship such as marketing. Some researchers claim that such teamwork enhances the success of entrepreneurial activities. This is consistent with the other research on the positive effects of teamwork and other forms of group interaction on innovation (see groups, teams). Teams can benefit from the multiple perspectives and skills of their members to achieve the complex goal of taking an idea through the various stages required for entrepreneurial success. These include idea development, modification, and feedback and the development of a talent pool for the production and marketing of

the product. Teams also need to be creative in recognition of opportunities in markets and technology. Although there is a growing literature on innovative and entrepreneurial teams, much of this literature relies on surveys of team members and managers. Some studies suggest that such reports may not always be accurate indicators of the processes and outcome related to innovation. However, there is considerable consistency among various studies in findings and among the survey studies and studies in more controlled settings with objective measures of process and performance. Hopefully, future research will confirm this consistency and the validity of the prevalent generalizations.

Most entrepreneurial teams are likely to be co-located, especially during the early stages of the process when frequent face-to-face collaborations are required. However, sometimes the diverse skills and interests required involve geographically distributed or virtual teams. These teams have to rely on the various media such as email, teleconferencing, and video conferencing to facilitate their collaborations. Such teams can be effective, but they tend to be more difficult than conventional teams to manage effectively. It is difficult to build the cohesion, trust, and the transactive memory (knowledge of who knows what in the group) required when group members are not co-located, especially during the early stages of the entrepreneurial process. Some degree of training for the team members and the leader on the key principles for effective functioning of such teams is likely to be helpful. It also appears to be important to supplement the virtual team interaction with periodic face-to-face meetings.

Creativity in entrepreneurial teams is a complex and multifaceted phenomenon. It involves creative thinking in many different phases. Unfortunately research on groups and teams has not provided much insight into the unique processes related to the different stages. Research on ad hoc groups, often in laboratory settings, has focused mostly on the process of generating ideas while research on work teams has emphasized the actual implementation of ideas. Very few studies have examined how the outcome of one process affects the subsequent ones. Often there is a distinction made between exploration and exploitation processes. The exploration processes are the creative/divergent thinking ones involved in the development of new ideas or initiatives. Often these may be incremental in that they involve modifications of existing ideas, products or processes. However, sometimes they can involve radical changes in approach or paradigm. This requires that the team members are strongly oriented to risk taking, experimentation, and innovative thinking. Exploitation involves the subsequent evaluation, selection and development, and marketing of the innovations. It is often difficult to balance the exploration and exploitation processes in an organization. These may require different types of people and processes. Apparently some of the most successful companies use an ambidextrous organization in which the exploration and exploitation are separate units but are integrated at the senior executive level. This way the organization can effectively maintain a culture in which rapid and disruptive innovations can be developed without distracting from the incremental processes required to maintain operational success for products already developed. Others have emphasized the importance of originators of ideas staying with the development of products related to their idea given

their unique perspective and background relevant to this idea. However, such an approach can probably be accommodated in an ambidextrous organization.

Effective Entrepreneurial Teamwork

Since entrepreneurial teamwork requires much complex coordination, it is important that team members have the necessary social skills in addition to creativity and task relevant skills. One important skill for teams is the ability to adapt to changing circumstances. Since the exploration process involves much uncertainty and numerous potential dead-ends, it is important that team members evaluate their activities and adjust them in accord with changes required for maintaining positive momentum in the team toward innovative outcomes. This type of team skill is sometimes referred to as team reflexivity.

Many entrepreneurial founding teams are composed of individuals who are rather similar in values and background. This enables them to maintain the social cohesion required during the difficult early stages of development. However, to maintain their innovative edge, especially for radical innovations, it will be important for such teams to incorporate team members with diverse skills and perspectives. This can be accomplished by a gradual turnover of membership in the team. Such teams can help maintain some level of cohesion while continually bringing fresh perspectives into the team. One such team that started with individuals who had similar values and later incorporated team members from different backgrounds to maintain a creative and technical edge were the founders of *Fast Company* magazine. This was launched by a team of two ambitious entrepreneurs Alan Webber and Bill Taylor, former *Harvard Business Review* editors. With the help of its diverse work force, the company created a social network online called the 'Company of Friends.' This soon became a business support group where people with diverse skills and backgrounds met together, discussed challenges in their businesses, brainstormed together and found exceptional solutions. Hewlett-Packard (HP), one of the world's largest information technology companies was also formed by two individuals from very similar backgrounds. Hewlett and Packard were electrical engineers from Stanford University. Over the years HP collaborated with various other companies such as Sony and Yokogawa Electric to develop several high quality and innovative electrical products. Working with other companies and merging with Compaq Computer enabled HP to develop successful lines of scanners, cameras, and computers and develop sales of over 100 billion dollars a year.

Innovation requires effective communication among team members and with others outside the team. Communication with individuals outside the team can help supplement gaps in knowledge and skill in the team as well as providing a means of assessing the validity of the ideas expressed by team members with unique expertise. However, one has to be careful to balance the amount of time one spends in communication with outsiders and the amount of time spent on actual development of innovations. There is some evidence that being too centrally involved in communication networks may detract from innovation. At some point the group members have to make a best decision and move forward or the opportunities that exist for the application of the innovation may disappear.

Leading Entrepreneurial Teams

Ideally entrepreneurial teams have a considerable degree of autonomy in carrying out their goals. Such feelings of autonomy are important for maintaining the intrinsic motivation that underlies much creative and entrepreneurial behavior. However, groups do require a degree of monitoring and structure in order to be effective. This function typically resides in a team leader. This person can be part of the team (potentially the founding member) or can be someone external to the team (as in larger organizations). The role of the leader should be to help provide the vision for the team and to provide financial, emotional, and structural support for the innovation process. One type of leader that has been associated with enhanced innovation is a transformational leader. This leader inspires group members through high expectations and a shared vision, provides individual consideration and support, and encourages team members to take new approaches. However, there is also evidence that the type of leader should vary with the stages of the entrepreneurial process and the degree of diversity of the team. At the startup phase of the entrepreneurial process, a team with diverse members may need a directive type of leader who makes sure the team focuses on its common goals and does not become distracted by conflicting perspectives. Later on in the development process, a more empowering or transformational style may be best to maintain a high degree of motivation and an effective sharing of diverse perspectives. This would require either a change in leadership style over time or the ability of the leader to modify his or her style as the needs of the team change.

The Role of Creativity Training in Entrepreneurship

Many entrepreneurs attend a university before delving into new ventures. However, research indicates that the ability of university students to identify entrepreneurial opportunities is suboptimal. This suggests the importance of training students in creative problem solving and enhancing their ability in identifying entrepreneurial opportunities.

Creativity training occurs in disciplines such as art, architecture, and design. All these areas share a common required outcome of their work – novelty. Additionally, design disciplines add attributes such as usefulness, feasibility, elegance, and simplicity to their work. Creativity is commonly taught to students in design, architecture, and mechanical/manufacturing engineering but very rarely in computer science.

In engineering, creativity has been introduced as exercises/training to promote divergent thinking or idea generation techniques (e.g., brainstorming). In the former case, manufacturing engineers have increased their tendency to generate new solutions, while in the latter case the training has improved scores on creativity tests. Positive effects of creativity training have been attributed to enhancements in the following areas: good thinking skills (e.g., divergent thinking), positive attitude, confidence, motivation to be creative, and reduction of anxiety about creativity. The effects of short-term training on creativity do not persist over time and do not transfer to situations significantly different from those experiences in training. However, it appears to be possible to train students to seek new ideas and to

try novel approaches. Past studies have shown that students who receive lectures on creativity and counseling about their creative styles design more elegant and creative projects than those who attend the lectures only.

In computer education, students do not learn creativity and innovation explicitly; they are not essential requirements of computer products (software or hardware). Creativity emerges mostly in the process of producing novel and useful computer applications. Information and communication technology experts and students perceive their work as highly creative because of the opportunity offered by programming to create new artifacts. Some researchers have examined the cognitive processes that underlie creative innovations in computer science. They see creativity as arising in the process of coming up with a new problem – by frustration with repetitive, dull tasks and by identification of a need for a new product, technology, or application (i.e., frustration-based creativity). Computer scientists use local or distant analogies in coming up with solutions to their problems.

Training in entrepreneurship commonly occurs in business schools and in engineering schools. In business schools, the focus is on acquiring the right business skills needed to start a new business. In engineering schools, the objectives are a balance among innovation, technology, and business skills. Interdisciplinary programs between business and design students that stress entrepreneurial thought and action with design thinking and team building have also been introduced.

Cultural Diversity in Entrepreneurial Teams

Diversity in teams helps foster the creative expansion of ideas. Many studies suggest that creativity in teams may be influenced by the type of diversity present among team members.

Diversity refers to individual differences on any attribute that causes us to view another person as different from self. There are many types of diversity that group members bring into their work groups. Demographic diversity or social categorization diversity refers to differences in group members in terms of characteristics such as age, gender, or ethnicity. Informational diversity refers to differences in knowledge bases that are more job-related, such as educational and functional background. Value diversity refers to differences in values, beliefs, and attitudes.

Informational or functional diversity in a founding entrepreneurial team is associated with high quality strategic planning and product innovativeness. This may be because interdisciplinary entrepreneurial teams can integrate the wide range of technical, marketing, and financial knowledge that is available at their disposal. There is evidence for the positive impact of interdisciplinary teams on openness and propensity for strategic change. These characteristics enhance innovative and strategic planning on new ventures. Informational or educational diversity in entrepreneurial teams also gives rise to cognitive diversity. Multiple perspectives among team members facilitate insightful discoveries and innovative products. Furthermore, entrepreneurial founders from various disciplines have a greater ability to identify and interpret relevant information in various areas. They consider a larger set of information that is relevant to decision-making. This results

in monitoring, retrieving, and evaluating the technological and financial market at a larger scale and enhances opportunities for product innovations.

Environmental scanning is one of the many important ingredients in successful innovation. It requires entrepreneurs to recognize and adapt to changing demands of the society. Team members need to perceive and process external information to gain insight into the needs of customers. Thus, when team members have diverse informational backgrounds such as technology, sales, or marketing they can conduct a comprehensive search of external information along various dimensions. There is a general notion that extensive environment scanning may lead to identifying potential competitive opportunities and producing innovative products.

Heterogeneous perspectives in new ventures in entrepreneurial teams may occur not only as a result of informational diversity but also as a result of demographic diversity. Diversity in terms of age, gender, and cultural background may increase creativity, innovativeness, and success. In cross-cultural entrepreneurial teams, there is a greater exposure to multicultural experiences as a result of visiting various countries. These experiences cause team members to tap into unconventional knowledge by incorporating ideas from various cultures, thereby facilitating creative problem-solving. Other findings indicate an increase in creativity in societies that embrace outside influences and are both politically and demographically diverse.

In diverse entrepreneurial teams, interpersonal and inter-organizational relationships among team members may also influence performance. A considerable amount of team cohesion is important for both effective and efficient use of available resources especially in cross-cultural teams. Recent literature on networking teams suggests that the impact of functional diversity drops drastically when more teams network together since greater network range results in lower internal cohesion. Further, networking among culturally diverse teams is associated with more communication errors, distrust of outgroup members, negative stereotypes, intragroup rivalries, poor cohesion, and a decrease in overall performance. This suggests that lack of cohesion stemming from cultural diversity may impact performance negatively in cross-cultural as well as non-cross-cultural diverse entrepreneurial teams.

Although dissimilarity of perspectives in entrepreneurial teams facilitates creativity, dissimilarity in terms of cultural dimensions is associated with poor communication, more conflict, less social integration, and more departure from such groups. However, these negative effects can be offset by enhanced communication among team members. In other cases, greater similarity in terms of skills, functional background, and attitudes in entrepreneurial teams may lead to minimizing cognitive conflict and reaching consensus in pursuit of group cohesiveness. This phenomenon is called groupthink. In small teams, people may avoid promoting conflicting viewpoints which is a key in the development of multiple perspectives and innovative solutions. Groupthink in entrepreneurial teams may hinder creativity by discouraging the merger of conflicting ideas that are important to developing novel and innovative new ventures. Several researchers suggest that novelty of an entrepreneurial idea is a prerequisite for successful ventures. Further, the amount of time members in an entrepreneurial team have spent working with each other may also

influence performance. During the initial stages of group development, there is evidence that ethnically homogenous groups perform better than the ethnically heterogeneous groups. However, in the long run heterogeneous groups outperform the homogeneous groups on some measures.

Although some knowledge gaps still exist in regard to the impact of diversity on entrepreneurial teams, there is also relevant research on the effect of diversity on the performance in brainstorming teams. This research involving demographic diversity has found that there is value-in-diversity. Many studies indicate that demographic diversity such as gender, ethnicity, and nationality can increase the number of perspectives and alternatives in group decision-making. When people from varying knowledge, gender, and ethnic backgrounds bring insights to the group, it increases flexibility and generation of higher quality ideas. However, these studies also found negative effects of demographic diversity on interpersonal relationships among team members.

In ethnically diverse settings, team members tend to categorize themselves and others on the basis of social categories, such as race, gender, or ethnicity, which leads to the perceptions of similarities and differences in the work group. People isolate themselves from those different from themselves and are attracted to similar others. The perceptions of differences among group members may lead to conflicts, lack of trust, and lower group commitment. Team members tend to favor ideas and opinions of similar others over dissimilar others, which in turn leads to potential conflict in groups. It has been found that similarity to in-group members increases in-group cooperation, trust, social attraction, higher member commitment, group cohesion, and fewer relational conflicts. In some situations, racial or national diversity appears to interfere more with group processes than gender or personality diversity. On the contrary, information diversity in brainstorming teams is associated with increased generation of ideas as well as higher quality (novelty) of ideas.

The literature on brainstorming teams suggests that diversity seems to act as a double-edged sword. Diversity can increase performance, provide broader perspectives, more innovative ideas, and a greater pool of potential solutions, but it can also cause problematic intragroup relations through increased conflicts and decreased group cohesion stemming from the lack of similarity.

There are several factors that appear to be important in determining the impact of diversity on creativity. First, the diversity has to be relevant to the task. If the variation in team characteristics does not enhance the diversity of task relevant perspectives, skills, or approaches, it is unlikely to enhance the creative potential of the entrepreneurial team. In this case, the effects of diversity may actually be negative because of the interpersonal differences. If the diversity is relevant to the team task, then positive effects are most likely observed in team members who are highly motivated to take advantage of this diversity. This usually occurs if the group members have positive interpersonal bonds based on some shared identity, team cohesion, or shared positive attitudes about diversity. Under those conditions team members appear to effectively build on the ideas and contributions of fellow team members.

Conclusion

Most entrepreneurial ventures involve the process of identifying opportunities, evaluating opportunities, and successful implementation of innovative ideas. Creativity is an important ingredient in opportunity identification and implementation stages. Tenacity, perseverance, self-efficacy, proactivity, and risk-propensity are other important qualities that contribute toward successful innovation. Over the years, several training programs have been developed to enhance entrepreneurial orientation.

Many entrepreneurial endeavors are started by teams of individuals. Entrepreneurial teams may enhance success in ventures because of the multiple perspectives and skills that team members bring to the table. However, in order for teams to be innovative, effective communication among team members is necessary. The composition of entrepreneurial teams may also influence innovativeness and creativity. Our review suggests that in the absence of groupthink, informational diversity is associated with quality planning and innovative products. Further, demographic diversity among team members may hinder innovativeness when cohesion and efficient communication are lacking. Entrepreneurial teams that have strong interpersonal bonds and shared goals should be able to take advantage of both the demographic and informational diversity in their team.

See also: Creativity Training; Leadership; Risk-Taking; Teams.

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Relevant Websites

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- <http://hbr.org/> – Harvard Business Review.
- <http://www.entrepreneur.com/> – Entrepreneur website.
- <http://econnect.entrepreneur.com/> – Entrepreneur Connect (networking website).
- <http://www.startupnation.com/> – Startup nation, by entrepreneurs, for entrepreneurs.

Everyday Creativity

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Glossary

Eminent-level creativity This regards creative persons or their creative products where recognition has been awarded by society at large, or by relevant organizations, and may involve awards, honors, prizes, publication, performances, or other forms of distinction. Criteria may vary, and may be implicit or explicit – the common factor here is social recognition. Such creators and their works are often thought to have exceptional qualities (although later generations might not agree). The term may also be applied to the underlying creative process.

Everyday creativity This regards the creative outcome (products, ideas, or behaviors) that involve day-to-day activities at work and during leisure time, or the person or process involved. Everyday creativity is characterized both by originality (involving new or unusual aspects) and meaningfulness to others. Beyond this, many manifestations of everyday creativity are possible, be this in office management, raising children, repairing a home, cooking a meal, or doing community service. Indeed, everyday creativity, viewed as a survival capacity, or motive for ongoing growth and human development, would necessarily have this universal applicability. Studies of creative *process* and *person* underline the many healthy aspects of living openly in the present moment.

Mood disorders Families of mood disorders, or affective disorders, in milder forms sometimes linked with everyday creativity, defined by multiple criteria in the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*. Disorders are characterized particularly by lowered or depressed mood (unipolar depressions – most significant also if there is a bipolar family history), or by alternating mood elevations and depressions (bipolar disorders); Bipolar I and II disorders each involve

major depressions; they differ in nature and degree of mood elevation, very dysfunctional in the first case, relatively more functional, even creative and productive, in the second case. Such moods may alternate with significant periods of normalcy – particularly with adequate treatment. Genetic factors have been shown by twin and adoption studies to contribute, although environment has a major (and so far incompletely understood) role.

Self-actualizing creativity Everyday creativity may help pave the way toward higher forms of creativity, and human development, involving what Abraham Maslow called *self-actualizing creativity*. As with everyday creativity, self-actualizing creativity can manifest throughout all of everyday life, more a way of life than special skills, drawing on diverse qualities of the person – here generally toward Maslow's self-actualizing way of life, and becoming one's potentialities, a high goal in Maslow's hierarchy of needs. Self-actualizing creativity draws from the personality and from higher 'being' values. Included are qualities like courage, spontaneity, perspicuity, freedom, and integrity.

States of consciousness Clearly distinct from ordinary waking consciousness are states such as sleeping, dreaming and meditation. More generally, altered states of consciousness can be said to involve "stable patterns of physiological, cognitive, and experiential events different from those of the ordinary waking state . . ." Creativity may involve some such alterations. Altered states may include ". . . changes in the registration of information and acting on it in a goal-directed manner (consciousness); the explicit knowledge of one's situation, mental states, and actions (behavioral consciousness); the stream of thoughts, feelings, and sensations that one has for oneself (subjective consciousness); and the sense of existence of the subject of mental acts (consciousness)" (Baruss, 2003, p. 8).

What Is Everyday Creativity?

One still hears it, "I can't draw a picture – I'm not creative!" As if all that creativity is about is artistic activity. Thus, the person decides, creativity is not for him or her. Meanwhile, what we call everyday creativity is not only universally available, but is essential to our very survival as humans, to our flexible accommodations to changing life conditions. Further, it can enrich our lives, and help us to further unfold our human potential.

Defined only by criteria of *originality* and *meaningfulness*, as below, everyday creativity can apply to anything from drawing that picture to raising a child, organizing the office, fixing the car, planning a family vacation, or counseling a friend. In process

terms, everyday creativity offers a way of meeting life that can enrich the moment, bringing us greater awareness, openness, and vivid appreciation of the world and ourselves. One finds that here are ways of integrating parts of our experience and mind–body continuum, and flexibly orchestrating mind states toward results that, all else being equal, seem healthy for us as individuals and cultures. Below four areas are considered:

1. What is everyday creativity?
2. Healthy effects, including some mental health paradoxes;
3. Creative mind states; and
4. Creative normalcy, why it's needed, and how we can enhance it.

It is also important, to begin, to consider what *everyday creativity* is not. For some people, creativity and Eminent Creativity are the same thing.

Eminent-Level Creativity

This subtype of creativity, which we are apt to most read about in the newspapers, may be called eminent-level versus everyday creativity. Here is the prize-winning playwright, the best-selling novelist, the distinguished artist, the groundbreaking scientist, or the Internet innovator with software that ties the world more closely together. Often these are accomplishments in the 'traditionally creative' areas of the arts and sciences. Most often, these have also received some significant form of social recognition. The criteria aren't so much about originality as how it is received in a culture.

Such creativity can be amazing. Yet, for too many people this is where creativity also ends. If they themselves don't have stellar levels of recognized accomplishment, then it doesn't count. Such people may also be equating creativity with the arts – or perhaps sciences – rather than as a way of life, which can be applied everywhere.

Everyday Creativity – Identification

Only two criteria are required for everyday creativity, after creativity researcher Frank Barron: *Originality* (the product or outcome needs to be relatively new or unusual) and *meaningfulness* (the creation is not random or idiosyncratic). Everyday creativity is less about *what one does* than *how one does it*. At best these approaches, tendencies, or cognitive styles can even become a way of life. Examples of everyday creative *product* or outcome include a sympathetic coworker saving her friend from a breakdown, an at home mother developing a thriving cottage industry to keep her family fed, a high school teacher who inspires new involvement in social studies, and social change, in an inner city school. Yet these creators also take their innovative approaches home with them. As Barron said, originality is 'habitual' with highly creative persons. Scientists do not turn their originality off when they leave the laboratory, nor artists when they leave the studio. And do note that Eminent Creativity, as defined, is not different than, but is a *subset of, everyday creativity, where the work has also received extraordinary social recognition*.

Through the lens of chaos theory, creativity may be viewed as a distinctly human hallmark of life's emergent systems (here using a term from nonlinear dynamical systems theory, or chaos theory) – of systems found everywhere from the working of our brains, to the weather, economic systems, and the rise and fall of governments. What is called creativity may involve a profound working out of a fundamental life force toward change, complexity, and benefit in our manifest reality, by human beings with intentionality, inspiration, and vision.

Everyday Creativity – Is It Real?

Is 'creativity' a 'real' quality or a fabricated human construct? This is a critical question. Here, creativity broadly defined,

must be the everyday creativity that fuels our flexible improvisations and adaptations to changing environments, for all humans. As our 'phenotypic plasticity,' it is seen as fundamental. (Other forms of creativity may be viewed as subsets of this broader category.) One thus turns from creative *product*, as above, to other of Rhodes' Four Ps of Creativity, namely creative *process, person, and press* of the environment. 'Phenotypic plasticity,' according to evolutionary biologists, involves our human capacity to manifest in different ways within our genetic endowment and environmental conditions. Unlike birds and other creatures who are more instinct bound – consider birds building a nest – human beings have flourished all around the world, building a remarkable diversity of homes, lives, and cultures, across varied conditions and climes. Some do this more routinely than others. Here one speaks to both creative *process* and to the more creative *person*. Indeed we could all further develop our creative potential. And this is not just about a special ability or two, but about attitudes, values and an approach to life.

Later we shall also address everyday creativity as a genetic *compensatory advantage*, in special situations. Any such evolutionary value must occur at the level of everyday creativity, to have any survival value, and not be selected against down through the generations. Authors such as Fred Abraham, Liane Gabora, and Scott Barry Kaufman have written about models and possibilities. Drawing on evolutionary biology and chaos theory, Richards has, in an open systems context, suggested that individuals find, in conjunction with others, a 'cognitive niche.' This includes a need within human society for certain persons who *seed change* and *live closer to the metaphorical edge of chaos*. They are the initiators, and others respond. (Most everyone knows people like this.) This leavening effect may happen at the everyday or the eminent levels of creativity.

In this regard, everyday creativity may seed spurts of *eminent creativity* in a culture. It may also produce broader cultural appreciation of novelty and change, as for instance among Ray and Anderson's so-called *cultural creatives*, said to include about one-quarter of the population of this country, who are more able to accept, appreciate, and incorporate innovations of others, and style changes, into their own lives. Hence one is also concerned here with the Fourth P, the *press* of the creative environment. In an open systems sense, we refer not just to what spurs creativity, but the matrix in an interconnected culture that will accept and use it. Perhaps one person discovered how to create fire. How quickly every home had a fire burning. (Plus, consider the relative survival of the group that was more hesitant and did not embrace this new discovery.)

Beyond Survival – Self-Actualizing Creativity

Creative process can also be viewed as a humanistic force in ongoing growth and development – in actualizing one's potentialities. New research on creativity and health further underlines its value as a force in human wellbeing and development. Abraham Maslow, who spoke of self-actualizing persons, viewed self-actualization as a peak in his hierarchy of needs, and *self-actualizing creativity* (vs. special talent creativity) as linked to this. Maslow (1968) said:

SA creativity stresses first the personality rather than its achievements, considering these achievements to be epiphenomena . . . It stresses characterological qualities liked boldness, courage, freedom, spontaneity, perspicuity, integrity, self-acceptance . . . the expressive or Being quality . . . rather than its problem-solving or problem-making quality. (p. 145)

Hence *self-actualizing creativity* is almost a byproduct of a way of life that is healthy, open, more evolved, and attuned to what he called Being Values (e.g., truth, justice, beauty) rather than Deficiency Needs of the self-concerned individual. Maslow proposed that we are motivated to actualize our potentials and talents “toward fuller knowledge and acceptance of (our) own intrinsic nature” (p. 25). Celeste Rhodes extended Maslow’s hierarchy to speak specifically of *deficiency creativity* – spurred by lower personal needs and wants – and beyond this, *being creativity*, that transcended more self-serving motives, toward universal themes, values, and altruistic motives. The first can indeed morph into the second, as in the author who writes of childhood traumas, first to heal, but later to connect with universal strands of pain, growth, and humanity

Self-actualizing creativity is often practiced, in more humble ways, “in the ordinary affairs of life . . . like a tendency to do *anything* creatively: housekeeping, teaching, etc. (p. 137) Under the right conditions, one can imagine everyday creativity providing spur to a higher path of development. For some people it could even contribute to a spiritual path, through the rich simplicity of deeper knowing, beyond ego, in the present moment, manifesting in one’s life in a way more consistent with Eastern models of creativity, as Zen Master Loori and others have described.

One Creativity or Many?

J. P. Guilford postulated 120 different structure of intellect abilities; a subset of these, called ‘divergent production’ abilities, 24 in number, were particularly linked with creativity, across verbal, visual, and other modalities. Howard Gardner has written about seven multiple ‘intelligences,’ including linguistic, musical, mathematical, spatial, kinesthetic, personal, and interpersonal capacities. Some people can be good at painting, some at mathematical problems, and some at modern dance. Whence comes ‘everyday creativity’?

The notion of everyday creativity is not in conflict with the idea of discrete abilities or talents. Everyday creativity is not necessarily an ability, or *only* an ability. For one thing, it appears to relate to personality factors found in highly creative people across fields. Originality is ‘habitual’ with highly creative persons. Scientists do not turn their originality off when they leave the laboratory, nor artists when they leave the studio. They tend to encounter the world in more transforming ways than another person might do. In fact, in a recent edited book, bringing together some celebrated and visionary authors, called *Everyday Creativity and New Views of Human Nature*, 12 integrating themes for the volume included many stylistic and characterological features. Themes included qualities such as Dynamic, Open, Conscious, Nondefensive, and Brave.

Everyday creativity, as a disposition or style, may potentially lead to the ‘self-actualizing creativity’ of humanistic psychologist Abraham Maslow, as above. Along different

lines, research on everyday creativity and bipolar affective disorders indicates that higher creativity appears in connection with somewhat milder forms of bipolar disorders – as dealt with further below. This may yet be in the service of health, not appearing in the most severely ill. The pattern appears despite subjects’ areas of endeavor. There is higher familial creativity in many cases, but it does not ‘run true’ to a particular modality or interest, such as the Bach family of musicians. Hence the creative impulse might emerge for one person in art, one in schoolteaching, and one in business.

In the area of cognitive style (modes of thinking reflective of underlying personality trends), greater ‘overinclusive thinking’ has been found among creative persons in general. *Behavioral overinclusion* involves the number of elements in a category. *Conceptual overinclusion* regards the range of classification rules involved, which may be more vague, developmentally primitive, or distant. Overinclusion has also appeared among people with bipolar mood disorders, especially when hypomanic, consistent with tendencies toward ‘loose associations.’ Overinclusion has also been a consistent finding both with eminent creators, and with everyday creators.

Studies have additionally found greater overinclusion among people in general who were in a mildly good (vs. neutral) mood. This finding helps explain one way in which mild mood elevation may be relevant to creativity. Another primary feature is Openness to Experience, now one of the factors in the Five Factor Theory of Personality. Here one finds, indeed, generality across life activities.

Summary

Hence, everyday creativity, as defined, appears universal and applicable to all of life, and all of us. It is a style more than a special ability, one which, unlike specialized abilities, crosses domains. It appears relevant to survival itself and can be linked to our human ‘phenotypical plasticity.’ It draws on stylistic qualities such as Openness to Experience. At higher levels of personal development it may transform into self-actualizing creativity. However it is probably not well developed in most people.

Can Everyday Creativity Be Good for Us?

Is creativity healthy? This may sound odd to people who are concerned about the likes of ‘creativity and madness.’ However, all else being equal, the effects of creativity tend to be good for us physically and psychologically. The discussion concerns more direct and obvious benefits, as well as the issue of creativity emerging from illness or pain, with potential for resilient coping.

Arts, Creativity, and Health

Here one’s mind–body connection can be seen in bold relief. Although much research on expressive arts is anecdotal and not well controlled, the work on expressive writing in particular is abundant and often rigorous. The writing paradigm of James Pennebaker and colleagues, and related work on the ‘writing cure’ can surprise even the nonbeliever.

Imagine you are asked to write about absolutely the most traumatic thing you ever experienced, and in rich emotional color – something so traumatic you had never told anyone about it. Meanwhile a control group writes about something more neutral. In the classic paradigm, two groups of college students did this writing, remarkably, for 4 days at only 20 min apiece. The results were startling. Although the experimental group was initial more upset (understandably), 6 weeks later they scored higher, and significantly so, compared to the control group, on measures of psychological well-being. And not only had they made fewer visits to the college health center, they were actually higher, compared to controls, on two measures of T-cell function. *That is, the expressive writers were higher on two biological measures of immune function. They were more resistant to disease.*

What were they writing about? Stress of college, loneliness, conflicts with potential partners, with parents, divorce, trauma, death. Is it possible they had not even fully confessed some of this to themselves – or at least integrated it more into their conscious experience? Among multiple replications and expansions upon this basic design, one finds support for integration of fragmented mental structures and freeing of working memory. The working through of the conflict seems particularly important. Art therapists such as Shaun McNiff profess something similar about benefits of art therapy. One doesn't just draw; one processes.

Yet can one say that going out and painting a landscape or doing bird watching is any less therapeutic? Or taking long and demanding hikes and enjoying the beauty of the outdoors, which can indeed be creative? These are questions that need answering. In addition, a growing literature on guided imagery and health is exciting indeed. Using attention and intention, guided imagery can even produce physiological changes. It has been used with breast cancer, diabetes, and eczema among others. It has been said that such imagery is "the very foundation of all mind-body interactions and effect . . . (and) plays a critical role in all health care. . ." And what allows the best access? Our everyday creative minds.

Opening Pandora's Box

The therapeutic benefits of inner processing are of clear interest. In a sense, one opens Pandora's Box, and sees the unconscious, the Shadow, the rejected past – the hidden parts we need to accept consciously for greater balance and integration. One moves ahead resiliently to cope with them, to integrate them into conscious experience. Among descriptors for high everyday creative *process* are qualities of openness and non-defensiveness, along with the 'ego-strength' to make adaptive use of such buried yet rich material.

Accessing such material is not unlike what Ernst Kris meant by 'regression in the service of the ego,' or what Frank Barron addressed when he said "The creative person is both more primitive and more cultivated, more destructive and more constructive, occasionally crazier and yet adamantly saner, than the average person" (Barron, in Richards, p. 33).

Ever greater attention is being given to many forms of arts medicine for healthy confrontation of difficult issues – with indications including grief, shock, depression, cancer, HIV, and more, as recent mind-body medicine books attest. Creative

activity of many types also seems linked to successful aging, to greater acceptance of one's circumstances, to finding purpose and meaning in life. One can also apply this to many everyday endeavors such as mental health effects of journaling, blogging, and perhaps in some contexts, social networking. Can these forms of communication qualify as everyday creativity? They can.

When Illness Yields Creativity

However sunny the picture, there is a connection between creativity and certain illnesses or problems. Yet, the mistake is to think that the creativity is a problem too, when it may actually be the best medicine.

Creativity may be found in a disproportionate amount, for instance in people at risk for bipolar mood disorders – perhaps one of the most common associations one hears about. See the glossary for typical classifications, which include major mood swings, elevation and depression, and more minor variants. They are common, and serious, but can be very treatable. The picture may be healthier for everyday than eminent creativity – and certain cognitive, affective, and motivational advantages for creativity have been posited, as a potential *compensatory advantage*. These have been linked especially to mild (not extreme) mood elevation. This topic is covered more fully in the article on *Bipolar Mood Disorders* within this encyclopedia. But it is important to stress here as well that *creativity tends to be healthy, even and perhaps especially with certain illnesses*.

One can make some general statements. Consider the simpler genetic model of sickle cell anemia, where a genetically homozygous person with the full-blown syndrome may suffer and die young, but where the heterozygote may have a mild anemia at best, but still manifest the compensatory advantage: Resistance to malaria. Everyday creativity has been suggested as a *compensatory advantage* for certain better-functioning individuals at risk for bipolar disorders, and for some mild schizophrenia spectrum conditions as well. Some potential generalizations:

- *'Creative benefit' fits an inverted-U pattern of Compensatory Advantage.* Evidence supports higher everyday creativity in the presence versus absence of risk for bipolar disorders. Yet, contrary to the stereotype, it is not the sicker people who benefit most. Higher creativity is found in better functioning individuals (e.g., cyclothymes not manic-depressives), or people in better functioning mood states (mild mood elevation especially, and not mania.) Beyond that, affective, cognitive, and motivational advantages have all been suggested. One key implication is that *treatment* should tend to help, not hurt, creativity.
- *Both personal and family history need consideration.* Surprisingly, a creative advantage even has been suggested in the psychiatrically normal relatives of bipolar individuals. Subtle and subclinical factors may be operating – perhaps in mild mood elevation – even factors which are not about illness at all. In addition, creativity emerged higher in people with unipolar depression who had, rather than lacked, a family bipolar history. Personal *and* family history are both important.

- *Everyday creativity may work toward health not illness.* Heightened *everyday creativity* in the more mildly affected people at risk, and even in normals, support this, although more work is needed. Perhaps creativity can even be protective for certain children at risk for mood disorders.

Findings may pertain not just to a handful of eminent people, but literally to millions in the population. Akiskal and colleagues estimate that as much as 5% of the population may have a bipolar spectrum disorder. Plus there are more unipolar than bipolar offspring of bipolar parents; finally many more people carry the risk. How important it is if this risk has a silver lining, especially if it can boost health and resilience. Notably, early conflict and difficulty is frequent among eminent creators. How have they overcome, and what were their unusual strengths, resources, models, and supports? Why did they prevail when others did not? Studies of *compensatory advantage* in everyday creative individuals may provide further perspective on creative coping and resilience

Summary

One finds many healthy consequences of everyday creative activity, perhaps seen most clearly in expressive arts therapies and healing imagery. Further study is needed of creativity in other contexts. Further, the link of everyday creativity with bipolar mood disorders – especially with milder conditions – raises new questions about resilience and a *compensatory advantage*.

Does Creativity Involve Diverse States of Consciousness?

One rarely hears about altered states of consciousness in creativity – at least beyond discussion of Mihaly Csikszentmihalyi's *flow*, where a person becomes totally involved in an activity. In sports, the term 'in the zone' is also used for this special state. Interestingly, Baruss in his text, *Alterations of Consciousness*, describes *flow* and its eight features, in the same chapter as Maslow's Peak Experiences (related to self-actualizing persons), and also aspects of meditation.

Surely we have all had at least a few moments of such *flow*. We become so involved that every detail sparkles with intensity, time fades, the world dims around us, and only the effort, only our task, remains – and our work may in fact proceed with a naturalness far beyond the usual meaning of the word 'effort.' Within this harmonious whole, a lot is getting done.

Receptive and Diffuse Mind States

Why not more attention to this and other altered states in creativity? Creativity is often treated as another form of conventional problem solving, using ordinary consciousness. Could one reason be to separate creativity from allusions to the 1960s, to psychedelics and to induced 'altered states of consciousness'? Do 'altered states' to some people seem only about exogenous substances or countercultures? For creativity, this is not at all so!

Flow states may relate to only one part of the multistage creative process. Other possibilities should be studied too.

Flow appears most relevant to the seeing through of a creative work once the main goal is clear – be this a canvas, a script, or perhaps a game of basketball, or creating a party game with children. The challenge is on. Taking Wallas's four stages of creativity, *preparation, incubation, illumination, and verification*, the *flow* experience may involve the illumination and post-illumination working through of a creative idea.

Consider other crucial mind states in creativity, notably involving the *incubation* stage or opening of one's mind to new insights. Rather than intense and one-pointed, this state may be diffuse. The two styles have been loosely compared to *shamatha and vipassana* approaches in meditation, as well as to aspects of Eastern models of creativity.

Psychologist Colin Martindale did key work here a decade ago, now being built upon. He found, on EEG, in the more diffuse and receptive creative stage features including (a) low cortical activation, (b) right hemispheric dominance, (c) theta waves and low frontal activity. The subjective experience of the participants involved associative thinking, defocused attention, and multiple simultaneous representations. Here is a creative stew out of which a bright creative idea could emerge.

Intuition, Stylistic Features, and Relaxed Mental Control

To many, intuition and insight are the heart of creative functioning. Intuition concerns finding the solution to a problem without explicit reasoning toward it. It may involve tacit and vague knowledge; it may be vague and suggestive, and contrasts with insight which is sudden, sharp, and definite. There are varied theories of intuition involving special processes and multiple processes. Intuition may draw on right hemispheric specialization – as Martindale suggested – and on unconscious knowledge, experiential, holistic, procedural, and body wisdom, on affect as well as cognition.

There may be stylistic and preferential aspects, such as being open to one's 'gut' feelings. Adaptive use of 'latent inhibition' is relevant, involving the ability to lower a gating mechanism that screens from attention stimuli previously found irrelevant. S.B. Kaufman has shown this is linked to 'faith in intuition.' It has also been related (in creators) to openness to experience. By contrast it has been linked (in schizophrenics) with thought disorder. Here, indeed may be further evidence of a *compensatory advantage* linked to intermediate levels of key characteristics, where there is mental control to use it, perhaps relevant, again, to what Kris called 'regression in the service of the ego.' There is also apparent fit with creative personality traits such as 'tolerance of ambiguity' and 'preference for complexity.' And with the notion, related to chaos theory or nonlinear dynamical systems, as suggested by Richards, Schulberg, Zausner, and others that the creative person may live intentionally closer to a metaphorical 'edge of chaos.'

Neuropsychological Findings

A range of ingenious laboratory studies by Kounios, Jung-Beeman, Subramaniam, and others have used EEG and fMRI to compare a rapid and more unconscious strategy of problem solving called the *insight* approach to a contrasting and more conscious *analytic* strategy. Note one cannot rule out the action

of *intuition* prior to the creative *insight*; hence with the *insight* strategy, both types of phenomena may be involved.

Tasks could use either the *insight* or *analytic* strategy, such as Mednick's Remote Associates Task, or anagram problems. Participants reported, after solving each problem, what strategies they had used. Of interest, corresponding brain changes were found for *insight*, actually occurring *before* the problem solutions were discovered. The Aha! Moment therefore appeared to be the end of a stylistic preparatory sequence that raised the odds of solution.

In other work, remarkably, EEG changes and distinct brain states were found even *before* the activity was begun, at all. In some sense, participants were anticipating the task and changing mental set. What mental set was this? Similar to what Martindale found earlier, participants using insight strategies showed attentional diffusion and right hemispheric dominance. Beyond this, such strategies have correlated with embedded figures tasks and identifying out of focus pictures, both right-hemispheric and holistic tasks.

Certain results are relevant to creativity as *compensatory advantage*, as reported above, for persons at risk for bipolar disorder showing creativity with mild mood elevation. In addition, Isen and colleagues have shown a mild positive mood appears to augment creative thinking. In general. Here, participants solving Mednick Remote Associates tasks in a *positive mood state* both solved (a) more problems than controls, and (b) more using an *insight* versus *analytic* strategy.

Clearly, there is much more to be learned about brain states and creative inspiration, using neurobiology, behavior, and subjective experience. Research may even open new doors to understanding healthy and integrative effects of creativity in our mind-body continuum, as well as help explain some findings of *compensatory creative advantage*, related to certain personal or familial psychiatric disorders.

Summary

Diverse states of consciousness may be involved, both in the receptive state of everyday creative inspiration and in the more active flow state of realization. New EEG and fMRI evidence is showing that special mind states not only occur during, but actually in preparation for, creative activity. The mysteries of incubation and creative insight are yielding increasingly to scientific inquiry.

Seeking 'Creative Normalcy'

The creative person is not currently the typical, or average, person. Yet what is 'normalcy'? The norm, the average, the usual case. That doesn't necessarily mean the norm is good, or beneficial to us individually or to society. In fact, many scholars and visionaries, for example, in edited books by Richards, or Montuori and Purser, referenced here, posit that being and living more creatively can lead to healthier individuals and a sounder more participative culture. This requires modifying our sometimes conformist and mindless societal norms toward modes that are more aware and alive, diverse and growing – a more creative way of being, and toward a more 'creative normalcy.'

New Views of Central Tendency and Variation in Society

In addition to the 'norm' or central tendency, we can also talk about 'variation' that goes along with it, for example, the standard deviation that accompanies the mean, the range that complements the median. Nurturing creativity means valuing 'a broader acceptable range of normality.' We, in a shrinking and multicultural world, have a wide range of ways to manifest, and many varied gifts to bring each other across lifestyles and across cultures. We need to go farther to appreciate that diversity, that creative variety, rather than push for a normative conformity.

The prices of mindless conformity can be strikingly evident. Consider the famed Stanford Prison Experiment of Phillip Zimbardo (2008) and collaborators from the 1970s. College students who role played guards and prisoners became so involved, so believing of, and so conforming to, their roles, so cruel on the one hand, or so traumatized on the other, that the study was terminated early. Some had to seek clinical help. If one thinks this level of distress and abuse unlikely in our day to day lives, let us just remember Abu Ghraib. We humans have a dangerous potential to go along with the crowd.

Who is most apt to resist such pressures? Surely our everyday creative person, open to experience, nondefensive, non-conforming, courageously questioning. This person, who is alert and aware, mindful not mindless, who will not take things at face value. Here is someone who has developed the skills to create change, to question the *status quo*. And who, nearing higher levels of self-actualizing creativity, may also manifest higher values that benefit all humanity.

Factors that Can Inhibit Our Creativity

There are many factors – as healthy as our creativity can be – that can oppose it. It's worth thinking how some of these may affect us, singly or in combination and estrange us from our own creative birthright.

1. *Idealization of the eminent creator* – our tendency to glorify certain people – heroes, geniuses, and the like – who seem qualitatively different from us and can do (we think, or hope) what we cannot; thus we may disenfranchise our own creative selves.
2. *Fear of as well as mystique of creativity*, coming from irrational places in our minds we may prefer not to access. We may shy from creativity or project our own unconscious material onto others (e.g., the so-called ill creator).
3. *False dichotomies that keep us from our whole creative selves* – as promoted by our culture, for example, thought versus feeling, mind versus body, science versus art, objective versus subjective, male versus female – rather than embracing the whole-person mind-body integration and freedom from stereotypes that frees our fullest creativity.
4. *Resistance to the nonconformist and the new*. Sources of resistance can be grouped into four categories, involving inner and outer, and both conscious and unconscious, factors. These allow us to reject the innovative, either individually or together with others. Particularly fearsome are unconscious self-organizing forces that can subtly squeeze out certain views.

Changing Our Classrooms, Changing Cultures

Studies suggest that too often, some teachers do not greatly value – and even those teachers who think they value creativity sometimes poorly tolerate certain behaviors going along with it. This pattern might sometimes be true in our families, and workplaces as well. This complex situation requires a change in our institutions, with a greater societal valuing of creativity, and of attitudes and values needed to nurture it.

This advocates for a more participatory, less hierarchical structure. In the schools, for instance, there could be greater valuing of the new, of the dissident person, of alternative perspectives, rather than one universal truth, of the teacher more as resource and guide than universal expert. Of the young person or child as a new and valuable resource in the world. Of the value of exploration, and the ability to be wrong, as well as right. Or the use of conflict resolution skills to facilitate creative syntheses between independent thinkers, to smooth the way among diverse perspectives. Finally, greater honor could be accorded to qualities of bravery, challenge, nondefensiveness, and ongoing openness to new possibilities. On top of everything is the joy of creative living that can make this all worthwhile. My recent review in *Creativity in The Classroom* (2010) included the following seven areas for enhancement:

1. *Outer space* – Greater attention to a rich, safe, and accepting environment. Creativity requires an openness and attitude that ‘anything goes,’ at least until later evaluation. It also requires the potential to make – and to value – mistakes, without which we cannot learn. Creativity also thrives in a resource rich environment. Our schools could go far to furnish these conditions.
2. *Inner space* – This is about development and acceptance of inner mental processes, including irrational or unconscious content, and varied mental states, including more right and left-hemisphere dominant modes of processing.
3. *Bravery within* – This alludes to the healthy effects of creativity, which are not won without a cost. As per the previous section III, healthy effects involve challenging oneself, hurdling over mental blocks, valuing this creative *process* more than defending certain fixed views of self. Being non-defensive, and open. Thus one moves beyond ego and more into the present moment.
4. *Bravery without* – This means in one’s environment and in the world. It can mean taking a stand, and challenging the *status quo*. Do we not want our young people to develop this possibility? Consider our frightening potential for conformity in the Stanford Prison Experiment above, and dangers that erupt in so many smaller ways. The creator is able not only to see farther, but to share this, even when difficult, to create a healthier environment, even a healthier world.
5. *Cherishing our creativity* – Not as simple as it seems, this means living with the disruption of multiple views and challenges to one’s opinions and even worldview. It touches on valuing *change* and the process of evolution above fixed views and outcomes. It means, when creating in groups, to value the unique contributions of all, but also the group product, using skills of conflict resolution and compromise to make and honor the mix.
6. *Relating to each other creatively* – Here is our too often overlooked interpersonal creativity, the *relational creativity* we bring

to our awareness and interactions in the moment. We are present, aware, empathetic, flexible, and can manifest mutuality in a give-and-take that is characterized by the hallmarks of everyday creativity, *originality* and *meaningfulness*. The context is one of intimacy and of enhanced group creativity. The outcome can often be, appropriately, a surprise.

7. *Knowing the Joy* – This shining reward can occur at any time, as one goes beyond preconceptions, fears, fixed views of self, to be present, take chances, enter the flow of life, and learn something new. There are also moments of frustration to be sure. Individually, creativity can enhance our further development, our potential for self-actualization. There are advantages for resilient coping, self-healing, seeing multiple options. Interpersonal creativity can also bring us more together and enhance our potential for caring and collaboration. For some people, creativity can further a spiritual path. Creativity is as diverse as we are. Whatever it be for you and me, this delight in being creative appears another sign that this way of life is, overall, *good for us*.

Summary

Making everyday creativity a central part of our life, in schools, in jobs, at home, will require dealing with obstacles, in ourselves and others, and social structures that are not set up for this, along with needed changes in attitudes and values. This could, however, be well worth it.

Conclusions

Everyday creativity is universal, necessary, key even to survival itself. It also holds promise of greater life meaning and even personal development. It seems an intrinsic quality related to ‘phenotypic plasticity,’ our ability to flexibly adapt and change as a function of conditions (or adapt conditions to us). Although we all have it, we could develop our creativity more than we do.

Creativity, viewed as a process, gives us new insight into healthy ways of living. One is more open, less defensive, more richly aware, with implications for physical and psychological health and even immune function. We can use arts, imagery, and more to these ends. There is even evidence supporting a *compensatory advantage* for certain people at psychiatric risk. This too is not about illness but about health.

One sees, in creative incubation and insight functions particularly, signs of innovation in terms of characteristic creative mind states. This draws on hemispheric specialization, unconscious knowledge, affect and cognition, mind–body integration, and other factors including procedural memory, experiential and holistic impressions, and more, which bear further study.

Making creative processing more normative in our culture, and honoring a wider range of ways to be, could diminish some of our mindless conformity and rejection of the new. The creator is especially immune to significant group pressures, while more aware of needed change. Our schools among others could lead in furthering a new valuing of creativity and the diversity we all can bring, toward a healthier population and world.

See also: Bipolar Mood Disorders; Brain and Neuropsychology; Chaos Theory and Creativity; Cognitive Style and Creativity; Definitions of Creativity; Education and Creativity; Eminence; Expressive Arts Therapy; Families and Creativity; Flow and Optimal Experience; The Four Ps of Creativity: Person, Product, Process, and Press; Mental Health: Affective Disorders; Multiple Intelligences; Zen.

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Relevant Website

- <http://www.saybrook.edu> – Support site for M.A. Program in Creativity (in Psychology with Specialization in Creativity), and the Creativity Studies Certificate.

Evolving Systems Approach

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Glossary

Authenticity A characteristic of a person who demonstrates creativity – ‘authenticity’ literally means ‘author of values.’ The person who demonstrates creativity must form new principles, new heuristics, make new connections, and open new worlds.

Constructionism The belief that the person who creates participates in choosing and shaping the surroundings within which the work proceeds, the skills needed for the work, and the definition of the ensemble of tasks – the person must take possession of whatever is needed for the work.

Constructive repetition An important organizing principle proposed by Gruber – the central theme is that creativity, mastery, and meaningful repetition have an important connection. For example, da Vinci sketched over one thousand hands before selecting the version he used for the ‘Mona Lisa.’

Facet Any aspect of a creative case that can be made sufficiently distinct to permit intensive study of it, whether regarding process, product, content, or context.

Initial sketch The creative person frequently begins work on a project by making a quick and crude sketch of the work to follow.

Intrinsic and extrinsic motivation When the considerations impelling a person to do a certain project are inherent in the nature of the work, either as a process or as

product, we speak of intrinsic motivation. When the motivating considerations are different in kind from the nature of the work we speak of extrinsic motivation. The two kinds, although usually contrasted with each other, are not necessarily incompatible.

Network of enterprise Creative work can be viewed as organized so that enduring enterprises are composed of several projects, and to carry out a project requires engaging in several tasks. The whole assembly of a creator’s enterprises is a network of enterprise.

Pluralism An attitude guiding the investigator, welcoming and looking for the many rather than the one or two essentials. Thus: many metaphors, many insights, many mentors, many motives.

Purpose An essential system of the ‘evolving systems approach’ – the creating person requires the ability to see vividly into the future, to have a sense of mission, and to designate a network of viable strategies to ferry one’s self to the desired goal.

System The way in which the elements comprising an entity are interrelated or organized into a functional whole. It is usually intended that the elements do not completely lose their identity when participating in such an arrangement.

Introduction

The evolving systems approach (ESA) is both a method and a theory created by Howard E. Gruber. Its foundation consists of three pillars: purpose, affect, and knowledge. ESA is designed to study and understand creativity. The focus of ESA is for understanding the uniqueness of the individual creative person at work. It involves no commitment to discovering generalizations one can make about all creative people. Its primary aim is to construct an account, both analytical and developmental, of each creative person considered and to arrive at what may be called a ‘theory of the individual.’ By ‘developmental’ we do not mean an account starting with infancy, but one that starts wherever it is feasible. Fortunately, productive creators usually leave ample traces of their work. The evolving system comprising the creative person includes three major subsystems: knowledge, purpose, and affect. Creative acts are taken to be outcomes of the functioning of this system, and every episode and every facet of the process of creative work engages all three subsystems.

ESA has the following points of emphasis:

1. The approach is developmental and systematic. ESA views creativity as the result of protracted, hard work over long periods of time.
2. The approach is pluralistic. The person who creates exploits many insights, projects, social relations, and educational sources. ESA identifies three essential, wedded systems that give rise to creative production: purpose, affect, and knowledge.
3. The approach is interactive. The person’s work is always conducted in relation to the work of others.
4. The approach is constructionist. The person who creates must reconstruct the elements of a medium to bring a vision to fruition.
5. The approach is existentially, experientially, and phenomenologically sensitive. The person who creates is not considered simply as the maker of the product, but additionally as an active person in a world. He or she is literally living in a medium.
6. ESA proposes that an understanding of creative work requires a conception of the person as an evolving system in an evolving milieu. Each person-as-system is comprised of three subsystems: organization and application of knowledge, a sense of mission and purpose, and a rich affective domain. Each of these subsystems has a dual aspect; in one way it has an integrated life of its own, in another way it contributes to the internal structure of the person’s other systems.

7. The preferred methodology of ESA is the case study. The case study method has a venerable tradition in psychology. It was employed with great effectiveness by such luminaries as Rudolf Arnheim, Sigmund Freud, Jean Piaget, Gordon Allport, Erik Erikson, Jean-Marc Gaspard Itard, Hermann Ebbinghaus, and Alexander Luria. Each made their groundbreaking discoveries through the in-depth exploration of relevant case studies.

One of the important facets of the case study is the initial sketch, which seems to occur in many if not all instances of creative work. For example, when Picasso began the month long effort that produced the great mural *Guernica*, his first move was a small, rather primitive sketch to which he referred repeatedly in the month that followed. Later, we will come to other facets of the creative case study. For the moment suffice it to say that each new starting point serves as a searchlight that reveals new configurations and as a gyroscope that keeps the creator pointed toward remote goals. In this way, selecting a new starting point permits the creator to maintain a freshness of his or her work. In practice, history and evolution guarantee that such new starts will recur incessantly.

If we do no more than vary the starting point of each study, other changes follow so that each new starting point reveals new facets of the creative process. Consider two contrasting points of view: the psychobiographer approaches the case with the primary aim of understanding the historical and personal factors that set the stage for the creative process, without actually examining in any detail the creative work itself. On the other hand, the experimental psychologist interested in creativity, in order to have a manageable experimental design, narrows the focus of attention drastically and increases the number of subjects. The psychobiographer typically pays little attention to the process of creative work; the experimenter relaxes the criteria used in selecting creative subjects (e.g., the more creative half of an ordinary high school class) in order to have enough subjects to complete the experimental design. Taken to an extreme, the assumption underlying much of this experimental research is that everyone or almost everyone is creative to some degree, and we can consequently study the process in the less than great even if our aim is to understand the higher levels of creative endeavor.

By a system we mean a set of distinct components in specified relationships. A simple list of traits is a kind of theory because it proposes to say what is important, but it is not a systemic theory. Only when we examine interrelationships of these members of the system can we begin to speak of systems. Systemic analysis is possible at many different levels, for example, the organism is composed of organs and society is composed of organisms. To choose as one focus of attention a particular level of analysis, or set of levels, need imply no denigration of other levels of their students.

Organization

In the present context, the idea that organization and adaptation are twin aspects of creative evolution could also be expressed by describing them as forces making for stability and forces making for novelty. In the study of creativity, as in all other living processes, there must be continuity and stability.

There is a confederation of scholars interested in creativity, such as genetic epistemologists, Gestalt psychologists, and system theorists. Some researchers in each camp claim superiority for their brand. Each of these approaches can be considered as highlighting some important aspects of the whole process, their totality providing the context for any one of them.

One of the cardinal concepts of ESA is 'pluralism.' At any given historical moment there are several schematizations available to the person, and they can be selected, composed, and arranged in different ways. The principle of pluralism proposes several schematizations, multiple metaphors, and many enterprises are examined, explored, exploited, redefined, fused, and synthesized with the person's current and evolving vision and body of knowledge.

At times, the discipline of psychology seems to present a puzzling spectacle. The same controversies seem to crop up in every generation, such as the conflict between holism and atomism, or that between evolution and stasis, or that between sudden intuitive leaps and incremental change. In 1937, the prominent personality psychologist Gordon Allport wrote, "It is not upon the cell nor upon the single organ, nor upon the group, nor upon the species that nature has centered her most lavish concern, but rather upon the integral organization of life processes into the amazing stable and self-contained system of the individual living creature." (1937: p. 3)

It may be that these repeated controversies stem not from blind commitment to one or another ideology, but from the legitimate necessity to rework fundamental concepts as circumstances change. Allport argued emphatically and at length for the necessity of studying the single case and to point out the various tendencies, in the psychology of that period, to escape from the trap of atomistic, individualistic positivism.

Facets

It is common in psychological research to distinguish between 'how' questions and 'why' questions. 'How' addresses itself to the processes of creative work; 'why' asks, what are the underlying reasons for doing it? To a large extent the failure to separate the two kinds of questions has led to profound neglect of 'how' questions. An important movement in the study of creativity has been psychobiography, which is the application of personality theory, especially Freud's, to understanding creative people. A related effort, psychohistory, applies the same range of theories, not to understanding the individual creator, but rather to historical events for which a psychological theory is proposed. Insofar as these approaches delve deeply into the life of a creative person, they are of very great interest. Unfortunately, to a large extent psychobiography and psychohistory have been the occasion for neglecting 'how' questions. Insofar as these approaches draw upon the early years of the creator they are forced into undocumented speculations. A third category of creativity research is the psychometric approach, in which tests are administered to large enough numbers of subjects to permit statistical analysis. For different reasons these three methods all avoid studying the creative person at work. On the contemporary American scene this has meant a shifting focus on:

- Birth order effects, in which the person becomes creative because of his or her special place in the developing family.

- Bipolar disorder, where the anguish of private life provides the stimulus for creative expression.
- Metaphor, where the ability to see and express commonalities between unlike things is the central ingredient of creativity.
- Great powers of visualization.
- Divergent thinking, the ability or propensity for thinking of unusual responses.

All of these and many more have been singled out as the essence of creativity.

Paradoxically, in the ESA we avoid a singular focus by welcoming all such proposals into our tool shed. However, the uses to which the tools will be put vary from project to project and different creators may accomplish similar ends with different collections of tools. For example, the physicist Richard Feynman solved an important class of physical problems with theoretical tools quite different from those used by others in solving the same problem. Feynman's method was geometric and the others' was algebraic. While in this instance Feynman's method eventually prevailed, the work of the others was also creative. Moreover, the creator does not use one pre-fabricated tool but a collection of them, including some that are invented in the course of work on each project.

Looked at from the creator's point of view, a given facet or facets may be foremost in attention, the vast remainder being the background. The distinction between figure and ground is well known in the psychology of perception. A change in attention may be thought of as a figure-ground reversal. If the figures in question are cherished projects, the creator may experience mixed feelings at the new engagement together with regret at what is left behind. The ground, or context, is so complex and dynamic that new facets are continually appearing. For example, after Charles Darwin published the *Origin of Species* he took up with great vigor questions of physiological botany that had long lain fallow in his network of enterprise. This move brought a certain closure to his work: nearly a century before, his grandfather Erasmus Darwin had written much on botany. Of particular relevance was his long scientific poem, "The Love of the Plants," which the young Charles Darwin greatly admired but never emulated.

For a second example, many scientists who are completely engrossed in their work are nevertheless aware of severe and chronic social disorders in the world around them. Even if they manage to shut that world out it may still cast a dark shadow on their lives.

Insight and Problem Solving

Prior to the introduction of the Evolving Systems Approach, researchers studying creativity tended to ignore processes and emphasized states, such as the sudden epiphany. There was a widespread belief in the prevalence of sudden insights arrived at intuitively, such insights constituting the genuine article, a creative product. An often retold and celebrated story is August Kekulé's account of his discovery of the benzene ring, which he made while half asleep on a London bus. However, if his account is read carefully in light of the Evolving Systems Approach, one can see that he had been moving in that direction for well over a decade, and the dance of the molecules that

he described was not a unique event, but a mode of thought that he employed in his chemical thinking.

The reverie on the bus must be seen in its larger context, the general nature of Kekulé's thinking. Moreover, his thinking must be seen in the still larger context of the history of chemistry in the nineteenth century. Viewed in these lights, Kekulé's epiphany was not a miracle of intuition, but the product of protracted and directed work by a network interested in structural chemistry.

If insight is not the cause or the embodiment of creative work, what is its role in the creative process? First it should be said that insight, when it does occur, takes a variety of forms. As the culmination of a protracted process it may be a sudden change in awareness or it may be a gradual shifting in point of view. With this in mind, there is no great need to define insight *a priori*: researchers employing the evolving systems approach simply study the record, note changes, and describe them (sudden or gradual, aware or unconscious, pursued immediately or bracketed for later attention).

Purposes and Motives

A sharp distinction widely agreed upon is made between intrinsic and extrinsic motivation. The former refers to the self-satisfaction sought in actually engaging in creative work. The latter refers to the satisfaction arising out of recognition, prizes, monetary awards, and the power that comes with fame. With regard to intrinsic motivation we ought to distinguish between the satisfaction deriving from engaging in the work and that derived from completing it. On the surface it might appear as though extrinsic motives correspond to 'why' questions and intrinsic motivations to 'how' questions. But if we take the creator's network of enterprise as a whole as reflecting the totality of his or her intentions, absorption in this set of tasks becomes a powerful motive.

Beginning work on a task sets up a kind of drive for completing it. The question remains open whether this drive is the same as the pleasure in actually engaging in the work. It may well be that in real creative work, both kinds of satisfaction are at work under the broad heading of intrinsic motivation. Meanwhile, it is reasonably clear that extrinsic motivation is also important. Nobel prizes and other blandishments are ever present and highly visible. A plausible hypothesis is that, for whatever reason, at moments when one is not engrossed in the work, extrinsic motivation drives the creator back into it; when he or she is engrossed, the very same extrinsic motives may be a distraction, even a pollutant: intrinsic motivation takes over. In Darwin's notebooks there are few passages indicating extrinsic motivation, but there are some. And it should be remembered that writing the notebooks was itself part of the work process, a record of activity governed by the task, not of activity governed by other considerations. On the cognitive side belief systems evolve throughout the life history, and on the intentional side motives evolve.

Tasks are not undertaken singly. Each task becomes a member of one or more enterprises. These, taken together, form a network of enterprises, and this network can be thought of as the individual's evolving organization of purpose. This network of enterprise, once formed, serves to locate any

given project within it; at the same time, it represents a large portion of the individual creator's self-concept. Every task may be said to have a history. A gap, disequilibrium, or unsatisfactory situation is observed; this leads to the undertaking of a task. Some subset of such tasks forms an enterprise. Seen in this light, an insight need not be the solution to a problem; it may be the initial recognition that one exists. Often, the recognition of a problem unsolved, a voyage not yet taken, can produce the thrill of discovery that we usually associate with solution.

Skill

Studies of persons who demonstrate creativity indicate convincingly that it is important to develop a level of expertise for a domain as a necessary foundation for subsequent creativeness. Astonishingly high levels of skill account for high levels of creativity. But we certainly can find examples of individuals with great skills who are not very creative. For example, among artists there are greatly skilled copyists and plagiarists who can successfully imitate at least one artist and sometimes many. Such individuals become the plague of museum curators, who for all their expertise sometimes fall victim to artistic fraud. So skill alone is not sufficient for creative work. On the other hand skill is certainly a virtue and it is attainable through practice.

Collaboration

Growing out of the extreme individualism of modern Western society, the picture of the creator as a lonely genius is very widespread. But we are coming to see that various kinds of collaborative processes are also important. For example, there is the well-known case of Albert Einstein and the Olympia circle, three young men who met every week over coffee to share ideas. Thus Albert Einstein, during his years working in the Swiss patent office, was not, as is sometimes suggested, alone in his theoretical quest. He had important collaborative opportunities. Another example is the case of Pablo Picasso and Georges Braque, who together invented and initiated the important movement in art of cubism. We have Vincent van Gogh and Paul Gauguin, Dudley Warner and Mark Twain, Orville and Wilbur Wright, Marie and Pierre Curie, and on and on. All persons who demonstrate creativity have significant collaborations during some phase in their creative development, whether it be with teachers, peers, or heroes.

Even in the case of the project that is conducted alone, one almost invariably finds that the individual creator is in some kind of fruitful relation with others. Van Gogh, for example, sent his canvases to fellow artists all over Europe and received theirs, providing a rich language for aesthetic discourse, the work itself. Gauguin and van Gogh lived together in Arles, France, working side by side and simultaneously dreaming of a utopian artists' community. Mythically isolated creators such as Isaac Newton, Albert Einstein, Emily Dickinson, and van Gogh profited from collaborative relationships. To these examples should be added informal groupings such as the Salon des Refuses – artists who were rejected by the French artistic establishment, but nevertheless managed to construct relationships of mutual defense and support.

Conclusion

We need enough case studies to get from the unique creative person at work to whatever generalizations may follow. Post-Grubarians are approaching a position to present a well-founded, well-integrated theory of creativity that is both descriptive and prescriptive. We currently know that creativeness rises and reaches fruition from the viable pluralism of five evolving systems: (1) a rich store of domain-relevant knowledge; (2) the cognitive ability to rearrange and recombine the elements of a domain in service of a synthesis and insight; (3) high levels of motivation to work hard over long periods of time; (4) a sense of purpose; and (5) ability to benefit from collaboration and to benefit from exposure to the ideas of others. It is possible to study an individual in detail without raising individualism itself to cult status. Unique people, which we all are, can work together. Creative work always takes place in a multiplex environment. There is no necessary conflict between respect for the individual and sensitivity to the social nature of all creative thought.

See also: Adaptation, Adaptiveness, and Creativity; Attribution and Creativity; Collaboration; Definitions of Creativity; Expertise; Motivation; Pablo Picasso 1881–1973; Theories of Creativity.

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- <http://www.ischool.utexas.edu/~ssoy/usesusers/1391d1b.htm> – The Case Study as a Research Method.
- <http://davidlavery.net/Gruber/> – The Howard Gruber World Wide Website.
- <http://www.psychobiography.com/whatis.html> – What is Psychobiography?

Exercises

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Glossary

Broadening Building skills and knowledge well outside of your current areas of expertise.

Capturing Preserving new ideas as they occur, without judging or editing them.

Challenging Seeking challenges and managing failure constructively.

Core competencies of creative expression Skills that are important for the expression of creativity in individuals. The four core competencies are: Capturing, Challenging, Broadening, and Surrounding (see separate definitions).

Creative problem solving A structured system for solving problems creativity, involving visionizing, attribute listing, problem finding, and other techniques.

Generativity Theory A formal, predictive theory of the creative process that asserts that new behaviors result from an orderly competition among previously established behaviors.

Hypnagogic state The semisleep state people experience when just falling asleep or waking up.

Managerial competencies for enhancing creativity Skills that help managers, teachers, and supervisors elicit creative

expression in other people. Eight important managerial competencies include: Encouraging the Preservation of New Ideas, Challenging Others, Encouraging the Broadening of Skills and Knowledge, Providing Diverse and Changing Physical and Social Environments, Managing Teams Appropriately, Providing Adequate and Appropriate Resources, Providing Positive Feedback, and Modeling Creativity Competencies.

Open-ended problems Problems that have an endless number of solutions. Almost all tasks and goals can be made open-ended by adding a phrase such as 'at least' to the description, as in: 'Please generate at least three names for this new product.'

Resurgence The reappearance of previously reinforced behaviors that occurs when a current behavior is no longer effective.

Shifting Allowing people to leave group or team meetings for short periods in order to work privately on idea generation.

Surrounding Surrounding oneself with diverse and changing physical and social stimuli.

Background

Exercises intended to enhance creative expression have been around since at least the 1940s, when Alex Osborn and Robert Crawford formed the first creativity development programs. In the 1950s, Osborn founded the Creative Education Foundation and the annual Creative Problem Solving Institute, and William Gordon and George Prince founded Synectics, precursors to dozens of training programs and consulting firms dedicated to enhancing creativity in both individuals and organizations. Today, many business schools have also incorporated courses on creativity and innovation into their curriculums, and thousands of companies and organizations, including the US military, feature creativity training in their training programs. Dozens of popular books, such as Julia Cameron's *The Artist's Way* and Michael Michalko's *Thinkertoys*, also promise to increase creativity. Exercises and games of various sorts play an important role in many of these efforts.

Osborn's 1953 book, *Applied Imagination*, described both the Creative Problem Solving technique, later updated by Sidney Parnes, and the now-ubiquitous practice called 'brainstorming.' Both were taught in part through exercises. In brainstorming, people work as a group to generate ideas following guidelines that increase creative output, the most important of which is to withhold judgment when someone voices an idea. Brainstorming groups strive for quantity of creative output,

deferring judgment until a later time. One can teach brainstorming by assigning tasks and problems to a group and then having them follow the guidelines. One can also show the power of the brainstorming rules by comparing the output of groups that follow the rules to groups that do not.

Although particular exercises are usually not evaluated, programs that employ exercises have been evaluated in a number of studies. In a paper published in 1972, E. Paul Torrance reviewed 142 studies that evaluated various creativity-enhancing techniques programs for children and students, many using the Osborn-Parnes Creative Problem Solving technique, concluding that 72% of them had produced positive results. In a review of additional studies published in 1987, Torrance found a success rate of 68%. More recently, Ginamarie Scott and her colleagues at the University of Oklahoma looked at 70 carefully selected training studies with both adults and children and concluded, unambiguously, that 'creativity training works.' This was confirmed in a similar study published by Hsen-Hsing Ma in 2006.

Creativity training studies tend to focus on problem solving abilities *per se*, but creative expression can also be enhanced in other ways: through play, incentive systems, altering the work environment, broadening people's knowledge, providing new resources, changing the feedback that people are given, forming and guiding teams in certain ways, and so on. Exercises can be used to teach all of these concepts.

A Scientific Framework for Understanding Creativity Exercises

Games and exercises for enhancing creativity can be organized into 12 categories suggested by Generativity Theory, a formal, predictive theory of the creative process first proposed by Robert Epstein in the 1980s.

According to this theory, which has been validated in both laboratory and applied settings, the behavior we call creative occurs as previously established behaviors (which also includes thoughts and ideas) become interconnected in various ways to produce blends and new sequences. The process of interconnection is both orderly and predictable; instantiated as a series of equations called 'transformation functions,' Generativity Theory can predict the emergence of novel performances in the laboratory moment-to-moment in time in both animals and people. According to the theory, creative behavior or ideas are especially likely to occur under circumstances that cause multiple behaviors to compete. Two situations invariably cause such competition: when behavior is ineffective and when organisms are exposed to multiple or novel stimuli.

In the laboratory setting, ineffectiveness is studied by first reinforcing behavior (say, with food if an animal is hungry, or with money if humans are being studied) and later by withholding reinforcement, a process called 'extinction.' All situations involving 'problems' are, by definition, extinction situations. Laboratory research shows that extinction affects both behavior and emotions in ways that are consistent with what typically happens when people solve problems. The primary effect of extinction is to weaken behavior: if a problem is sufficiently difficult, initial attempts to solve it fail, and ideas are rejected; in other words, behavior weakens. (If you can solve a problem quickly and easily, it's unlikely that much 'creativity' has occurred; previously established behaviors were apparently adequate for the task.) As behavior weakens, 'resurgence' takes place: other behaviors that were successful in similar situations in the past rapidly increase in probability. Now multiple behaviors (ideas, thoughts, images) are competing, setting the stage for interconnections. This dynamic process is typically felt as 'confusion'; if it continues long enough, more negative emotions are experienced, such as 'frustration.'

From this competition, both new sequences and new forms of behavior (blends) emerge in an orderly way; interconnection is the fuel of solutions to problems and the basis for all novel behavior, some of which is sometimes labeled 'creative.' (That label is applied by a community when it values the novel behavior; one can't label one's own behavior creative.)

Generativity Theory and related research suggest: (a) that virtually everyone has enormous creative potential; (b) that most people tend to express little creativity because of inhibitions created by socialization; and (c) that creative expression can be enhanced both through various environmental manipulations and by teaching people special skills (called 'creativity competencies').

Four core competencies of creativity expression flow directly from the theory: Capturing (preserving novel ideas as they occur, without first judging or editing them), Challenging (seeking challenges and managing failure constructively), Broadening (acquiring knowledge and skill well outside of

one's current areas of expertise), and Surrounding (surrounding oneself with diverse and novel physical and social stimuli). Because novel behavior occurs naturally and frequently, simply teaching people to preserve their new ideas (by jotting things down, keeping a notebook or recorder by one's bed, finding quiet places where one can listen to one's thoughts, etc.) often has a dramatic effect on creative output. Teaching people to seek challenges and to manage the negative emotions that often are produced in challenging situations sets the stage for resurgence to occur and for new ideas to emerge at a high rate. When people broaden their knowledge and skills, more diverse material is available for interconnection, and new ideas tends to be more interesting and unusual. And when people surround themselves with interesting and diverse stimuli, both social and physical, again, multiple repertoires of behavior compete with each other, increasing creative output.

The four core competencies are helpful for individuals. Eight competencies that allow managers and supervisors to enhance creativity in other people also flow from Generativity Theory and research:

1. Encouraging Capturing (encouraging people to preserve novel ideas, and providing resources that make it easy for people to capture such ideas);
2. Challenging Others (giving people difficult problems to solve and ambitious goals to reach);
3. Encouraging Broadening (providing training in areas well outside current areas of expertise);
4. Providing Diverse and Changing Physical and Social Environments (changing the work environment frequently, assembling diverse teams, and in other respects creating an interesting and stimulating environment);
5. Managing Teams Appropriately (assembling diverse teams, e.g., or 'shifting' team members out of the group periodically to work on problems on their own);
6. Providing Appropriate Feedback and Recognition (rewarding people for contributing new and valuable ideas);
7. Providing Adequate and Appropriate Resources (providing tools and supplies adequate to solving problems or generating new products or methods); and
8. Modeling the Core Competencies of Creative Expression (showing others that you, as a supervisor, practice what you preach).

Shifting people out of a team meeting to work on a problem on their own, even for a few minutes, can increase team creativity dramatically. While in the group, the presence of other people, although stimulating, also inhibits creative expression. When people shift out of a group, inhibitions are reduced, and people typically record many new ideas. When the group reassembles, people have a much larger pool of ideas with which to work. With even one brief shift (about five minutes), groups that shift tend to produce 50% more ideas than nonshifting groups.

Managers can challenge employees in many ways. One of the simplest and most effective ways is to make sure that all tasks, goals, and assignments are stated in an 'open-ended' fashion, meaning that what is requested has no set limit. Instead of asking for three new names for a product, for example, a manager can ask for *at least* three new names. Challenge can also be added to deadlines by adding phrases such as 'at the latest.'

All competencies for enhancing creative expression can be taught through games and exercises. Here, organized by competency area, are examples of such exercises.

Exercises that Boost Individual Creativity

Exercises can enhance four types of competencies that are important for creative expression in individuals, which Epstein calls the Core Competencies of Creative Expression: Capturing, Challenging, Broadening, and Surrounding.

Capturing

Exercises can quickly show people the value of capturing new ideas without judging them. Exercises can also help people learn to use a variety of materials to help them capture ideas on the fly and to identify places and times that facilitate capturing – to make use of the ‘Three Bs’ of creativity, for example: the Bed, Bath, and Bus. Some capturing exercises, such as simple daydreaming exercises, do little more than remind people that they have creative potential which they may currently not be exploiting. Studies of people who are famous for expressing creativity virtually always show that they have excellent capturing skills; they obsessively record new ideas on pads, memo recorders, napkins, or whatever is at hand.

Both Salvador Dali, the great Surrealist artist, and Thomas Edison, the most prolific inventor in history, got ideas by making deliberate use of the hypnagogic state – the semi-sleep state that everyone experiences at least twice a day. Dali would lay on a sofa, extending a spoon outward over the edge. On the floor beneath the spoon, he placed a glass plate. As he began to doze off, his hand released the spoon, and it fell to the plate and made a noise, which brought him back to full consciousness. If he had experienced interesting images during his brief hypnagogic experience, he would grab a pad and sketch. Edison got ideas for inventions by relaxing in a chair, holding steel spheres in each hand, beneath which were metal plates.

Although other competencies are important for enhancing creative expression, when people learn and practice capturing skills alone, their creative output sometimes increases by a factor of ten or more. No other competency increases creative output to such an extent.

Here are examples of relevant exercises.

Morning pages

Poet and artist Julia Cameron, author of *The Artist's Way*, teaches people to enhance their creative output by doing stream-of-consciousness writing every morning: so-called ‘Morning Pages.’ Says Cameron, “Every morning, set your clock one-half hour early; get up and write three pages of longhand, stream-of-consciousness morning writing. Do not reread these pages or allow anyone else to read them. Ideally stick these pages in a large manila envelope, or hide them somewhere. Welcome to the morning pages. They will change you.”

Capturing a daydream

In *The Big Book of Creativity Games*, Epstein describes a simple daydreaming exercise: he instructs people to close their eyes, relax, and let their minds wander for a few minutes – in other

words, to have a daydream deliberately. When done in a group setting, almost everyone reports having a daydream, and some are quite bizarre. The exercise quickly demonstrates that daydreaming can be used intentionally for creative purposes. It also empowers; that is, it reminds people that even if they don't normally express much creativity, the generative mechanisms that underlie creative expression are operating inside their heads every day.

The memory game

Another of Epstein's exercises, ‘The Memory Game,’ shows what happens when people fail to capture. Some groups work on a simple problem – say, generating names for a new running shoe – without the aid of paper or recording devices. Other groups work on the same problem and have access to paper and pencils. After 15 minutes, both groups report on their best ideas. The groups that had access to paper will often report three times as many ideas as the groups without paper. The longer the work sessions, the greater the difference in creative output between the two types of groups.

Challenging

Most programs that promise to enhance creative expression do so by improving problem-solving strategies, and all of these programs incorporate exercises of some sort. Dozens of exercises used in the venerable Creative Problem Solving training program are collected in books such as Sidney Parnes' *The Magic of the Mind* and its sequel, *Optimize the Magic of the Mind*. Popular creativity-enhancing books such as Edward de Bono's *Lateral Thinking*, Tom Wujec's *Five Star Mind*, and Roger von Oech's *A Whack on the Side of the Head* are also filled with intriguing problems, as are thousands of books of puzzles, riddles, and mathematical challenges, some of which have been around for centuries.

As noted above, the ‘problem’ is a special case of a larger class of situations in which behavior (which includes thinking) is ineffective. The only way to be effective in such situations is to do something new, or at least to do old things in a new order; hence the connection between problem solving and creativity. Thus, any tough situation in which we don't know exactly what to do is good for creativity, and so are exercises which (a) teach us to value and seek such situations, (b) teach us how to be more effective in such situations, and (c) teach us how to manage the unpleasant emotions we often feel in such situations, some of which can ‘block’ creative expression. Here are some representative examples:

The nine dots problem

Perhaps the most famous problem-solving exercise of all time, this is the exercise that gives rise to notion of ‘thinking outside the box.’ The problem solver is shown nine dots arranged in a square, three-by-three array and instructed to connect all of the dots by drawing four lines or less – without lifting his or her pen from the paper. Initially, people try to draw lines within the square, but they eventually discover (sometimes after experiencing considerable frustration) that the problem can't be solved this way. The solution involves extending lines *outside* the square. The problem appears in a puzzle book published in 1914 and may have even earlier origins.

Half of eight

This is one of dozens of exercises used in the Osborn–Parnes Creative Problem Solving program. It appears in Parnes' book, *The Magic of the Mind*, and elsewhere. When asked, "What Is Half of Eight?" most people immediately reply, "Four." An instructor then asks for more creative replies, and people soon become aware of interesting possibilities: splitting the number 8 into two zeros (with a horizontal cut), for example, or into two threes (with a vertical cut). Employing problems of this sort, a Creative Problem Solving workshop teaches people new strategies for solving problems: visionizing (focusing on dreams and visions), forcing relationships among ideas or objects, listing attributes of a situation, and so on.

Wrestling with your voice of judgment

Negative emotions associated with solving problems or expressing new ideas can be debilitating. In this exercise, from *The Creative Spirit*, by Daniel Goleman, Michael L. Ray, and Paul Kaufman, one is instructed to close one's eyes and imagine hearing a negative statement, such as "You've never had an original idea." Then one amplifies and enlarges it "using laser lights, screaming rockets, full symphony orchestras, and choruses of disapproval," until the message is so big that it looks ridiculous. The exercise derives from a powerful technique used by clinical psychologists called 'flooding.' Michalko teaches a simpler exercise called 'Tick-Tock' that also aims to eliminate harmful thinking: on the tick of an imaginary clock, one writes one's fear; on the tock, one writes a positive thought that overcomes the fear.

Steel pipe

This is from former Stanford University professor James L. Adams' book, *Conceptual Blockbusting*: "Assume that a [4-inch-long] steel pipe is imbedded in the concrete floor of a bare room as shown below. The inside diameter is 0.06" larger than the diameter of a ping-pong ball (1.50") that is resting gently at the bottom of the pipe. You are one of a group of six people in the room, along with the following objects: 100' of clothesline, a carpenter's hammer, a chisel, a box of Wheaties, a file, a wire coat hanger, a monkey wrench, and a light bulb. List as many ways you can think of (in five minutes) to get the ball out of the pipe without damaging the ball, tube, or floor."

Stone soup

This is from creativity consultant Michael Michalko's book *Thinkertoys*: After you learn about an old fable in which a beggar asks villagers to imagine that the stone in his pot can make a delicious soup, you are challenged as follows: "List as many 'what if' scenarios as you can" and then "answer the questions posed by your scenarios." This is an example of an open-ended task with virtually no boundaries. Edward de Bono describes a similar game, called "The 'Why' Technique," in *Lateral Thinking*.

Egg drop soup

Web designer Stefan Mumaw and graphic designer Wendy Lee Oldfield's book *Caffeine for the Creative Mind* includes a classic design problem, sometimes given as a challenge to school children: "Create a container for an egg that will safely keep the egg from breaking when dropped from a two-story window.

The container can be made of whatever materials you deem appropriate. Draw a sketch of the container as if you were going to show a craftsman what your idea is and how to make it. Use a dotted line to signify where the egg would be, inside of the container, and callouts to describe what the materials are and what their functions would be."

Broadening

Exercises can also be used to teach people the value of broadening their knowledge and skills. Generally speaking, the more diverse a person's knowledge, the more interesting the behavioral interconnections – and, ultimately, the creativity.

Reading archaeologically

Choreographer Twyla Tharp recommends a unique way of broadening one's knowledge in her book, *The Creative Habit*. When you read a book that refers to an earlier book – maybe even one written long, long ago – read that one next. Then repeat. She calls this a 'reading dig.' A variation on this, called 'reading fat,' involves reading books related to the one you just read, and then, in turn, books related to those.

Imaginary lives

In *The Artist's Way*, renowned poet/artist/playwright Julia Cameron recommends that you generate a list of professions you might have led in other lives. Then, each week, she suggests *living* one of them to some extent. If you imagined yourself as a bus driver, you could read a pertinent training manual, for example – or even sign up for some *real* training.

Surrounding

Exercises can also help people learn the value of surrounding themselves with interesting objects and people, as well as the value of modifying one's environment regularly.

Artist date

In *The Artist's Way*, Cameron recommends that people go out on adventurous little dates every week. One possibility: "Take five dollars and go to your local five-and-dime. Buy silly things like gold stick-'em stars, tiny dinosaurs, some postcards, sparkly sequins, glue, a kid's scissors, crayons. . . . Just for fun." Fresh environments stimulate thinking and lead to fresh ideas. Michalko recommends nature walks in his book, *Cracking Creativity*, for the same reason. An early trash compactor was invented when engineers got curious about how different animals handled their waste. Goats, it seems, compact it.

Create your own oracle

In his book, *A Whack on the Side of the Head*, creativity consultant Roger von Oech reminds us that in ancient times people consulted oracles or wise men to get new ideas or solve problems. You can create your own oracle, he says, by asking yourself a question, then generating some random information, and then interpreting that information as the answer to the question. For example, you might ask, "How can I become more creative?" and then open a book to a random page and point. I just did this and found the word 'Mexico.' Then interpret: Yes, visiting Tijuana for a few hours (I live fairly near the border) would definitely free up my thinking.

The Srtcdjgklerden Game

It's difficult to pronounce, and that's the point. In this game, from Epstein's *Big Book of Creativity Games*, people are asked to generate sentences as quickly as possible in reaction to random streams of alphabet letters called 'word ticklers.' Stick a dagger in a juggler? Sort your CDs from black to red? The possibilities are endless.

Selling a zork

In this exercise, Epstein also teaches the value of surrounding oneself, and especially one's work area, with unusual stimuli. A trainer first asks for a volunteer 'salesperson' to come to the front of the room. That person, the trainer explains, will soon have to try to sell a very unusual object to the audience for a large sum of money, explaining in detail why it's worth so much. Then the object – something absolutely bizarre that has no obvious function – is uncovered or displayed on a screen, and the fun begins. What's especially interesting in this exercise is that the salesperson virtually always has no trouble at all generating outlandish ideas almost immediately. Unusual stimuli generate unusual ideas.

Exercises That Help Managers to Enhance Creativity in Others

Exercises can also enhance eight types of competencies that help managers, teachers, and supervisors to elicit creative expression in other people, whether in small groups or large organizations.

Encouraging the Preservation of New Ideas

Just as individuals can learn the value of Capturing, managers can learn many ways to promote Capturing in an organization. They can use exercises, for example, to train people to capture their ideas. They can also create an environment in which people are simply more *likely* to capture their ideas; the employees themselves usually don't have such power. For example, a manager can equip everyone's computer with capturing software: 'new idea' boxes or icons that encourage people to record their new ideas on the fly. Managers can also provide free time for people to listen to their own thoughts and explore their ideas. Both 3M and Google are famous for allowing employees to spend part of their time every week exploring pet projects. Managers can also create physical spaces that promote capturing. At the famous Lockheed 'Skunk Works' where stealth fighters were invented, people could write on the walls, for example – a superb way both to promote capturing and to surround people with idea-generating stimuli.

Here are two pertinent exercises.

Brown paper caper

A stunning photograph in Hanley Norins' book, *Young & Rubicam Traveling Creative Workshop*, shows thousands of words and designs written on wide brown paper lining a 30-foot-long wall. To generate new ideas for a project, he often has people capture all of their thoughts on a 'problem-solving mural' of this sort. You can show people the benefit of wall writing by creating a large writing surface on a wall, giving

them a difficult problem to solve, and then having people use markers to record their ideas one at a time on the surface. With each new contribution, the group will be able to see how the ideas grow and develop over time. In some companies, erasable white boards are permanent fixtures on a great deal of wall space.

The anonymous suggestion game

This exercise, from *The Big Book of Creativity Games*, demonstrates a way of dramatically increasing the number of contributions people make to suggestion boxes in an organization. People are asked to suggest ways of solving a sensitive problem, such as how to reduce street crime. Some are given forms on which they must reveal detailed information about themselves; others are given forms that allow them to remain anonymous. The latter group will typically produce twice as many suggestions as the former. Given this outcome, people are asked to redesign their organization's present suggestion system. In an ideal system, people can submit suggestions anonymously, but the suggestions are coded in a way that allows people to claim them (and perhaps be rewarded for them) if they're later adopted by the organization.

Challenging Others

Managers can increase the creative output of employees by giving them difficult assignments, and all assignments, including easy ones, will produce more creativity if they are open-ended. When managers (or teachers or supervisors of any sort) are being trained or retrained, exercises can be used to teach these concepts. Perhaps equally important, managers also need to help employees deal with the frustration that often accompanies challenge. They can do this by teaching stress-management skills and by providing resources that help people manage stress. These concepts can also be taught with the help of exercises.

The lola cola game

This exercise, from *The Big Book of Creativity Games*, teaches the value of open-ended assignments. Teams are divided into two types, those who receive traditional closed instructions and those who receive open-ended instructions. Written instructions are distributed. The closed instruction is to invent three names for a new cola product; the open-ended instruction is to invent *at least* three new cola names. After ten minutes or so, the groups report on their creations. Typically, the open-ended groups will have devised at least twice as many names as the closed instruction groups. The difference in the instructions is then revealed, and a discussion follows. The critical question is: What if *all* assignments were always open ended? How much more would people produce and create?

Building bridges

Bridge-building exercises of various sorts are commonly used for team building and management training. In a typical scenario, teams are given equal quantities of newspaper and instructed to build a bridge between two tables. Sometimes, each team is divided in half, and each subgroup must build only half a bridge; the two halves must ultimately connect to each other. The first team to build a successful bridge wins the

exercise, or bridges can be judged according to how much weight they can support or other criteria. The exercise can then be repeated with the tables moved much farther apart, increasing the difficulty of the task. This kind of exercise not only builds teamwork, it also shows the power that challenge has to boost creativity.

The ultimate challenge game

In this exercise, also from Epstein's *Big Book of Creativity Games*, people are asked to propose solutions to extreme challenges, such as, "Give me at least three ways of flying people from here to the moon for the price of a New York subway token" or "Give me at least three methods for making birds swim and fish fly." No matter how difficult the problem, people generate solutions, and if the challenge is made open-ended, they will generate many solutions. The game can easily be adapted for the business environment: people can be asked to spend a few minutes each day generating solutions to ultimate challenges related to a particular business or industry.

The beastly boss game

In this exercise, from Epstein's *The Big Book of Stress Relief Games*, people learn the value of performing relaxation exercises when they're under stress. People divide into pairs and role play situations in which a Beastly Boss makes unreasonable demands of an Exemplary Employee. In some role plays, the employee subtly performs simple breathing exercises in order to stay relaxed. Without such exercises, the conversations often escalate; with the exercises, they do not. Exercises of this sort can be used to teach both managers and employees the value of stress-management training.

Encouraging the Broadening of Knowledge and Skills

Managers can teach people the value of broadening, and they can also use an organization's resources to make sure that people acquire new knowledge and skills. Some companies groom people for high management positions by having them work in different departments in the organization; the broad knowledge they acquire not only gives them a more informed picture of the organization, it also gives them the raw material they need to be more creative.

The experts game

Used in a group setting, this exercise, from Epstein's *Big Book of Creativity Games*, teaches the value of broadening. People from the audience who are experts on something very obscure (and there are always such people in every audience) are asked to give five minute, impromptu lectures about their unique knowledge – about hooking rugs, perhaps, or color-balancing a picture using Photoshop, or designing a nuclear reactor. Then everyone is asked to invent at least three new products based on the three kinds of new knowledge they just acquired. A colorful carpet with molecular designs, perhaps?

The amazing magazine game

Also from *The Big Book of Creativity Games*, in this exercise, individuals or teams are supplied with small stacks of widely different kinds of magazines. They're given time to read articles from each of the magazines and then asked to solve a

challenging problem using the new knowledge they've acquired. They can also be asked to design new products or services, or even to write a poem or story based on their new knowledge. A discussion about the value of broad training follows.

Providing Diverse and Stimulating Physical and Social Environments

Managers have enormous power to enhance creative expression through manipulation of the physical and social work environments. Diverse teams typically produce more and fresher ideas than homogenous teams. Interesting workspaces produce more and better ideas than dull ones. Most important of all, changing environments produce more and better ideas than static ones. Moving people or desks or posters around is unsettling to people, and that's the whole idea. In team meetings, people can temporarily become quite different people through role playing.

Here are exercises that demonstrate such concepts.

Six thinking hats

Creativity consultant Edward de Bono's exercise, 'Six Thinking Hats,' described in his book by that title, is a widely used role-playing technique that helps teams solve problems and generate ideas. It involves having people imagine wearing, and sometimes removing, each of six different hats that signal that one is to play a specific role in the discussion: the white hat signals that one is neutral and objective, the red hat that one is angry, the black hat that one is negative and gloomy, the yellow hat that one is positive and sunny, the green hat that one is creative, and the blue hat that one is cool and concerned with control issues. As a discussion proceeds, the team leader can ask people to remove a hat or to switch hats. The technique allows people to examine an issue from many angles, and it also brings out different sides and capabilities of people that otherwise might never appear. The value of the Six Hats technique can be demonstrated by having two sets of teams work on the same problem; one set uses the technique and the other does not. The work product of the two teams can then be compared. If time allows, the two sets of teams can then swap methods and take on a new problem.

Picture portfolios

This is an exercise from Michalko's *Cracking Creativity* which uses both pictures and other people's ideas as stimuli to help improve creative expression: "1. Read a problem statement aloud and ask the group to verbally brainstorm solutions. 2. Give each group member a folder containing eight to ten pictures that are not related to the problem area. 3. Instruct them to examine each picture and silently write down any new ideas or modifications of previous ideas suggested by the pictures. 4. After a designated time period, ask the group members to read their ideas aloud. 5. As each idea is read, ask the group to discuss it and try to develop more new ideas or modifications."

Airplanes

Also from *Cracking Creativity*, this exercise gives people a fun way to build on other people's ideas: "Have each participant

construct a paper airplane. Each participant writes down an idea on the airplane and sends it flying to another participant. Upon reading what's been written on the airplane, he or she writes down a modification or improvement of that idea, or an entirely fresh possibility, and then sends it flying to someone else. Continue the exercise for twenty minutes and then collect and categorize the ideas."

Managing Teams Appropriately

As noted above, one of the best ways to enhance team creativity is to ensure from the outset that the team membership is diverse. Michael Michalko suggests a dramatic way of assembling diverse teams: occasionally announcing 'open meetings' that anyone in an organization can attend, from custodians to accountants to CEOs. Once a team has been assembled, surrounding techniques such as Six Thinking Hats can improve process and output. Other rule systems, such as brainstorming, can also be helpful. Finally, since group settings will tend to inhibit creative expression in many people, team output can be greatly increased by having people shift out of a group one or more times to generate ideas on their own. Here are exercises that teach such concepts.

Brainstorming

First proposed by advertising executive Alex Osborn in 1938, brainstorming is the most widely used technique for generating new ideas in teams. Team members are instructed to follow simple rules to keep ideas flowing: express ideas freely; withhold making any kind of judgment, especially a negative one, about people's ideas; the team is seeking to generate a large *quantity* of ideas; quality concerns will come later. The power of this technique can be demonstrated by dividing people into teams that brainstorm and teams that do not. Then all of the teams work on the same problem for the same amount of time, after which results are compared. Typically, brainstorming groups will produce far more ideas than non-brainstorming groups.

The shifting game

Two sets of teams, Shifters and Togethers, are given the same naming task or a problem to solve. Over the next 15 minutes, the Togethers remain together to work on the task. Shifters team members spend five minutes together, then split up and work on the problem on their own for five minutes, and then reassemble for the remainder of the 15 minutes. Even though time has been wasted moving around, the Shifters will typically produce 50–100% more names or solutions than the Togethers. Although groups are stimulating, they also inhibit creative expression in many people, in part because people are afraid of receiving negative feedback in the group, but also because of criticism people have received throughout their lives. The shift makes it more likely that people will capture their own ideas. When the group reassembles, people usually pool their many ideas.

Providing Adequate and Appropriate Resources

It's difficult – sometimes even impossible – to express creativity unless you have access to adequate and appropriate resources.

If your job is to develop a new glue or medication, you'll only get so far without a well-equipped chemistry lab. Simple exercises can help managers and teachers see how this concept works in action. Here is an example:

Sticky business

In this exercise from *The Big Book of Creativity Games*, two sets of teams are supplied with equal amounts of wooden sticks or pieces of colored construction paper. One set of teams is also supplied with a full bottle of glue. The other set of teams are given glue bottles that are nearly empty. The task for all teams is to create at least one beautiful work of art. After 15 minutes, participants who have been appointed judges rate the creativeness of the artistic creations and also count the number that each team has produced. Teams lacking glue generally fare poorly in this exercise.

Providing Positive Feedback

Scientists sometimes debate about the value that positive feedback has for creative expression. Under some conditions with children, if creative expression is rewarded and then later rewards are no longer available for expressing creativity, the rate of creative expression may drop. That said, there is strong evidence that rewards, properly used as incentives, can greatly increase creative output. Adults routinely make discoveries or produce new books, works of art, musical compositions, products, or services in order to win awards, get praise, or earn money. What's more, even the slightest negative reaction to a new idea – say, a raised eyebrow – can have a devastating effect on creative expression, in some cases leading to blocks that can last for years.

In an organization, incentive and evaluation systems that recognize and reward creative contributions can help keep creativity flowing. Managers also need to use care when giving people feedback on their ideas. Here is a pertinent exercise from *The Big Book of Creativity Games*.

The tiny little nod game

This game shows that even very subtle feedback can have a big effect on behavior. People are divided into pairs in which one person chooses to be a speaker and the other a listener. The listener then writes down a target sentence that he or she wants the speaker to say. Listeners are told that they can't communicate with speakers in any way except to nod their heads very slightly up and down (in other words, signifying 'yes' but never 'no'). Participants are told that they have five minutes in which to try to reach the target sentence. Then speakers are told to start talking. Listeners are instructed to raise their hands when they hear the target sentence or something close to it. Remarkably, within the allotted time, at least a third of the pairs will reach the goal. If additional time is allotted, more pairs will reach the target. The speaker and listener can then switch roles.

Modeling Creativity Competencies

One of the best ways for a manager to stimulate creative expression in other people is to model the core competencies. People tend to imitate the behavior of others, especially the behavior or authority figures. Here is an exercise from *The Big Book of Creativity Games* that makes the point:

The green-and-yellow game

The instructor asks an audience to suggest names for two new soft drinks, one green and one yellow. As people raise their hands and make their suggestions, the instructor makes two lists on a blackboard or flipchart and also asks people to take notes. When suggestions for green drinks are made, the instructor records them accurately, but he or she records suggestions for yellow drinks less accurately, in abbreviated form, or not at all. After a fairly large number of suggestions have been made, the instructor erases the board or flips the page and then gets a rough count of how many green and yellow names people recorded. These numbers are compared to an accurate count that a designated person has made secretly. Because people tend to imitate authority figures, participants' notes will under-report names for the yellow drink. In this instance, people were imitating the instructor's uneven capturing skills. A discussion about the importance of being a good role model follows.

See also: Problem Solving.

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Expertise

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Glossary

Deliberate practice Structured activity, often designed by teachers or coaches, with the explicit goal of increasing an individual's current level of performance. In contrast to other activities such as work and play, it requires the generation of specific goals for improvement and the monitoring of various aspects of performance. Furthermore, deliberate practice involves trying to exceed one's previous limit which requires full concentration and effort.

Consequently, it is only possible to engage in these activities for a limited amount of time until rest and recuperation are needed.

Domain Area of behavior with an organized set of activities where experts and an accumulated body of shared (teachable) knowledge are recognized. The most well-known disciplines or domains are those of the Arts and Sciences, Medicine, Sports, and Games.

Expert performer An individual who, by objective standards and over time, shows a superior and reproducible performance in representative (typical) activities of a domain. In contrast to the everyday usage of the term expert, which is applied freely to any specialized individual, expert performers must display consistent superior performance in their respective domains.

Innate talent Innate capacities that many believe are necessary for attaining the highest levels of performance in a specific domain. It is well known that most necessary component skills and attributes of expert performers require extended training for their acquisition – with the exception of talent. Talent is thought to be directly determined by genes, and it cannot be modified or improved through training. The associated abilities develop naturally without the need for any specific practice. Consequently, society tries to identify talented individuals during early phases of training and provide them with the best education and encouragement for the extended road to expert performance. The terms 'talent' or 'giftedness' are used in the text, despite the lack of firm scientific evidence supporting these constructs.

Novice A person who has received all the necessary knowledge and instruction to be able to perform independently in a domain. Novices represent the lowest level of attained skill for individuals who can still perform the basic tasks of the domain. They are therefore often used as a reference group for comparisons with the highest level performers in studies of expert–novice differences.

Expertise refers to the cognitive, perceptual-motor and physiological mechanisms that allow experts to consistently attain superior levels of performance in routine and new challenging situations and/or produce new products valued in the domain of expertise. Webster's dictionary defines an expert as "one who has acquired special skill in or knowledge of a particular subject through professional training and practical experience." Accordingly, typical experts are individuals such as medical doctors, accountants, teachers and scientists, who have been certified as professionals after extended training and have then accumulated experience in their specialty. More recently, the term expert has been expanded to describe any highly skilled performer who exhibits superior achievement after instruction and extended experience in a field. Among those fields, which are called domains, are the arts (e.g., music, painting, and writing), sports (e.g., swimming, running, and golf), games (e.g., chess, Scrabble, crossword puzzles, Othello, and bridge), and professional activities (e.g., medicine, nursing, and business). Because we assume that the mechanisms mediating performance of experts in different domains share certain characteristics, we use a single concept, namely that of expertise, for different domains. Also, we expect expertise to require domain-related experience and thus develop in a similar manner across

domains. As the level of performance and achievements increase we expect that the quality and value of products and the adaptation to situational demands will increase and reflect higher levels of creativity.

Overview: Expertise and Expert Performance

The main task for researchers of expertise is to explain how some individuals attain the highest levels of achievement in a domain, and why there are only so few who reach these superior levels. In order to be able to attain very high (expert) levels of performance in domains of expertise, both nature and nurture must be involved. Experts' performances often look effortless, and their most refined and insightful behavior is generated rapidly and naturally rather than being the result of prolonged deliberation. One is thus led to believe that experts excel based on general basic characteristics, such as intelligence, memory, speed and flexibility. It has traditionally been assumed that those general characteristics are impossible to train and thus are determined to a large degree by genetic factors (nature). Everyone agrees, however, that experts must acquire at least some necessary domain-specific knowledge and

skill (nurture). The relative importance of nature versus nurture for expert achievement has been discussed and argued since the origin of our civilization. A couple of questions have been the primary focus. First, how does expert achievement develop and what is the role of instruction and training? Second, are people born with certain characteristics to attain expert performance or are those characteristics acquired as a consequence of training? We will briefly review the most important conceptions of expertise spanning the last centuries, then turn to a summary of our current knowledge, and finally outline the implications and connections of expert performance for genius and major creative innovations.

The Traditional Account for Expertise, Expert Performance, and Exceptional Achievement: Innate Talent

Beginnings in the Nineteenth Century: Sir Francis Galton

In his pioneering studies of excellence in nineteenth century England, Sir Francis Galton found that a very large number of the most valued achievements were made by members of a small number of eminent families. Galton found that as the genetic similarity between relatives decreased, the likelihood that individuals had outstanding reputations also was reduced. To explain how individuals from these eminent families could succeed in such diverse professions as politics, literature and science, Galton claimed that instruction and training were beneficial, and associated with large initial improvements of performance. However, with further experience the associated improvements in performance became increasingly smaller and eventually a rather fixed upper bound for performance was attained. Galton thought that the upper bound on individuals' performance was limited by their respective basic capacities which could not be modified through training and experience. The rare occurrence of expert performance could thus be explained by the small number of individuals engaged in the domain who were genetically endowed with superior basic capacities critical to the domain of expertise. Consequently, Galton and many other contemporary psychologists and educators developed psychometric tests to measure basic capacities of memory, perception and thinking. In those tests the influence of knowledge and prior experience was minimized. Through extensive testing of children and adolescents, investigators hoped to identify innately talented individuals who, given the necessary resources of training and support, were most likely to achieve high levels of performance.

Importance of Innate Basic Capacities Overrated?

Today, over a century later, we can safely say that past efforts to measure individual differences in basic capacities did not succeed in predicting future expert performance or even identifying adult experts. For example, when athletes or other experts are tested in the laboratory on how fast they can respond to the onset of a light (simple reaction time), they are not systematically faster than other subjects. The superior speed of a tennis player in returning a fast tennis serve must thus reflect an acquired ability to respond rapidly in representative situations rather than a general superiority of speed of neural impulses.

Similarly, chess experts can recall nearly all the 24 chess pieces in a typical chess arrangement after a brief exposure, whereas beginners in chess can only recall around four pieces. Yet, if the chess pieces have been randomly arranged, then the advantage of the experts over beginners is dramatically reduced to a few pieces. Both the chess experts' and athletes' superior abilities are primarily limited to their domain of expertise and therefore do not reflect basic capacities measured in the laboratory.

In recent reviews, the major differences between experts and less proficient individuals were found to nearly always reflect specific adaptations acquired by the experts during their lengthy training. This holds true for many anatomical and physiological characteristics of athletes such as the size of their muscles and bones and the flexibility of joints; and for the increased range of mobility of the limbs in ballet dancers and musicians. Some of these attributes, such as structural changes in the brains of musicians are correlated with the length or early onset of training. Other adaptations – for example the increased thickness of the bones of the playing arm (but not the other arm) of tennis players, or the optimization of oxygen absorption of runners only at certain levels of running intensity – are so specific that (self) selection of individuals in those domains appears highly unlikely. Finally, most physiological adaptations have been shown to revert back to normal values once training was stopped or dramatically reduced at the end of athletes' active career, which is clearly an indication of their acquired nature. However, at least in one instance, namely height, we know for certain that genetic factors independent of experience and training can play an important role for the attainment of expert performance in domains, where more height constitutes either an advantage (e.g., basketball) or a disadvantage (e.g., gymnastics).

The incidence of expert achievement in some famous families, such as the Bach family with many famous musicians, is frequently cited as proof for the high heritability of special talents. However, recent reviews of this evidence have questioned such claims. Instead, the early start of instruction of children initiated by domain-competent parents and access to networks and specialized training seem to offer sensible alternative accounts. Because expert performers are so rare, it is very difficult to conduct rigorous studies of heritability. So far, the small number of published studies on experts (i.e., Olympic athletes and musicians) has been unable to document any significant heritability of expert levels of performance. Heritability studies rely mainly on data from individuals who have shared the same environment during upbringing (adopted children), and from those who share genetic material (identical twins, fraternal twins, or siblings). Unfortunately, those individuals are surprisingly underrepresented in the expert population, making estimation of heritability of expert performance extremely difficult.

The Alternative Account: Expertise as Acquired Knowledge and Skill

Acquiring and Organizing Knowledge for Use in a Given Domain

One of the most significant advances in our understanding of expert performance resulted from a direct comparison of the thought processes of experts and less accomplished

individuals. In the 1940s researcher Adrian de Groot gave a pioneering account of the thought processes that allowed world-class chess players to consistently find better chess moves than less skilled players. He instructed chess players of each group to think aloud while they selected their next move for a given chess position. The transcriptions of these reports, so called think-aloud protocols, revealed that all chess players were quickly retrieving promising moves from memory while examining the organization and structure of the presented chess position. Then, during the process of evaluating these potential moves by searching and planning, even better moves were often discovered. Neither de Groot nor other researchers found evidence that elite players were more intelligent or that their speed of processing tasks unrelated to chess differed from those of less skilled chess players. The primary difference between the chess players was that the world-class players were superior in evaluating and reasoning about possible chess moves and generating corresponding moves.

According to authors Herbert Simon and William Chase, who extended de Groot's work, expertise is an extreme case of acquired skill. Their view is thus in agreement with general theories of skill acquisition in which knowledge is first acquired and then organized into adequate procedures and actions. With continued practice, individuals become increasingly able to access more appropriate chess moves automatically and speedily through pattern-based retrieval. By recognizing complex configurations of chess pieces, Simon and Chase argued that an expert can retrieve good moves from his memory of related chess games. Their theory was also able to explain the chess experts' superior memory for briefly presented chess positions. Also, the availability of stored complex chess patterns could explain why experts recalled much more pieces from presented positions for chess games than less skilled chess players. However, randomly rearranged configurations reduced the advantage of the experts over the less skilled players to a few pieces, because the random configurations would not match the experts' body of already stored patterns.

Highly organized knowledge was also proposed to be a key factor in expertise involving more traditional, academic activities, such as solving textbook problems in physics. When physics experts (professors) read through a physics problem, they immediately retrieve a solution plan as part of their normal comprehension. In contrast, nonexperts (novices such as beginning college students) typically look for the question at the end of the problem first and then retrieve formulas – one by one – and compute intermediate results by working 'backwards' from the requested answer. As one would expect, physics experts not only had more knowledge than novices, but as researchers Micheline Chi and her colleagues found, they also had organized it around relevant theoretical principles of physics. This allowed the experts to retrieve plans for solving the problem directly as part of their understanding of it. In contrast, the physics knowledge of the novices was poorly integrated and based on superficial appearance rather than deeper concepts. More generally, the superior ability of experts to reason and solve problems appears to be specific to material related to their domain of expertise. For example, studies have shown that experts in chemistry and social science lacked the special knowledge and strategies to successfully analyze a problem in political science; experts in experimental research were

found to be able to design experiments of superior quality only within their particular area of research specialty.

All these results support the general notion that experts' superiority is closely linked to their superior accumulation of knowledge. Could one use this knowledge to build computer programs, so-called expert systems, which almost behave like a human expert? A number of researchers have indeed taken this knowledge-based approach to expertise by designing methods to elicit the knowledge of experts, and then describing the structure and organization of their knowledge in specific domains. However, the massive amount of relevant knowledge and methodological problems of extracting knowledge and implementing it in computer models present major obstacles to the expert-systems approach to expertise.

Recent Challenges to the Knowledge-Based View of Expertise

Once psychologists had become interested in expertise, they went out and searched for domain experts. To their amazement, some experts with lengthy education and extended experience did not exhibit a performance superior to that of less experienced individuals or even novices. For example, professional stockbrokers were not found to be consistently superior in selecting investments when compared to random selection of stocks from investment indexes. Similarly, psychological therapists with a Ph.D. and many years of clinical experience were not more successful at helping clients than less experienced therapists with much less advanced training. The most consistent dissociation between level of expertise (indicated by the amount of schooling and experience) and performance has been demonstrated in many types of expert judgment, especially in medicine and nursing.

With experience, individuals generally increase their performance for a limited time until they have reached an acceptable level of performance. Further improvements beyond this point are unpredictable. For domains such as medicine, nursing, computer programming, auditing and sports, the number of years of work experience has been repeatedly shown to be a poor predictor of attained performance. Thus, it cannot be taken for granted that all highly experienced and knowledgeable individuals (experts) will actually exhibit superior performance. For scientific purposes, objective evidence for their superior performance is therefore indispensable.

Identifying Experts' Superior Performance

How do we establish superior performance, if mere social recognition does not always yield scientifically reliable evidence for a person's expertise? If we assume that expertise consists of reliable superior performance in a domain, then the first step is to ensure objectively that all the studied experts actually exhibit this performance under controlled conditions. By defining expertise as a reproducible performance which is superior to that of most other individuals in the domain, it becomes an observable empirical phenomenon that can be measured independent of any theoretical framework. It now becomes possible to analyze the phenomenon experimentally and compare alternative theories of its structure and acquisition. For example, we can try to find out whether or to what degree the performance requires innate talent or if it can be

explained with skills acquired through extended experience and training.

Objectively measuring performance of individuals is difficult, and most domains have developed and refined relatively standardized methods for assessing the level of achievement. Virtually every domain focuses on independent and reproducible performance of participants in the domain. In the simplest case, different performers perform the same task, such as athletes running 100 yards during a competition, and the performer with best performance for an event wins. In other domains, such as chess and tennis, the outcomes of many pair-wise competitions allow to compute a ranking of all the advanced performers in the domain. In the arts, sciences, and some sport events, a panel of experts or judges evaluates and agrees on the quality of individual performances or specific achievements. Those achievements can be artifacts, such as paintings, compositions, recordings, books or articles that are ultimately recognized as major creative contributions and innovations. In sum, the evidence from the measurement of expert performance shows a general superiority of experts that can be consistently reproduced under different conditions. Next we will discuss findings regarding the importance of experience and practice for attaining consistently superior levels of performance.

Need for Extended Domain-Specific Experience to Reach High Levels of Performance

Recent reviews show that long-term engagement in activities of the domain is absolutely necessary to attain expert performance. When the skill development is studied over longer periods of time as in longitudinal studies (see Figure 1), we find that there are no sudden increases in performance from one point of time to the next. For example, even child prodigies in chess show a gradual yet steady increase of their performance in adult chess tournaments over time. Also, expert performers continue to improve their performance long into adulthood. They typically reach the highest (peak) performance of their career at ages from the mid to late 1920s for many vigorous sports and from the mid to late 1930s and 1940s for the arts and sciences. The extended development

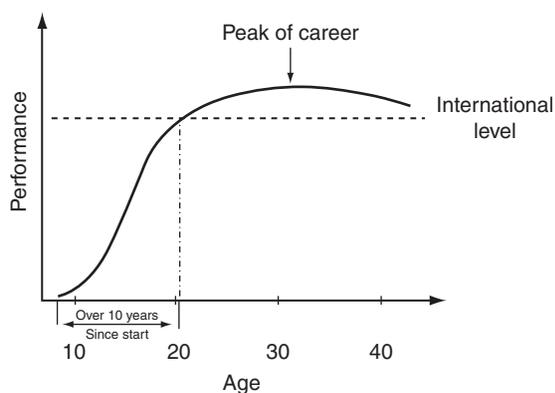


Figure 1 An illustration of the general performance trajectory of elite chess players as a function of age. The international level, which is attained at around ten years of involvement in the domain, is indicated by the horizontal dashed line.

past physical maturity, illustrated in Figure 1, shows that experience is necessary for improving performance.

Finally, the most compelling evidence for the necessity of extended experience is how long it takes even the most talented individuals to reach an international level after their start of engagement in the domain (see Figure 1). In their influential theory of chess expertise mentioned earlier Simon and Chase proposed the 'ten-year rule,' because they observed that no modern chess master had ever reached the international level in less than around ten years of playing. Although there are now several recent exceptions to that rule for young chess players, the fact remains that everyone needs well over five years and nearly everyone more than ten years of concentrated training before reaching the international level in chess. Results from domains of expertise other than chess, such as music composition and a wide range of sports, science and arts, are consistent with this modified ten year rule. However, the vast majority of individuals who reach such high levels take considerably longer. For example, winners of piano competitions have typically spent over 20 years of concentrated training. In sum, the necessity of active engagement in domain-related activities in order to improve performance in a domain of expertise is well established.

Mere Experience is Not Enough: The Role of Deliberate Practice and Teachers

When individuals start to engage regularly in a leisure activity, such as playing tennis or golf, or begin to work in a job/profession after finishing school, they initially go through a limited period of relatively rapid improvements. During this time obvious mistakes are corrected. Once they reach a satisfactory level of performance further increases are usually not noticeable. Most of us have experienced this phenomenon of a stable level of performance in spite of long-term active engagement in a domain. Consistent with this cessation of improvement, the length of experience in the domain has been found to be, at best, a weak predictor of current level of performance in a wide range of domains, such as sports, medical diagnosis, psychotherapy, and accounting. If additional experience does not automatically change individuals' behavior, what does?

When our actions and activities run smoothly, the structure of performance becomes habitual and thus remains essentially unchanged. Even if mistakes occur, such as when a tennis player misses a back-hand volley during a game, the other players are not willing to stop the game and give the player chances to train on similar shots. Moreover, this shot is so rare, that the next encounter with a similar shot may well occur unexpectedly and only after hours of subsequent play. Yet, the same performance could easily be improved by specially designed activities. For example, a tennis player could hit many consecutive back-hand volleys under the supervision of a tennis coach, who could create back-hand volleys of suitable difficulty. When first learning to master the basic stroke, the student would benefit from simple training situations. Later, the trainer could challenge the tennis player with less predictable and more difficult shots that are embedded in a representative game context. Optimal training involves exactly this design and presentation of situations that challenge the trainee. But at the same time, the trainee has to be able to master the

challenge with full concentration and/or repetitions. 'Deliberate practice' is the term that Anders Ericsson and colleagues have coined for such training activities that are designed by a teacher (or even the skilled learner) solely for the purpose of improving an individual's performance. Contrary to what one might think, active participants in domains rarely engage in deliberate practice. Although they recognize that engaging in this type of training would improve their performance, they also find it so much more effortful and less enjoyable than regular recreation – that its costs outweigh its benefits. Engaging in a domain activity is usually motivated by its inherent enjoyment (play) or external rewards (work). Yet these activities lack essential prerequisites for efficient improvement which deliberate practice offers, including training goals, feedback and opportunities for gradual improvement through repetition. Active engagement in a domain does not invariably lead to improvement of performance once some initial acceptable level has been attained.

It is well established that mere engagement in activities of the domain is necessary but by itself not sufficient for attainment of very high (expert) levels of performance. In many domains, promising individuals are supervised by a teacher who instructs them and designs their practice from a very young age. Benjamin Bloom and his colleagues found out through interviews with international level performers in mathematics, bio-chemistry, music, sculpture, swimming, and tennis that they had studied with excellent (master) teachers. In fact, many of these performers or their families had even relocated to be close to a desired teacher or an excellent training environment. Virtually all of them had chosen teachers who either were international level experts themselves or had successfully trained students to reach that level.

Why is it nearly impossible for individuals to guide themselves to expert levels of performance without the help of teachers? Moreover, why does the level of excellence of teachers appear to be so important? Whereas the general cognitive development in children is surprisingly invariant across very different environments and cultures, the development of expertise in domains of expertise, such as music, sports and science, shows large differences across varying cultures and historical times. One of the primary reasons is that domains of expertise have over time extracted and accumulated a body of organized experience in the form of knowledge and produced artifacts. This body of externalized, written-down, and codified experience can be shared with subsequent generations through teachers, books, and other media. It is no longer necessary for each individual to rediscover pieces of knowledge and methods for doing things, and individuals are thereby able not simply to match but to surpass the level attained by pioneering predecessors. In the thirteenth century, for example, Roger Bacon argued that it would be impossible to master mathematics in less than 30 to 40 years by the contemporary method of learning through self-study; Bacon was talking about a material roughly equivalent to the mathematics which is today taught in well-organized and accessible form in high schools everywhere.

The necessary role of teachers in mastering any of the arts and sciences becomes apparent when one considers that the accumulation of knowledge and achievements is based on specific shared concepts, symbolic systems, technology (in a

very broad sense, e.g., instruments, equipment, materials), and theories with efficiently organized knowledge. Generally, we take the increases in level of expert performance over historical time in science and sports for granted. Given the large changes in technology in these domains, it is difficult to make inferences about the actual changes in skill. Yet, in domains with less changing technology such as music performance on the piano or the violin, today's performers readily master music that was, by the best musicians in the eighteenth and nineteenth centuries, initially considered unplayable. Similarly, in many sports with minimal equipment, such as running or swimming, the highest level of performance attained early in this century is now common place and matched by serious amateurs.

In all major domains there has also been an accumulation of effective methods for teaching the growing body of knowledge and skills. By going through the sequences of training tasks that teachers and coaches have developed over the last centuries, students eventually perform more complex tasks than they thought they would be able to master. Unlike the beginners themselves, the teacher can foresee future skill demands. They know with what method and to what degree of mastery the simpler tasks have to be learned to serve as a solid foundation for more complex future skills. If the simpler skills are not acquired properly, the student might have to completely relearn the fundamental skills. The core assumption of deliberate practice is that expert performance is acquired gradually and that effective improvement of students' performance depends on the teachers' ability to isolate a sequence of simple training tasks that the student can successfully master by repetition with feedback and instruction. As mentioned earlier, the individual training tasks have to be difficult enough to lie slightly outside the students' current range of skills, so that the students concentrate on critical aspects and gradually refine their performance through repetition in response to feedback. This requirement of focused attention to individual task components differentiates deliberate practice from both mindless drill and playful engagement. In the best of cases these latter two activities would strengthen the current structure of the performance but not change it.

In many domains, promising children start training with teachers at very young ages. Because of the requirement of sustained concentration, the duration of training is initially quite short – typically no more than around 15 to 20 minutes per day. This leaves enough time for many other more playful but still domain-related activities. Many parents supervise their children's practice by helping them to concentrate during practice, by establishing regular practice patterns, and by encouraging them. With increasing age, domain-related activities, especially deliberate practice, occupy more and more room in the daily lives of future expert performers; by the end of adolescence the commitment to the domain is essentially full time.

Using diaries and other methods to study how expert musicians spent their daily lives, Ericsson and colleagues demonstrated the importance of deliberate practice for attaining expert performance. They investigated three groups of experts differing in their level of music performance. Although all experts from the three groups spent about the same overall amount of time with music-related activities each day, the

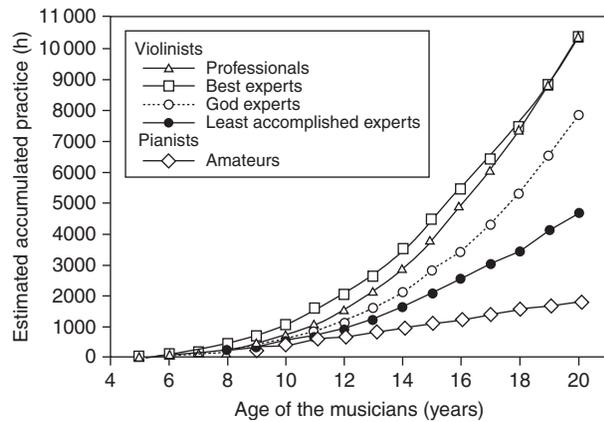


Figure 2 Estimated amount of time for solitary practice as a function of age for the middle-aged *professional* violinists (triangles), the *best expert* violinists (squares), the *good expert* violinists (empty circles), the *least accomplished expert* violinists (filled circles) and *amateur* pianists (diamonds). Adapted from Ericsson KA, Krampe RTh, and Tesch-Römer C (1993) The role of deliberate practice in the acquisition of expert performance. *Psychological Review* 100(3): 379 and 384. Copyright 1993 by American Psychological Association.

better musicians spent more time in deliberate practice; the top two groups spent around 4 hours every day, including weekends, in solitary practice. Based on retrospective estimates of past practice times, the researchers calculated the number of hours of deliberate practice accumulated by the different groups of musicians (see Figure 2). By age 20, the best musicians had spent over 10 000 hours of practice, which was 2500 and 5000 hours more than the two less accomplished groups of expert musicians; and 8000 hours more than typical amateur pianists of the same age. A number of studies in chess, sports, and music have confirmed the relationship between performance and amount/quality of deliberate practice. The broad range of known evidence suggests that individual differences in giftedness or talent can be attributed to differences in practice history, rather than innate differences in talent, especially among children. For example, John Sloboda and his colleagues found that higher achieving music students who showed faster improvements spent more time practicing each week than lower achieving students.

Some critics of the benefits of practice incorrectly equate practice with mere drilling to attain rapid and effortless automaticity. However, the next section will show that developing expert performance results in acquisition of complex mental mechanisms. Experts rely on these mechanisms to evaluate, reason, and improve planning, and also to continue learning without a teacher, essentially becoming their own teachers.

The Structure of Expert Performance

The development of performance of most active individuals in the domain is often arrested once an acceptable level of performance has been reached. These individuals want to achieve effortless performance, similar to how they master most everyday activities, such as driving a car or typing. In contrast, aspiring expert performers want to improve important aspects of their

performance with deliberate practice and continue to do so for years and decades. The key challenge for these performers is thus to avoid a stagnation in their development and instead acquire mental mechanisms that can support continued learning and improvement. What these cognitive mechanisms are and how they mediate performance will be explained in the next two sections.

Cognitive Mechanisms that Mediate Superior Performance

By giving experts representative tasks that capture the essence of the expertise in their domains, it is possible to reproduce their superior performance in the laboratory. Figure 3 gives some examples of tasks for which experts' performance in the laboratory would correspond closely to real-life measures of performance used in their domain. In laboratory experiments we can instruct the experts to think aloud while they perform a certain task or give a retrospective report immediately afterwards. Reviews by Ericsson and Walter Kintsch show that in a wide range of domains experts' think-aloud protocols reveal precisely how their superior performance is mediated by preparation, planning, reasoning, and evaluation. The first example in Figure 3 illustrates de Groot's procedure where different chess players are asked to select the best move to a set of unfamiliar positions from published games of elite players. By presenting medical doctors with descriptions of a patient's symptoms and asking for a diagnosis, one can similarly study medical doctors' expertise. In both above examples the correct solutions are known to the researcher: We know what move the best chess computer programs would make (these programs are far better than any human player), and we know what disease the patient was eventually diagnosed to have, sometimes from autopsies or advanced tests. The second example in Figure 3 illustrates how to reproduce superior typing performance in a controlled situation by instructing every typist to copy the same material. The final example shows how musicians can be asked to give multiple renditions of the same piece of music. All three types of expert performance are mediated by different types of acquired cognitive mechanisms. The mechanisms mediating chess and medical diagnosis have many similarities, but the mechanisms underlying expert typing and performing music differ and will be considered separately.

When highly skilled chess players select the best move for an unfamiliar position, they rapidly identify potential moves which are retrieved from among the many moves they have previously stored in memory. To select the best move the players then examine the retrieved moves by planning out their consequences mentally. During this evaluation even world-class players can discover better moves than those they retrieved at first glance. Although chess experts can retrieve acceptable moves soon after being confronted with a new chess position, their move selection is further improved by planning, reasoning, and evaluation. This indicates that performance of experts is not completely automated but remains controlled by increasingly complex processes. The ability to anticipate what consequences a particular chess move would have after several move exchanges increases slowly as a function of chess skill. Chess masters have perfected this type of planning to a point where they are able to play chess

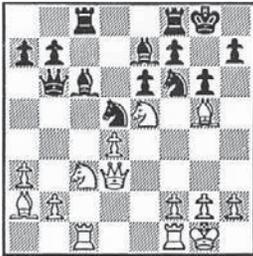
Domain	Presented information	Task
Chess		Select the best chess move for this position
Typing	<p>Overview—nature and nurture of expertise</p> <p>The central challenge for any account of expertise is to explain how some individuals attain the highest levels of achievement in a domain and why so few reach that level. However, given the continuing struggle in Psychology to explain every day (lower) levels of achievement, it many appear presumptuous to attempt to explain even more advanced levels. Consequently, the accounts of expertise have been focusing on the general characteristics of the mechanisms. In order to be able to achieve at very high (expert) levels in domains of expertise both nature and nurture are necessary. Hence, everyone agrees that experts need to have acquired the necessary domain-specific knowledge and skills (nurture). Furthermore, the expert's performance often looks effortless and their most refined and insightful behavior is generated rapidly and naturally rather than the result of prolonged deliberation. It would thus appear that experts must excel in general basic characteristics, such as intelligence, memory, speed and flexibility, which have been assumed to be impossible to train and thus must be determined to a large degree by genetic factors (nature). Over the last couple of centuries, the arguments of the relative importance of nature versus nurture for expert achievement have been intricately linked to the theories of the actual processes that mediate the achievement of experts and to the conceptions of which aspects of human characteristics could be modified through development and training. Hence, this entry will briefly review the most important conceptions during the last century and then turn to a summary of our current knowledge and in conclusion the implications and connections of expert performance for creativity and genius will be outlined.</p>	Type as much of the presented text as possible within 1 minute
Music		Play the same piece of music twice in the same manner

Figure 3 Three examples of laboratory tasks that capture the consistently superior performance of domain experts in chess, typing and music.

blindfolded, that is without seeing a chessboard, and relying entirely on their mental image of the chess positions. Experts from other domains reveal similar characteristics. The processes that mediate the performance of medical experts allow them to extract the relevant information about a patient better than less accomplished doctors. Also, they can entertain and reason through alternative diagnoses until they have found the correct one. Thus, at higher levels of performance, individuals have acquired the ability to mentally represent relevant information. This information is made accessible in a fashion suitable for supporting more extensive and flexible reasoning about an encountered task or situation. In most domains, better performers have acquired complex memory skills that allow them to rapidly encode and store relevant information during representative tasks. However, as mentioned earlier, their superior memory skills are developed to encode information related only to executing superior performance in their domain of expertise.

Even the rapid typing speed of expert typists appears to depend on acquired representations rather than mere speed of their nervous system or finger movements. High-speed films of typing show that expert typists look ahead in the text beyond the words that they are currently typing and move their fingers in position for anticipating upcoming keystrokes. In fact, the best predictor of individuals' typing speed is how far they look ahead. Accordingly, in experiments where typists were

restricted from looking ahead in the text, their typing speed was dramatically reduced. During the mastery of typewriting the expert typist has acquired the skill to look ahead in the text in order to prepare future keystrokes. Similarly, the rapid reaction times of athletes such as hockey goalies, baseball hitters, and tennis players, have also been found to reflect the ability to anticipate future events.

In many instances, the relevant information that performers extract and encode changes as a function of attained level of performance. For example, the primary reason that expert tennis players can so rapidly intercept and return a fast serve is the following: rather than looking at the actual trajectory of the ball once it is hit, they anticipate the ball's path from the preparatory body movements of the server, they are even able to make rough predictions before the server's racquet makes contact with the ball. Hence, the resulting shorter reaction times of experts (as compared to less accomplished individuals) in a domain of expertise are not explained by an innate basic speed advantage but by superior anticipation, preparation, and improved perceptual skills.

Finally, expert musicians are well known for their ability to vary their performance of a given piece of music to convey a different musical interpretation. This ability would be difficult to study if the performance changed every time the musicians performed. Laboratory studies have shown however, that if expert musicians are instructed to play the same piece several

times in as similar a manner as possible, they are able to reproduce their own performance very accurately from one rendition to the next. Expert artists have a high level of control along with a precise image of their own performance, allowing them to reproduce or vary a performance at their will or to satisfy external requests or their own aesthetic decisions.

In sum, expert performance is not simply characterized by reduced cognitive processing and automatization. In fact, in order to reason about, anticipate, and plan alternative future actions, experts increase the control over their performance and their ability to internally represent it. This control is essential for experts in order to select appropriate behavior. In the case of athletes this could mean capitalizing on an opponent's weakness or taking into account the weather conditions; for the performing artists it may imply adapting to unfavorable room acoustics or synchronizing with other members of the ensemble. Imagine competitive domains, where newly discovered techniques or knowledge constantly change the *status quo* of a domain, or where each tournament takes place with different opponents and in unfamiliar locals. If experts were not able to adapt rapidly to those conditions, the emerging weak points would be exploited by others. Thus, in order to maintain high levels of performance despite any changes in the environment, experts need to possess a flexible, generalizable skill.

Cognitive Mechanisms that Mediate Learning

Attaining expert performance in a domain appears to depend on the acquisition of mental representations that permit control and monitoring of the gradual improvements. Only when the expert performers themselves can image and plan their desired performance, and monitor and evaluate their own ongoing performance, are they able to become independence of their teachers and coaches, and reach their highest levels. Developmental studies show that the improvement in representations goes hand in hand with increases in observable performance. Thus, a similar development of representations appears to be the key mechanism that prepares students for adult independence.

Bloom showed that the training of expert performers can be roughly broken down into three phases illustrated in Figure 4. After a brief period of playful engagement in a domain (Phase I) some children are introduced to systematic practice in the domain (Phase II). The teachers will present the beginners with simple training tasks and often explicitly guide their students to focus their attention on critical aspects and to make specific changes and corrections. Parents or teachers normally help the children, at least initially, to monitor their performance and to give feedback on how well the training goal was attained. As the complexity of the acquired level of performance increases, so does the complexity of the practice tasks and goals. With further increases in performance, some individuals reach a point where they decide to commit full-time to the domain and make it their professional career (Phase III). Along with the improvement of observable performance, students acquire improved representations to image the desired performance and to monitor their own performance, and they learn how to reduce discrepancies between the two. For example, musicians must be able to internally represent many different aspects of their music performance,

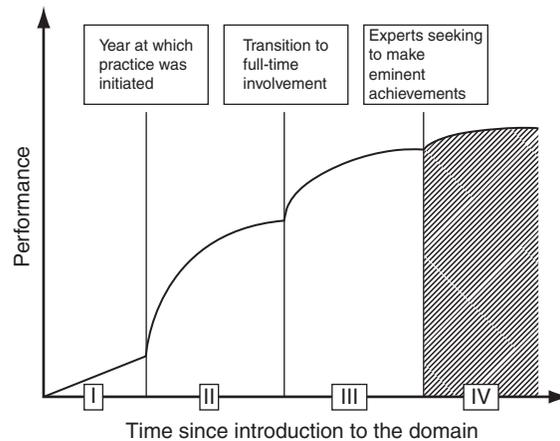


Figure 4 Three phases of acquisition of expert performance, followed by a qualitatively different fourth phase when experts attempt to go beyond the available knowledge in the domain in order to make a creative contribution. Adapted from Ericsson KA, Krampe RT, and Heizmann S (1993) Can we create gifted people? *The Origins and Development of High Ability*, pp. 222–249. Chichester, UK: Wiley. Copyright 1993 by CIBA Foundation.

such as how a given music performance should sound to an audience, and how to play their instruments to achieve this goal. In this context, it does not matter whether the musician is in the practice room or performing in public. It seems unlikely that a musician who fails to acquire any of these representations would be able to perfect their music performance through solitary practice.

When the expert performers have finally assimilated most of the available knowledge and skills in the domain, they start their professional career. During this fourth phase that Ericsson and colleagues added to Bloom's three phases, the primary goal is to make a personal creative contribution to the domain. By making those major innovations that permanently change the conception of performance or training in the domain, some expert performers will be able to reach a new level of achievement in the domain.

With the help of their highly developed representations skilled performers can organize their own training to further improve their performance. Studying and analyzing performances and achievements of masters in the field is one important way of doing this. For example, expert chess players collect books and magazines with published games of chess masters. Similar to the laboratory task mentioned earlier, they play through those games move by move and try to predict the next best move the master could have chosen. Any inconsistency between their own prediction and the chess master's actual move would imply that they overlooked some aspect of the configuration during their planning and evaluation. According to Neil Charness and collaborators, serious chess players spend up to 4 hours every day with this type of solitary study. In general, this form of self study is theoretically interesting because attempting to copy the model behavior of established masters allows the performers to gradually refine their own independent representations and expand their body of knowledge.

Expert Performance and Creative Achievements

Within the framework of expert performance, the first three phases of training leads to increases in the quality and generality of the aspiring experts' performance by learning from teachers and experts, thus benefiting from already codified knowledge and insights about performance and deliberate practice in a given domain. During the Phase IV a small number experts go beyond and thus redefine the current boundaries of a domain of expertise and generate creative innovation. This view contrasts sharply with the popular view that creativity is reflected in children's spontaneous behavior and that education and extensive training tend to confine and suppress it rather than enable it. In fact, the expert performance view maintains that without training students do not acquire the necessary representations for imaging and generating their products and achievements. To even have a chance to make a genuinely new innovation it is necessary to have assimilated the previously accumulated knowledge and be familiar with earlier, similar achievements. Only extended education will allow an individual to recognize a purposefully generated innovation as being uniquely new and different from prior achievements by others.

As far as we know, the empirical evidence on creative achievement shows that individuals have not been able to make major creative contributions to a domain unless they had mastered the relevant knowledge and skills during a long preparatory period of study and training. Even prodigious children seem to need extensive experience and training, and their creative achievements do not always compare well when judged by adult standards. Not even in the cases of revolutionary innovations by individuals such as Einstein and Picasso, did Howard Gardner find that the key creative innovations were generated until the creative individuals had completed their study and mastery of the existing knowledge and techniques. Furthermore, careful analyses of extraordinarily gifted children have shown that the trajectory of development they follow is similar to that of normal children engaged in the same domains. The difference appear to be that gifted children progress through the stages faster than less gifted children, attaining higher levels of proficiency at younger ages. Detailed analysis of the mechanisms mediating the very high level of performance of children in tennis and chess suggests the same types of acquired mechanisms as those of adults with comparable level of performance. These findings do not support

claims of qualitatively different mechanisms in talented children. In music, and also in other artistic domains, researchers have found that the higher achieving children tended to practice more on a daily basis than the lower achievers. This higher involvement along with motivational differences, for which Ellen Winner has argued convincingly, may account for the faster progress of some children over others.

In conclusion, the training of expert performers should not stifle creativity but rather provide the tools to empower the experts to be more successful and effective in their daily work and their search for innovative ideas, especially those few that go beyond what is currently known and done. Equipped with the rich knowledge of other experts' creative achievements through extensive education, the artists, scientists, athletes, or other expert performers can explore possibilities, and perhaps generate major innovations, thus making lasting contributions to their domain.

See also: Creativity Training; Eminence.

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Expressive Arts Therapy

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Glossary

Aesthetic response Our felt-sense response to works of art.

Aesthetic responsibility The commitment the expressive arts therapist has to the emergent in the creative process.

Affect regulation Management of one's emotions or in response to stress and daily living.

Approach Multiarts or integrative arts processes.

Archetype Existence of universal forms that channel experiences and emotions, resulting in recognizable and typical patterns of behavior with certain probable outcomes.

Creativity Mental and social process involving the discovery of new ideas or concepts, or new associations of the creative mind between existing ideas or concepts.

Decentering The process of play in which one does not focus on the issue at hand, but instead uses imaginative processes to explore in an unfocused manner.

Imagery Productions from the imagination that can appeal to any of the senses, and not just the standard five.

Imagination The ability to form mental images, sensations, and concepts.

Intermodal Multiarts approach.

Modality Refers to one singular creative arts therapy.

Play space An imagined free and protected space between therapist and client where there is room for the imagination to create.

Potential space A term coined by D. W. Winnicott as a space shared between mother and child in which creativity can occur.

Temenos A Greek word meaning the sacred space surrounding a temple or an altar. Used by C. G. Jung to name the relationship, frame, and vessel the analyst creates with his/her client.

Definition

Expressive arts therapy (EXA) connects the creative arts, the imagination, arts rituals, and the creative process into a therapeutic approach. This arts tapestry weaves forms of creative expression into integrative arts processes for therapeutic healing, self awareness, understanding the psyche/soul, accessing alternative states of consciousness, individual and collective creative growth, community building, and political action. The thrust of expressive arts therapy is to ignite the creative process in each person or group through the use of creative expressive techniques to facilitate healing and growth. This approach is also referred to as expressive therapies, integrative arts therapies, intermodal therapy, multiarts therapy, multimodal arts therapy, and creative expression therapy.

While there is diversity of orientation in the field of expressive arts therapy, 12 dimensions have united this approach. These define the essential parameters and expand the definition of expressive arts therapy.

1. *Multiarts imagination*: The imagination is not limited to any singular arts form, and the human experience is revealed not only through words, but through images, symbols, and the body.
2. *The creative process*: Stimulating the creative process is central in this approach.
3. *Temenos and play space*: Creating a safe relationship and a free play space is critical for the creative process to unfold.
4. *Imagery*: Imagery is holistic and nonlinear and helps us hold many ideas simultaneously. It allows us to create, innovate, and plan for the future.
5. *Power of each art discipline or modality*: Each art modality has its own experience, language, and therapeutic application.
6. *Direct action-oriented experience*: Direct experience of art making is essential to this action-oriented approach.

This focus on direct experience guides the practitioner to emphasize the process more than the product.

7. *Phenomena of the image*: Staying focused on the phenomena of the image and first exploring it artistically is very important in the creative process.
8. *Potentials of image*: Each image has vast unending potentials for meaning on personal, relational, cultural, and archetypal levels.
9. *Intermodal theory*: Understanding intermodal or multiarts theory can aid in blending the arts into processes that are healing and increase creative potential.
10. *Therapy as art*: With these healing multiarts processes, the creative spirit is aroused and the therapeutic process itself is experienced as art.
11. *Approaches to intermodal processes*: There are many styles of integrating the arts. They range from structured predesigned processes to a flow process; allowing the unfolding of the arts intuitively. This choice is determined by the goals of the practitioner.
12. *The power of play*: Play, improvisation, and decentering increase the freedom and imagination in the Temenos play space.

These 12 agreements form the foundation of the discipline upon which practitioners differ only in their application. This is explored in the methods and applications sections.

The Development of the Expressive Arts Therapy Approach

The pioneers in the field of expressive arts therapy came from diverse disciplines. As the field was cultivated, the inspirational seeds of thoughts were transformed into a distinct expressive arts therapy voice and theory. The trailblazers were from the

arts, psychology, philosophy, science, arts education and community action professions, and also from various locations: the east and west coasts of the United States, Europe, and Israel as well as South Africa. The zeitgeist of the 1960–1970s encouraged interdisciplinary endeavors and the interdisciplinary aspects of expressive arts flourished. The dimensions of the definition trace the development of this approach.

Multi-Arts-Multimodal Imagination

The 1960s atmosphere of open exploration supported a shift in perspective about the arts and psychology. Shaun McNiff, one of the first East Coast trailblazers, used the image of the Enduring Shaman as inspiration. In many people's minds, Shamanism often refers to indigenous traditional beliefs and practices concerned with communication with the spirit world in order to heal illness and address the problems of the community.

The Shaman used all artistic forms of expression to transit into the spirit world. McNiff emphasized group and community arts approaches as a defining element in expressive arts. Similar to ancient Shamanistic practices, McNiff relied on the group's multimodal imagination and cohesion to heal, change, and creatively solve problems.

Paolo Knill, a physicist and musician, incorporated his European and more scientific background to define his interdisciplinary approach. One of his chief mentors was Wolfgang Roscher. Roscher's interdisciplinary approach, called polyaesthetics, observed that all arts disciplines engage in all sensory and communication modalities in the perception and production of art. This was similar to traditional Chinese models of arts education where all arts are part of one harmonic body. To truly educate the artist there must be a synthesis that engages all the sensory modalities. Roscher had a profound influence on Knill, who was one of the pioneers of EXA, in the development of intermodal theory, which emphasized the sensory and somatic ways each art discipline communicates to the psyche. Knill blended in broad interpretation of the neurological concept of synaesthesia to his intermodal approach. Synaesthesia is a neurologically-based experience in which the stimulation of one sensory pathway stimulates a different sensory pathway. At times, these multisensory experiences are involuntary and automatic, and can occur naturally in children and adults. A central concept for Knill was the idea that one art/sensory channel would stimulate another, thus creating an intuitive flow of arts.

The Creative Process

Otto Rank was a major influence on the importance of the creative process in healing. A poet, playwright, novelist, and therapist, he understood the creative process and the creative personality. He argued that the artist delves not only into personal creativity, but into collective creativity, thus adding to the continuity of life. Rank felt the artist's creativity solves personal and collective problems and that art becomes a universal symbol. His thoughts gave expressive arts therapy a foundation in understanding the importance of the creative urge and process in societal as well as individual growth.

Natalie Rogers, who led the expressive arts therapy vanguard on the West Coast, was tremendously influenced by

her father, Carl Rogers' humanistic psychology orientation. This model emphasized growth through the creative process as well as holistic and somatic understanding, self actualization, consciousness, relationship in the emotional here and now, and creativity as the life-fulfilling expressions of the healthy personality. Natalie expanded her father's approach, creating an expressive arts approach called the creative connection or person centered expressive arts therapy, in which the creative process was fundamental. She emphasized that finding one's creative connection ignites this process of change and transformation.

Temenos and the Play Space

Creating a free and protected relational space is crucial in any therapeutic relationship. The expressive arts therapists took these ideas into the play space. Ellen Levine, from the East Coast of Canada, was one of the first expressive arts trainers to highlight that safety and freedom were requirements for creativity and the creation of the play space. She was greatly influenced by D. W. Winnicott and the idea of play or potential space. He emphasized that play develops the creative potential and is essential to development. He saw creativity as a basic human experience. This creation of potential space in which inner and outer are blurred permits the creative process to unfold.

Daria Halprin, an early West Coast California expressive arts instructor, was greatly influenced by the work of Jacob Moreno, the originator of psychodrama, and his idea of the protected frame of the stage for creativity and healing. Many other California pioneers were inspired by the work of C. G. Jung, the founder of analytical or archetypal psychology in terms of creativity and safety. Jung borrowed the Greek word Temenos, meaning a sacred circle where one can be himself without fear, to illustrate this image of safety and freedom. These ideas reaffirmed the concept of the importance of Temenos and a safe, clearly defined play space as essential for creative healing and growth.

The Phenomena of the Image

Images are the chief language in expressive arts processes. They have their own intelligence and communicate sensory and somatic experiences. These add to the repertoire of tools in the field. Staying close to the image initially is essential in the expressive arts process. Many expressive arts processes originated from the idea of active imagination, conceived of by C. G. Jung. He proposed that the psyche could be best understood through symbols. Active imagination uses the power of the imagination and creates images that guide associations, out of which a distinct dramatic character is created. Jung used visual arts, drama, and movement to aid his patient's in accessing their multilayered imaginations, and creative expression. Each image becomes a symbol of the psyche and consequently can be more fully understood.

The Potentials of the Image

Here again, the founders of expressive arts therapy were inspired by C. G. Jung and his keen understanding of the

potential of images. He called images *affect images*, as they contain an emotional response, one of our first sources of discovering meaning in the world and in ourselves. Images also become associated with perceptions of other experiences. As the symbolic meaning of an image takes shape, it accesses a never-ending reservoir of meaning. A singular image can offer associations on personal, relational, cultural, and archetypal domains. Archetypes are primordial universal motifs that exist for all people, in all cultures throughout history and they compose the collective unconscious, a reservoir of unconscious imagery that is shared by humanity. These Jungian concepts create a link through imagery, imagination, creativity, and spirituality to earlier Shamanistic practices.

Play, Improvisation, and Decentering in the Play Space

As noted earlier, Winnicott, Jung, and Moreno informed the early expressive arts therapy founders of the importance of play and improvisation. Knill and his colleague, Steve Levine, a prolific author in the early and current expressive arts therapy literature, consider postmodern philosophy to be part of the foundational structure of expressive arts therapy, and use many of related concepts such as deconstruction and decentering. Decentering, a change in perspective or approach, such as improvisation, expands the play space so that unexpected new ideas may emerge. These concepts celebrate the imagination and increase the potential for creativity in the play space of the Temenos.

The Power of Each Art Modality

The trailblazers in expressive arts therapy were artists, musicians, dancers, poets, writers, actors, and creative arts therapists representing each of these disciplines. Each pioneer studied their respective discipline and knew its power thoroughly. These cocreators wanted to emphasize the power of each art modality with its own experience and language. Both the experience and language of the arts may offer great therapeutic value. Knill delineated a paradigm to explain what each modality may offer in terms of sensory-based expression, communication mode, therapeutic, and transpersonal application. Each art modality stimulates a particular set of sensory channels. This permits a particular mode of communication about the imagery and set of therapeutic applications.

Intermodal Theory

As the field developed, expressive arts therapists realized their specialty focused on understanding what happens in the junctures between modalities, with the goal of intensifying or containing emotional and imaginal energy. Understanding these junctures added an additional level of expertise for the expressive arts therapist, and offered them the ability to work with specificity with each person or group in creating these healing multiarts tapestries.

This specialization in intermodality gave rise to unifying concepts and differences in approach and application. There are certain concepts about the arts, imagery, arts modalities, intermodal weaving, and symbolic meaning that define how expressive arts work therapeutically. Over the last 40 years,

expressive arts therapy has grown and deepened its knowledge of the psyche through the use of creative expression and symbolic meaning of one's images. This depth of knowledge and theory gave rise to specialized methods of working with the arts.

Expressive Arts Therapy Methods

This section will highlight those methods that define expressive arts therapy and differentiate them from other traditional verbal therapy and creative arts therapies.

Methods with the Creative Process

In 1928, Graham Wallas defined four stages of the creative process: preparation, incubation, illumination, and verification. These stages are vital to all growth and healing. The expressive arts therapist's understanding of the stages of the creative process can aid in supporting the client when negative feelings arise. C. G. Jung hypothesized there can be negative emotional experiences that are part of the creative process: the void, the abyss, chaos, and alienation. Understanding these negative affects can prevent a premature cessation of the creative process. The incubation stage, which is a quiet stage of consciously turning away from the task at hand and allowing the unconscious to lead, can be enhanced by use of other modalities or de-centered play.

The creative process is universal and underlines all change. Otto Rank espoused that therapy is a process of revitalizing one's artistry, and bringing a creative attitude back into life. Expressive arts therapists accentuate the surprise experience, which is the illumination stage. Focusing on the surprise can invite creative energy back into one's life, and balance the suffering of life with one's creative potential.

Methods with the Image: Phenomena of the Image

Working the image artistically is foundational to expressive arts therapies. This direct experience with the art image, the actual phenomena of the image, separates expressive arts from many other approaches and keeps the focus on the art itself. The body and the senses, and the medium of the art, are used to explore the image artistically, not through cognition. The practitioner might stay with the same modality or transfer into another modality. In a movement sequence, a particular series of movements may have a great noetic or inner energy for the person. In exploring this, the practitioner might suggest that the movement sequence be repeated in larger movements and/or smaller movements, or could suggest drawing the movement or combining sound with the movement. These explorations can unfold into deeper levels of knowing what may be contained in the image, and may lead to revealing its meaning to the client.

Method with Decentering Play

Focusing, or centering on an issue, can narrow the play space and limit and block innovative ideas or images. The method of decentering, however, shifts the person's orientation from

what is known to what can be imagined. It relies on the incubation of the creative process to allow a shift from right to left brain, to create more potential space, and to allow what is new to emerge. Examples of this are free association, or transferring into another art modality.

Methods with Singular Arts Modalities

When working with singular art modalities, expressive arts therapists employ such modalities collaboratively to enhance a person's repertoire of creative possibilities and perspectives. Each modality aids in addressing what is needed at a given therapeutic moment or for a particular issue. Use of the various arts modalities also can open different aspects of the psychic experience that could not be experienced through words or with other modalities.

This approach, created by Paolo Knill, helps the practitioner more fully utilize these potentials, as described here. With visual arts, we have a full visual-motor experience that permits us to obtain a full picture or map of an internal terrain, as well as giving great detail about the experience. It is a modality that lends itself to individual, introverted processes, and then serves to therapeutically contain emotional expression as compared with other arts. Imaginal language arts, such as poetry, prose, or creative writing, permit a subtle opening of many sensory channels through the metaphoric word. Similar to visual arts, it tends to be a more individualized and introverted process and consequently creates more of a container for emotional expression. This creation of a container for emotions is reinforced in that the process of creating and the product of production are separated by time and can be encountered again, permitting more reflective distance.

Music, dance, and drama can be used in an individualized fashion as well as in a group manner to promote more socialization. Each has a more extroverted quality in the production of art and is often expressed in an act of collaboration. This increases the intensity of expression and is helpful when the full power of an experience is essential. Neurologically, dance and music without words can access preverbal experiences, have less reflective distance, and hence can connect to dissociated aspects of consciousness more easily. The multisensory experience of drama often can access these preverbal experiences as it utilizes sound and movement.

With knowledge of the therapeutic qualities found in each modality, the therapist can suggest the modality that may best meet the need for intensification or containment of emotional issues. This is particularly helpful in affect engagement and regulation. Since expressive arts therapy is a body-based approach that invites action and direct art-making, it enhances the relationship of the link between the body's experience and emotional understanding.

Methods of Integrating the Arts

Layered on the foundation of understanding the creative process, imagery, and the nature and language of each modality is intermodal theory developed by Knill. Its main concept, of integration of the arts, is called intermodal transfer, the sensitive, intuitively trained skill of integrating arts modalities. Its goals are multiple:

1. to focus the process;
2. to provide emotional clarity, containment, or intensification;
3. to enhance the play space or imaginative range;
4. to enhance the crystallization of emotional material that may emerge in the arts process.

An alternative concept is intermodal superimposition, in which the client is asked to stay with the original intention of the image, and add on another art to amplify the imagination around the original image. McNiff utilized this a great deal in his image dialogues, in which a visual image would be asked to speak or be asked questions. This is very similar to Jung's active imagination.

Low skill and high sensitivity is another idea, coined by Knill. It means the arts are available to all, so no artistic skill is necessary. However, the expressive arts therapist must be highly sensitive to the client's process by being fully present, and able to hold an understanding of the art and psyche in order to aid the client in their artistic expression. McNiff phrased this very simply: that, for the client, the simpler, the deeper.

Methods with Expressive Arts Therapy and Trauma

Historically, the Veterans Administration (VA) was the first large organization to realize that musicians, artists, actors, dancers, and poets could function as trauma therapists. After the First World War, VA hospitals hired musicians to use music to work with victims of *shell shock*. Music helped to 'heal the savage beast' who is suffering inside, and also enabled group activities for the many soldiers returning home with these issues. Similarly, after the Second World War, dancers, actors, poets, and visual artists were hired to assist with *battle fatigue*. The VA truly helped the arts disciplines develop into therapeutic approaches. The very names of war-induced traumatic disorders: shell-shock, battle fatigue, *combat stress* aids in understanding that trauma are a bodily sensory experience as well as an emotional one. Now expressive art therapists are working with many veterans diagnosed with *post traumatic stress disorder* (PTSD).

Current neurological research supports the intuition that trauma affects the homeostasis of the body as well as the organs and biological systems. In turn, these somatic experiences shape the perception of threat, attachment, and processing of memory. Trauma disorganizes, fragments, and dissociates memory into sensory shards, and there is little integration of narrative memory. Trauma therapist Bessel van der Kolk stated that traumatic memory is stored in the somatic, sensory, imagistic memory, and only later is it woven into narrative memory. He promoted the use of art making, an action orientation rather than verbalization, and this includes the use of multiarts approaches. Although still controversial, his ideas support much of the work of the early artists in the VA hospitals.

Lois Carey, in her book on trauma and the expressive arts, highlighted the ways in which the arts can be used with trauma. Modalities that address anxiety and encourage the building of a safe relationship are not solely verbal. Somatic awareness processes using the breath and imagery, playing soothing music, and/or drawing a safe place or protector can facilitate the decrease of anxiety and create an opening for an attachment to therapy. Using the body and drama techniques

can assist in reclaiming the essential elements of one's life. Rehearsing life tasks, and reclaiming the positive parts of life through movement and enactment, can rebuild the collapsed inner-structure of the trauma survivor. Visual arts can give a solid, strong reflective distance to begin to explore the trauma itself. These are among the many methods developed by expressive arts therapists to address and work through traumatic experiences and reclaim life. Addressing the effect of trauma on the soma and psyche has been one of the current major foci of expressive arts therapy today.

Expressive Arts Therapy Applications

The expressive arts approach has many applications, depending on the practitioner's training and goals. In addressing the application of expressive arts therapy and professional standards of practice, the International Expressive Arts Therapy Association (IEATA) has delineated three areas in which EXA can be practiced. The first is the expressive arts therapist, who combines mental health and psychological education with intermodal training. Expressive arts therapists may work in hospitals, private practice, clinics, schools, residential facilities, or for global organizations. They may work with deeper psychological issues or in long-term depth orientation with individuals, groups, couples, families, children, and adolescents.

The second mode of practice is of the expressive arts consultant/educator, who usually works within local, national or international organizations, conducting groups, and workshops, as well as addressing coaching and growth issues through the arts.

The third mode of practice is composed of artists who work in groups emphasizing the community, and growth aspects of the creative process. While there is tremendous overlap, and many IEATA members occupy all three categories and may conduct similar services, this differentiation might help reveal the breadth of expressive arts therapy applications and practices. For more information, refer to the IEATA's website listed in the reference section.

Conclusion

Expressive arts therapy has developed over the last 40 years into a strong therapeutic approach. It has created a solid theoretical foundation, strong methods, and expanded the application of the arts to address many issues of human suffering and potential in the last 20 years. Expressive arts therapy harkens back to earlier ideas that all members of a community have the potential to be creative in their lives, and to use all the artistic disciplines to heal themselves and their communities.

See also: Imagination; Improvisation; Music; Play; Poetry; Theater.

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Relevant Websites

- <http://www.ieata.org/> – International Expressive Arts Therapy Association.
- Sampling of Educational and Training Programs in EXA
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www.ciis.edu/academics/exa.html
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www.itp.edu/academics/spotlight/creative-expression.php
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<http://www.nrogers.com/index.html>
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Sites that provide information about the field of EXA
http://en.wikipedia.org/wiki/Expressive_therapy
www.artsintherapy.com/whatis.asp?id=26

Resources on trauma
<http://www.traumacenter.org/selfhelp.html>
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Journals in EXA
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Families and Creativity

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Glossary

Authoritative parenting A style of parenting characterized by high expectations and rules as well as freedom and flexibility. Dialogues about the rules and boundaries are also encouraged.

Child-centered families Families who spend a vast amount of time, energy, and resources on developing their children's interests and enriching their experiences. Some parents want to insure that the children they perceive as gifted receive early instruction in their domain of giftedness.

Complex families Families characterized by a balance between integration (i.e., seeking support and warmth) and differentiation (i.e., seeking independence as well as developing one's own identity and interests).

Eminent creativity Characterized by such originality and novelty that it is recognized by a certain field as

being culturally significant, and being remembered for altering a domain.

Enriched environment Home environments characterized by books and multitudes of other intellectually stimulating resources. Parents typically read to their children early on, hold serious discussions with them, and take them to interesting places such as museums, zoos, and theaters.

Everyday creativity Characterized by originality and uniqueness as well as meaningfulness and usefulness in day-to-day life. It might not revolutionize a field, but it makes a difference in the creative person's life.

Resilience The ability to function competently in a stressful situation that threatens development and adaptation. It has also been defined as the ability to recover from trauma.

Introduction

Families are lambasted or exalted in numerous works of arts such as plays, novels, songs, and operas. They are depicted mercilessly or indulgently in paintings. Playwrights, novelists, songwriters, composers, and painters thus hold particular views of families that may or may not be reflected in their work. Regardless, their families shaped their creative evolution. For example, Mozart's father resolutely turned away from his own (admittedly flailing) career and devoted himself almost exclusively to his son once he realized the boy's talent. Similarly, Picasso's father allegedly pledged to stop painting once he realized that the 13-year-old boy was better than him. He then dedicated much time and energy to his son's artistic education. Freud's mother adored her son and the family life was strictly structured around his work habits as a young person. Whether these eminent creators would have become equivalently eminent had their family circumstances been different is as infinitely intriguing as it is unanswerable. However, the influence of the family on the lifelong development of creative talent has received much theoretical and empirical attention. That is the topic that I will explore here. I will review family characteristics and the role of stress in the early lives of creators. I will then look at the set of responses that creative children develop as a reaction to stress, and will

examine how this very set of responses shapes their creative development. I will end by presenting a framework that ties together the overarching themes reflected on in this article. Even though it is generally accepted that creativity requires the input of both nature and nurture, I will not cover the hereditary aspects of creativity here because it is outside the scope of this article.

Family Characteristics

Parenting Style

Mothers who are warm, involved, caring, and yet willing to give their children the freedom to explore at their own pace are more likely to have creative and imaginative children. Mothers of creative children who scored high on creativity tests and were labeled as creative by their teachers seem to be less over-protective and more tolerant of the hostile feelings their children may direct toward them than mothers of other students. Naturally, many children labeled as creative do not necessarily become eminent creators. These women in general are well educated, successful in their careers, and self-confident. Moreover, parents of creative achievers tend to be more egalitarian, and creative young people themselves are less concerned about following rigid sex roles. Thus, they also seem comfortable

considering activities and fields that are not typically associated with their gender.

Families favoring independence are likely to have creative children. Indeed, highly original children were generally encouraged to be independent from their earliest age. Parents who value independence are also usually receptive to unconventional thinking and to particularly imaginary play, such as involvement with imaginary companions and imaginary worlds. This form of play is associated with various forms of creativity in adulthood. Thus, it seems that the child rearing style of creative achievers' parents tends to be less conventional, and more flexible, which promotes originality, and freedom of expression. Although they might appear lax, rules and expectations are firmly in place as well within these families. This style of parenting is sometimes referred to as authoritative, and is characterized by the presence of both boundaries and flexibility. Boundaries give children a sense of security, while flexibility offers children the freedom to discover, explore, and play, all of which have been associated with problem solving.

Parents of creative children have a particular approach to parenting. Likewise, they have a specific approach that is conducive to the development of creative potential, as evident in their interactions with their children, their home environments, and the experiences they expose their children to.

Family Background

Creative individuals had encouraging parents who were likely to be financially and culturally privileged. Finances, and more generally, socioeconomic status (SES) is relevant to creative development because it influences material resources available to the child, as well as whom the child is exposed to, how much travel he/she engages in, and which institutions the child visits. In addition, part of SES is education. The parents' level of education impacts what is discussed at home and how. Furthermore, it also carries the message that education is highly regarded in the family. Another aspect of SES is economical. Families with significant resources may be less concerned about gearing their children toward high salary careers and are willing and able to support nontypical interests. Thus, SES has an effect on richness of experience, which has been related to divergent and flexible thinking.

Creative achievers generally come from enriched, child-centered environments. Parents support, encourage, and are dedicated to the development of their child's innate creative talent. The climate at home is very stimulating with books and a multitude of other resources readily available. Parents make a conscious effort to regularly expose their children to various venues illustrating the richness and diversity of the life of the mind. Indeed, nothing is spared to feed the child's interest. Parents take their children to zoos, theaters, concerts, museums, and libraries. Creative achievers' parents respect learning and the pursuit of intellectual and artistic interests. They tend to be creative themselves in addition to broadly curious. These parents often love challenging debates, and are typically busy in cognitively demanding activities. They engage their children in serious discussions about complex matters. Parents also regularly read to their children from their earliest childhood. These parents respect their children's opinions

and consider what the children say and do as important. Hence, they regularly collect their children's work and highly value it. They also encourage their children to be independent, and foster as well as model values such as discipline and hard work.

Thus, through interesting books, enriching experiences, and stimulating conversations, creative children develop a certain understanding about the world that lays the foundations for the acquisition of further knowledge. A wealth of knowledge is indeed considered a prerequisite for creative endeavors. Moreover, a child centered environment builds the child's self-confidence and makes him/her feel valued and loved. However, a child centered environment does not preclude that tensions exist between parent and child, or that the child's life might be stressful because of other types of adversity of various degrees of seriousness. One type of stress is the presence of siblings.

Birth Order

In some families, particular children are clearly favored over others. This can lead the less cherished offspring to express their frustration creatively. Their creative efforts thus attract attention, and allow these creative children to distinguish themselves from their siblings. Indeed, birth order plays an important role in determining family expectations and resource allocations. It can also establish which child will occupy which niche within the family, including who will be deemed the 'creative one.'

However, there is a lack of consensus within the literature with regards to creativity and birth order. First born appear to be more creative based on some studies whereas others claim that it is later born who hold this merit. Another position is held by scholars who suggest that family size, age differences, and sex differences are the mediating factors in the birth order-creativity equation. There are also researchers such as Frank Sulloway who propose that first and last born do not seem to exhibit differences in their levels of creativity. Rather, they differ in the types of problems they attempt to solve, and in the particular creative approach they select to solve them with.

Sulloway argues that birth order affects the various stratagems that siblings concoct in order to win parental approval. Indeed, the overrepresentation of first born among creative achievers could be attributed to their special status within the family. As first and only children, they received all the attention from their parents and enjoyed all resources available. They are thus motivated to hold on to this privileged position when siblings arrive. They do so by identifying with parental authority and accepting the power structure within the family. They often act as surrogate teachers to younger sibling(s) to further please their parents, which gives them experience with responsibility and maturity. First born typically demonstrate early focus, and are more academically and achievement oriented than later born.

The exceptionally high number of last born among eminent creators might be due to birth order as well. As the youngest in the family, the last born also received a lot of parental attention, perhaps because he/she is the last child the parents will ever have. Last born, precisely because they are later born and never received undivided attention from parents, tend to be indifferent to power and to question and challenge the status quo. They are more rebellious than first born, who have clear

conventional and conforming tendencies. Indeed, last born must carve a distinctive place for themselves within the family sphere, and must experiment to discover their niche. Hence, they adopt a personality style and field of study that are distinct from that of both first born and parents.

Later born are thus much more likely than first born to accept and embrace new and revolutionary ideas (i.e., Darwin's theory of evolution). Whereas first born do not support radical revolution, later born do not back conservative ones. Likewise, first born demonstrate their creative brilliance within a field's accepted paradigm, while later born exhibit their creative virtuosity outside the *status quo*. First and last born also differ in the expression of their creativity through the two dimensions of openness to experience. Indeed, Sulloway proposes that birth order relates closely to this personality trait so that first born use the intellectual dimension of openness to experience (i.e., perceptiveness, curiosity, and culture) and later born the nonconformist dimension (i.e., risk taking, unconventionality, originality, and independence).

Furthermore, first born are disproportionately represented among eminent scientists, and tend to excel in the physical sciences, possibly because problems are well defined within this field. Numerous eminent scientists are last born as well, although less so than first born. Last born are more altruistic than first born, and thus likely to excel in domains that are socially oriented. They often prefer the biological and social sciences, where problem finding plays an essential role. In addition, last born tend to work simultaneously on multiple projects that often cross boundaries. When they win the Nobel Prize, it is in domains such as peace and literature, whereas first born tend to be honored for their contributions to the sciences.

Birth order therefore influences the personality of siblings because it shapes the approach they select to win parental favor. Thus, for Sulloway, birth order ultimately contributes to the ways first and last born reach creative eminence. Creative children also face much more taxing situations than competition with siblings.

Stress

Creative versus academic achievers (meaning, children who do well at school) present very different family profiles. The latter's families tend to be more stable, child centered, and favoring a conventional style of parenting. The former tend to come from troubled family backgrounds, where the relationship between family members is tense, the parenting style unconventional, and the likelihood of parental dysfunction high.

Indeed, studies on the childhoods of eminent individuals based on material culled from biographies and autobiographies reveal adverse family environments. Victor Goertzel and Mildred Goertzel examined the home environments of 400 eminent individuals, and then 317 additional ones. Forty-four percent of the entire sample of 317 eminent people experienced a stressful childhood, including a majority of the actors, novelists, composers, musicians, explorers, athletes, philosophers, and psychologists. For example, as children they were raised by single parents, moved frequently, witnessed parental alcoholism, fights between their parents, and other forms of family trauma. They experienced poverty, prejudice,

and racism. They were the victims of neglect, abuse, and abandonment. They suffered from the loss of a sibling or of one or both parents, mental illness in one or both parents, and suicide in the family.

Only 58 out of the 400 individuals studied by Goertzel and colleague had a normal, loving, and supportive family, which led the authors to conclude that a happy home environment does not predispose one to become creative. Nevertheless, limitations of studies based on biographical and autobiographical material are well documented, and the individuals reviewed by Goertzel et al. were eminent, which does not necessarily imply that they were creative.

However, these studies are not alone in their claim of a relationship between creative individuals and traumatic home environments. For example, Robert Albert found that a higher than average percentage of creative individuals experienced parental loss early in life (30% of eminent people studied suffered the loss of one parent, as compared to 8% in the general population).

Creative children are likely to experience more tribulations than their equally bright but less creative peers. It has even been intimated that a certain tension between parents and children furthers independent thinking, whereas a harmonious relationship tends to promote a more conventional thinking style. Children's response to stress may both be influenced by and play a role in determining the development of their creative potential.

Response to Stress

A distressing family environment does not automatically result in creative outputs. Indeed, William Therivel affirmed that different types of childhood afflictions may result in different outcomes. For example, trying relationships with parents, early parental illness, parental absence, or parental loss are tragic and painful for a child. However, these forms of adversity will not lead to feelings of hostility toward parents and other adults. Abuse, on the other hand, will often elicit strong opposition to all forms of authority. Individuals who underwent this type of trauma might be creative in their lifestyle, but will not be engaged in significant creative pursuits.

Children who experience a strained relationship with their parents may try to minimize contact and turn to intellectual and creative activities for solace. They are likely to feel in control within their domain of predilection. This feeling may help partially remedy the lack of control that they experience in their everyday life. They also involve themselves in creative pursuits to fulfill their emotional needs. In addition, being ignored or rejected by parents seems to lead to the development of a unique identity, distinct from those of the parents, which appears to be a critical element of the creative personality.

Furthermore, difficult home environments are likely to interfere with the normal process of socialization. Children sometimes have parents who are unable or unwilling to guide them through social mores, appropriate behavior, and rules. They may also fail to enroll them in traditional schools. These children then acquire limited knowledge of conventions, which Therivel referred to as 'scripts.' They are also prone to reject these scripts, and as a result, become autonomous, divergent, and independent thinkers. Further, absence of parents

automatically results in children being unable to create bonds and identify with the absentees. Lacking a role model, these children are likely to have more unconventional and unusual lives. More immediately, a problematic home life leads children to feel different.

Solitude

A lot of creative achievers and other gifted individuals were often rejected by others as children because they were deemed different. Rejection made them hypersensitive and tense. As a result, and because of their particular home situations, they spent a great deal of time alone as children. Time alone has been deemed critical to the development of the creative individual, and children used the time to read, learn, practice, and acquire new areas of knowledge. In addition, many creative and imaginative children who spend a lot of time alone develop a rich fantasy life. A vivid imagination is believed to stimulate the use of imagery and visualization, which can be used later on to problem solve. Furthermore, fantasy is an effective strategy to cope with emotional and psychological trauma and pain. Within their imaginary worlds, children are able to rectify the ills of their lives and play out scenarios in which they emerge victorious.

Regardless of the cause of their isolation, creative children come to develop a taste for solitude, and eventually even seek it out. This ability to be alone and enjoy it appears to be an important skill to possess, particularly in adolescence, when the lure of the crowd is particularly powerful. More generally, early adversity is likely to prompt children to develop a repertoire of responses and personality characteristics that are not only conducive to creative achievement but also prepare the individual for the risk taking inherent to the creative professions. Furthermore, these responses acquired in childhood may be very useful when facing the uncertainties, difficulties, and marginality often characteristic of the lives of highly creative people.

Outcome of Childhood Trauma

Children react in a multitude of ways to situations of dysfunction. As adults, they may try to capture the fear and panic and anxiety of their childhoods in their creative works. For example, early hardship could be a recurring theme in the individual's life, a haunting theme that the individual may revisit and attempt to rework and rewrite in a more satisfactory fashion. In addition, individuals may try to compensate for rejection or abandonment in childhood through a high desire to achieve. Indeed, inborn talent in addition to the motivation to surmount adversity might help account for the development of creative individuals who lack family support.

Further, Howard Gardner posited that creative individuals favor a certain level of anxiety and stress because it was a prevalent emotional state in their childhoods. They seem to crave some discomfort in their lives and feel anxious when tension is absent in the situation or within themselves. They then tend to generate stress in their professional and personal lives by engaging in different kinds of behaviors. However, it seems that there also exist creative individuals who did not develop creatively through tension and trauma, but through more conventional routes.

No Stress

As discussed previously, creative individuals tend to grow up facing adversity. However, there is a certain level of disagreement regarding the topic. Indeed, there are studies proposing that creative achievers also come from stable, happy, and supportive families. Contrary to Goertzel and colleague's findings, these scholars state that artists, musicians, scientists, and athletes also grow up in healthy atmospheres. Indeed, they claim that the most creative and productive of achievers come from such encouraging contexts. They also argue that outside the art world, there is little evidence of family malfunction. For example, scientists, inventors, and mathematicians are believed to come from stable families. Inventors in particular seem the less likely to have had stressful childhood homes.

These findings are reflected in Rogers' Theory of Creative Environment, which states that for constructive creativity to develop, the presence of two conditions is required: psychological safety and psychological freedom. Psychological safety is fostered when an individual is regarded by his/her environment as having unconditional worth, when the environment is nonjudgmental, and when the individual feels understood. The former is achieved when the individual is allowed to express him or her self freely. Rogers' theory was later empirically supported. According to this theory, the most central element to the development of creativity is for a child to receive unconditional positive regard from his/her family.

There are researchers who support neither the tense and tough home environment hypothesis nor the nice and loving home environment hypothesis and advance instead that happy families contribute to everyday creativity, where people live productive and helpful lives, whereas a certain amount of stress characterizes the background of eminent creators.

Stress and support are not irreconcilable, and it is possible to conceive of a family filled with stress and tension, and yet, giving the child unconditional positive regard and catering to his/her needs, interests, and achievements.

Reconciling Stress and No Stress

Stress alone does not necessarily promote creativity, but stress in addition to support is a more likely formula. For example, Cervantes, Picasso, Freud, Einstein, Goethe, Beethoven, Dickens, and Marx are believed to come from such a background. Moreover, although families of creative individuals tend to be tense and stressful, they may also be structured in a way that buffers stress. For instance, parental neglect may be counterbalanced by attentive siblings, relatives, or friends. A child with an abusive parent may receive attention and love from the other parent. Even in situations of poverty, parents of creative achievers attempt to shelter their children from adversity and emphasize the importance of books and education.

Thus, parents interpret the situations for their children, and these interpretations affect how the child will react to the events. In particular, this parental intervention might trigger a certain level of resilience in the children. Their creative talents and the enriched, child-centered home environment may also contribute to these children's ability to navigate difficult times. Resilience does not mean immunity from stress, but rather the capacity to cope well and be able to function even in the midst of adversity.

Further, resilient children and creative children share many characteristics. Indeed, both are likely to be curious, intelligent, and fast learners. They are able to concentrate and problem solve. Both also seem to have good self-esteem, and be independent. In terms of family background, and again, consistently with creative children's profiles, resilient children are close to their parents. These parents are likely to be authoritative, and are loving, communicative, and supportive. They hold high standards, and supervise their children closely.

It is important to note, however, that most childhoods marked by adversity lead to negative outcomes. For instance, poverty can prevent parents from having enough time for their children, and lack of parental involvement and support have been associated with low self-esteem and behavioral problems. Mihály Csikszentmihályi stated that when one has to fight to guarantee basic survival, there is no time and resources left for anything else. In addition, not all creative achievers are resilient since a higher than average percentage of creative writers and other creators suffer from a mood disorder.

Complex Families

Gary Gute, Deanne Gute, Jeanne Nakamura, and Csikszentmihályi applied a conceptual framework called the Complex Families Framework to the family's contribution to creativity. This is a fitting framework to include here because it pulls together a lot of the ideas and themes visited in this article.

According to this framework, complex systems seek to both differentiate and integrate in a continual, organic process. Family members differentiate by pursuing their own goals and developing a distinct identity. They value independence and involve themselves in activities that require increasingly more advanced skills. These activities also provide appropriate levels of difficulty. Differentiation includes parents facilitating the discovery of new interests and challenges for their children. Parents also model perseverance, self-discipline, and hard work. Thus, creative children observe their parents fully immersed in hard intellectual work and witness the satisfaction derived from it.

Family members integrate by pursuing harmony and continuity through emotional support. They also weave cohesive bonds with each other by establishing common values, traditions, and goals. Thus, integration provides support, security, and a sense of belonging. Integration also involves parents supporting their children's interests and skills, spending time with them, establishing values and rules, and responding to failure intelligently. Another aspect of integration involves the heterogeneous backgrounds, geographical or ethnic origins, ideological positions, or personalities of family members. Indeed, Goertzel, and Goertzel highlighted that first- and second-generation immigrants were well represented among the eminent individuals they studied. Likewise, first- and second-generation immigrants distinguish themselves on creativity tests. These findings are consistent with other empirical results suggesting that bi- and multilingualism, bi- and multiculturalism, as well as immersion in a milieu that tends to question or present alternatives to accepted norms and values stimulates creativity. This diversity within the family allows children to experience varied approaches to the world, as well as varied ways of thinking and doing.

Establishing a good balance between differentiation and integration seems imperative. An over-focus on differentiation would favor the development of eminent (and noncreative) levels of talent. An overemphasis on integration would result in stability and competence but neither in talent nor in creativity. Expectations and boundaries need also to be in place to create a healthy structure.

Conclusion

The contribution of the family to creativity begins early in life and continues as creativity progressively evolves during the lifespan. The family provides a climate conducive to the child's creative talent development. However, being child-centered does not exclude the presence of stress, and stress might elicit specific kinds of reactions and engender particular personality characteristics that are favorable to creativity but also to the creator's tumultuous lifestyle and career. Although trauma plays an important role in the evolution of creativity, it seems that normal, happy families can fuel creativity as well. It is possible that everyday creativity originates from such a milieu, whereas eminent creativity appears to necessitate some level of tension. It also seems likely that creative achievers come from hectic backgrounds that are also loving and supportive. Parents might filter external stressors and interpret the world for their children, and thus render the stress manageable.

Hence, high levels of creative achievement may rely on the desire to succeed, particular characteristics emerging from childhood trauma, as well as the need to fulfill emotional and psychological needs. It may be that a less dramatic balance of support and stress results in other levels of creativity. Creative achievers who lack family support may have to rely on their inborn talent as well as their motivation to overcome adversity in order to succeed.

Thus, elements conducive to the development of creativity in young people include both challenge and support. Young people are then likely to value and take pleasure in hard work and productivity, enjoy what they do, and thus derive self-esteem and feelings of competence from it. It also seems that one of the central aspects of creative people's lives is complexity. Complex families are able to establish a balance between supporting their children and establishing boundaries and rules; spending time with their children and yet resisting controlling them; having high expectations and yet recognizing that experimentation and failure are normal. It seems that families who find the right balance between integration and differentiation offer an environment that is optimally conducive to the development of lifespan creativity. Thus, the family context of creative children is likely to strongly influence whether the individual ultimately lives up to his/her potential or not.

See also: Bipolar Mood Disorders; Developmental Trends in Creative Abilities and Potentials; Eminence; Enhancement of Creativity; Everyday Creativity; Genetics; Giftedness and Creativity; Imagination; Longitudinal Studies; Mad Genius Controversy; Mental Health: Affective Disorders; Nature/Nurture and Creativity; Pablo Picasso 1881–1973; Play; Stress and Creativity; Talent and Creativity; Teaching Creativity.

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Film

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Glossary

Auteur theory The critical position that film should express the unique vision of the filmmaker, most often viewed as the director. As such, a film has the same status as a painting, novel, or symphony that can also be attributed to a single recognizable creator.

Box office gross The total receipts during a film's theatrical run, most often expressed in US dollars. Most research uses the US domestic gross, but sometimes the figures are from another nation or even worldwide. Gross may also be broken down by week or weekend.

Dramatic awards cluster The set of movie nominations and awards in the categories of direction, writing or screenplay (original or adapted), lead male acting, lead female acting, supporting male acting, supporting female acting, and, occasionally, film editing.

MPAA ratings The evaluations published by the Motion Picture Ratings of America that indicate the audiences most suitable for a given film.

Music awards cluster The set of movie nominations and awards in the categories of score and song.

Production costs All expenses associated with the making of a film, but excluding the expenditures involved in promotion and advertising. Also called the film budget (or negative costs, i.e., the cost of producing the negative from which the positives are made).

Technical awards cluster The set of movie nominations and awards in the categories of special visual effects, sound effects editing, and sound mixing.

Visual awards cluster The set of movie nominations and awards in the categories of art direction (and sometimes set decoration), costume design, and makeup (and sometimes hair).

Introduction

Film has been called the 'seventh art,' after painting, sculpture, architecture, music, dance, and poetry. Yet the comparison is somewhat misleading given the great antiquity of the other six forms of artistic creativity. Where the six were already well established by the time of ancient Greeks, film did not emerge until the early twentieth century. Even then, film was not immediately recognized as an art form. The medium had originally evolved from the application of photography to the study of motion. Later these 'moving pictures' became a form of popular entertainment, a transition perhaps best symbolized by the advent of Nickelodeon theaters.

But, as films became longer and more complex, the medium's potential for artistic creativity began to become realized at the hands of several classic film-makers. By the 1920s, certain feature-length narrative films began to be viewed as works of art. By the end of the decade, the Hollywood film industry formed the Academy of Motion Picture Arts and Sciences, which soon began awarding Oscars for major cinematic achievements. Not long after the first film festivals began to appear, starting with Venice in 1938 and the famed Cannes Film Festival launching in 1946. During these years film criticism appeared as an independent branch of journalism, and eventually the form received academic endorsement with the appearance of film studies programs at major universities.

By the latter half of the twentieth century there seemed to be no doubt that film could claim its proper place as the seventh art. In the United States, for example, the National Endowment of the Arts created the American Film Institute dedicated to celebrating the art of film. Soon AFI was publishing ranked-order lists of the all-time masterworks in the form. Another development that took place in this period was the

materialization of 'Auteur theory.' This doctrine began in the mid-1950s with the critics of the French New Wave, and it was further developed by film critics and scholars in the United States. The basic idea was that film provides an artistic medium in which film-makers – most often the directors – should express their personal creative vision. This theory gave the seventh art a more even status with the earlier six. Just as painting has Rembrandt, sculpture Michelangelo, architecture Le Corbusier, music Beethoven, dance Balanchine, and poetry Shakespeare, so does film have such creative geniuses as Pedro Almodóvar, Ingmar Bergman, Luis Buñuel, Sergei Eisenstein, Federico Fellini, Werner Herzog, Alfred Hitchcock, Akira Kurosawa, Spike Lee, Roman Polanski, Jean Renoir, and Yimou Zhang.

Although film is now recognized as a legitimate medium for artistic creativity, it has received much less research attention in comparison to the other arts. It is likely that one reason for this neglect has to do with its recent entry into the list of artistic media. Yet another reason may be no less crucial: Film is inherently a collaborative product. Even the core crew and cast consist of dozen of individual talents who must collaborate in the creation of the final product. As an instance of group creativity, it does not lend itself well to the most common research methods, such as laboratory experiments. Indeed, laboratory investigations of film tend to focus on empirical questions that are only tangentially related to cinematic creativity. For instance, a large number of experiments have been devoted to assessing how music can affect the processing of visual information. Despite the importance of the findings from the perspective of cognitive psychology, the connection with cinematic creativity is more remote. As a case in point, empirical research by Simonton (2002–2009) shows that the quality of a film depends very little on the quality of the film score. It is possible that the more the

music draws attention to itself the more it detracts from the film's overall impact.

The last point raises a critical question: How does one assess cinematic impact? On what basis can one film be called a masterpiece, another mediocre, and yet another a turkey or bomb? This question can be answered more than one way – a point that must be demonstrated next.

Impact Criteria

Scientists who study cinematic impact have a multitude of choices for the criterion variable. For example, investigators will sometimes use consumer surveys or, more recently, popular assessments posted on the Web (e.g., Internet Movie Database 'user ratings'). Nonetheless, the vast majority of investigators tend to use one or more of the following three sets of criteria: critical evaluations, financial performance, and movie awards.

Critical Evaluations

Professional critics provide evaluations of the hundreds of films released each year. These assessments are often expressed in quantitative form, most often stars. Thus, one film might get five stars, another 2½ stars, and yet another just one star. This practice permits the direct comparison of the degree of critical consensus. Research has shown that the agreement is extremely high even if not perfect. For the most part, the best films tend to receive consistently high marks whereas the worst films earn consistently low marks. As a consequence, composite measures using the ratings from multiple critics will exhibit reliabilities comparable to standard psychometric instruments. In addition, the critical evaluations display considerable stability across time. This stability becomes apparent when the assessments published during the film's theatrical release are compared with the assessments published after the film becomes available for rent or sale in video or DVD format. Despite a temporal separation of two or more years, this 'test-retest' reliability also compares favorably with that seen in the best psychometric measures. Composite critic evaluations have another feature: the scores tend to be normally distributed, masterworks and turkeys being much rarer than mediocre films. Finally, because critic evaluations constitute expert judgments, such assessments have strong face validity as well. The composite measures can be considered a version of the consensual assessment technique.

To be sure, critic evaluations have been disparaged as representing elitist evaluations. Film critics seem to prefer foreign-language, small-budget art-house films over the mainstream Hollywood wide-distribution blockbusters. However, this complaint is not completely justified by the research. Critical evaluations are positively correlated with consumer judgments. The main difference between critics and consumers is the quantity of films watched. Those consumers who are avid movie-goers are more likely to concur with critical opinion. Still, researchers concerned about critical elitism can turn to the next impact criterion instead.

Financial Performance

Although film is recognized as art, it must also be acknowledged that the film industry is big business. Like any business, the goal is to make a profit, and that end is only achieved if the film attracts large crowds of consumers to the movie theaters. Admittedly, films can also earn money through video/DVD rentals and sales as well as television broadcasts. Yet even these earnings depend very heavily on previous box office success. People are more likely to buy or rent a DVD of a blockbuster than a financial flop. Accordingly, financial performance can be used as an indicator of popular acclaim, as distinguished from critical acclaim.

Financial performance can be assessed a multitude of ways. The most common measure is US domestic box office gross. Less common is world gross earnings, which is not always available. Another alternative is the first weekend gross or the first week gross. Yet it should be noted that all of these figures could be misleading without introducing some adjustment for budget (or production costs). Budget is strongly associated with advertising and promotion expenses, and the latter are highly correlated with box office returns. Profit is what is left over after these costs and expenses are subtracted. Usually a film must gross at least twice its budget to become profitable. Consequently, most films lose money in the theaters. If it were not for the minority of blockbusters that reap huge profits, there would be no film industry, at least not without substantial government subsidies.

Interestingly, although critical evaluations are normally distributed, financial performance has a highly skewed distribution with a long upper tail. So poor are the financial expectations for films at the bottom end of the distribution that a significant percentage of the films made each year go directly into video/DVD, bypassing the theaters.

Movie Awards

The third way of assessing cinematic impact is to use awards. Various organizations offer numerous nominations awards each year. Besides honors for best picture, these can include recognition for direction, writing, acting – male/female and lead/supporting – cinematography, art direction, costume design, makeup, score, song, special visual effects, sound effects editing, and sound mixing. Some of these awards are bestowed by professional or guild organizations, such as the Academy of Motion Picture Arts and Sciences or the Screen Actors Guild, whereas others are distributed by critics associations (e.g., the New York Film Critics Circle). The Hollywood Foreign Press Association, a society of journalists, grants the famed Golden Globes each year. Despite the diversity of award organizations, they tend to display a consensus regarding the recipients. The agreement is almost as strong as that seen for critical acclaim, albeit the consensus is greatest for the most salient honors, such as best picture, direction, and acting. Furthermore, the consensus does not extend to awards earned at film festivals. The latter tend to be more capricious regarding the competition.

One major advantage of movie awards is that they provide a more finely differentiated profile of cinematic impact. Critics assign a single overall rating just as the financial records

provide a single figure. Although best picture honors are similarly global, the remaining honors are more specific. However, these more specialized awards cluster into four groups: (a) dramatic (direction, writing, acting, and editing); (b) visual (cinematography, art direction, costume design, and makeup); (c) technical (special visual effects, sound effects editing, and sound mixing); and (d) musical (score and song). Some films might receive the major dramatic awards without receiving recognition in the other clusters. It is significant that the dramatic awards correlate highest with best picture honors.

Movie awards do have some drawbacks as impact criteria. First, like financial performance, counts of awards and nominations are highly skewed. Only a minority of films are even nominated for any award, and a smaller proportion of these actually receive one. Second, the awards and nominations are often influenced by factors that are extraneous to actual cinematic merit. For instance, the larger the number of prior Oscar nods a director receives the higher the probability that he or she will win the award. Third, certain genres are favored over others. Dramas are far more likely to win a best picture Oscar than are comedies. Horror and science fiction are even more disfavored than comedies.

Criteria Correlations

If these three sets of impact all highly intercorrelated, then it would not matter which one was actually selected for study. One might serve as a proxy for all. Better yet, the three sets could be combined into a single composite measure of cinema greatness. Unfortunately, the empirical results yield a more complex picture.

To start with, the correlations between critical evaluations and financial performance are only weakly positive. Some researchers even find zero or negative correlations. Many of the inconsistencies can be attributed to the specific criterion in each category. For instance, although critic evaluations will often correlate negatively with first-weekend gross, they will more often correlate positively with total gross earnings. The early financial success of a film is often heavily influenced by promotion and advertising, whereas its ultimate success is contingent on aesthetic quality, which the critics do a good job assessing. The connection between critical acclaim and box office success is moderated by other factors, too, such as the presence of stars. Moviegoers will often buy tickets to see a star-studded film even if it is panned by the critics.

Financial performance also has an ambivalent relation with movie awards. One complication ensues from the timing of a film's release. If a film comes out toward the end of the calendrical year, then its receiving special recognition can enhance its box office success. But if a film is released early in the year, it may no longer be in the theaters by the time the award ceremonies begin. In that case, the question becomes whether its financial performance might earn it some honors. Another nicety concerns the distinction between nomination and actual award. These are seldom announced at the same time, and this temporal lapse can affect the association. As an example, consumers may go see the movies that have received Oscar nods for best picture, but not go back to see again the film that actually won. In that situation, the nominations but not the

awards influenced financial performance. One final complication is that only high-profile recognition bears any relation with financial performance. Few consumers go see a film to enjoy its sound mixing.

In contrast, the correlations between critical evaluations and movie awards are consistently and unambiguously positive. It is rare for a critically acclaimed film not to receive such recognition. Indeed, the correlation would probably be much stronger if it were not for the rather divergent distributions for the two sets of variables. The fine distinctions that critics make at the lower end of the distribution have no repercussions because nominations and awards are almost never allotted to the films at the bottom. Nevertheless, it is essential to point out that not all movie honors are in accord with critical commendation. In particular, critical evaluations correlate most strongly with the awards in the dramatic categories, with direction and writing having the greatest weight. Critics seem to prefer most a great script realized by great direction; the actors and editor merely helping to achieve that realization.

It would seem that of the three sets of criteria, box office is the 'odd person out.' Critical evaluations and movie awards agree more with each other than either agree with box office indicators. To appreciate the basis for this split, we need to look at the factors that predict each set of impact criteria.

Criteria Predictors

The three sets of impact criteria – critical evaluations, financial performance, and movie awards – can be predicted using a large inventory of variables. Because these predictors have contrasting relations with the criteria, the latter are clearly not assessing the same type of cinematic impact. In fact, it should become evident that there are really two general kinds of film, one concentrating on artistic creativity and the other on the entertainment business. This discrepancy shows up in the following sets of predictors: budget, screenplay, personnel, and distribution and exhibition.

Budget

Aficionados, consumers, critics, and professionals routinely distinguish films according to their production costs. Big-budget films seem to be most favored by the Hollywood studios while small-budget films are more often produced by independents. The costs of making a film have decided repercussions for all three sets of criteria. In the case of financial performance, the size of the budget correlates strongly with first-weekend earnings and with total domestic gross. In other words, it takes money to make money. As noted earlier, part of this relation is mediated by expenditures on promotion and advertising. The more producers spend the more they are willing to pay for selling the film. Big budgets mean big business for everyone in the industry. Yet, as also mentioned earlier, all of these expenditures on production and promotion do not necessarily result in big profits. On the average, every additional dollar spent on the film brings only about half that amount in return.

By comparison, critics seem disinclined toward big-budget products. Production costs have a negative association with the

reviews that a film receives during its theatrical run as well as the reviews received after its video or DVD release. The relation with movie awards is more equivocal. Although costs are positively associated with awards in the visual, technical, and music categories, production costs have no correlation with awards in the categories of best picture, direction, writing, and acting. It seems that money can buy excellence in the secondary aspects of the film experience, but cannot necessarily do so in the primary aspects. Many of the greatest films were actually medium- or even low-budget products. However, because the correlation is zero, there will be instances of big-budget films that obtain awards in the dramatic categories.

Screenplay

From what has been indicated so far, film as art focuses on drama. And the key component of drama is the script or screenplay. The best directors and actors cannot salvage a bad story with implausible characters. Naturally, these scripts vary tremendously not just quality but also in content. So far, research has identified the following seven sets of attributes as being particularly important in separating out the three sets of criteria.

1. *Sequels* are successors to an earlier film, such as the last two parts of the *Godfather* trilogy. Sequels do well in terms of financial performance. At least they gross more, especially in the first weekend. They are not necessarily more profitable, however, because sequels often have higher production costs. There is pressure on the producer to outdo what came before. It is interesting to report that sequels are more prone to receive awards in the technical categories because this implies that the extra money is being spent on bigger and better explosions and car chases. Yet this success has a price because sequels are less likely to win honors for best picture and for the dramatic categories of cinematic achievement. In line with this negative result, sequels receive lower praise from film critics.
2. *Remakes* are similar to sequels in being dependent on an earlier film, only the dependence is even greater. Remakes have very similar consequences as well. On the one hand, they tend to gross more, especially in the first weekend. On the other hand, remakes are less likely to win awards in the major dramatic categories – direction, writing, and acting – and they are more likely to be panned by the critics. Remakes, like sequels, are show business, not artistic expression.
3. *Adaptations* are like sequels and remakes in bearing some link with a previous creative product. Yet the predecessor now comes from a different medium, especially plays and novels. In terms of box office, adaptations from novels are neither better nor worse than average while adaptations from plays have poorer financial performance. As might be expected, adaptations have higher odds of winning awards in the principle categories of cinematic achievement. If the adaptation comes from a classic literary work, the resulting film is also prone to receive recognition for art production, costume design, and makeup. Such visual honors represent the typical ‘costumer’ based on a novel by Charles Dickens or Jane Austin. Given the critical preference for fine art, it should come as no surprise that adaptations are more apt to earn critical acclaim.
4. *True stories* purport to represent real events, albeit with varying degrees of factual accuracy (e.g., ‘based on a true story’). A special case of true stories is the *biopic* that claims to narrate the life of a real person. Because the scripts of true stories and biopics are often adaptations from nonfiction, they have somewhat similar correlates. They tend to do less well at the box office but score higher in critical reviews, plus earn more awards for best picture and the dramatic and visual clusters.
5. *Genre* is an extremely complex attribute simply because there are so many different varieties that can be combined in almost unlimited ways – like the horror sci-fi comedy. Even so, one genre dominates film scripts, namely, drama. Well over half of mainstream films are dramas of one kind or another. Dramas make for good art, too, for they tend to receive higher critical praise and they have a higher likelihood of winning awards in the principal categories. On the down side, they are less likely to earn recognition in the technical categories, and they earn less at the box office. Film dramas are too serious to make business sense.
6. *MPAA ratings* are determined by the Motion Picture Association of America. They are designed to ensure that films are exhibited before appropriate audiences. For current purposes, the most relevant ratings are R and PG-13. The former indicates “Restricted, children under 17 would not be admitted without an accompanying parent or adult guardian” and the latter “Parental Guidance advised, parents strongly cautioned because some material may be inappropriate for children under 13.” Films rated PG-13 do the best in the box office, those rated R the worst. Yet R-rated films earn higher critical acclaim and receive more recognition in the dramatic cluster of movie awards – but less recognition in the remaining three clusters. Needless to say, many R-rated products are dramas.
7. *Mature content* indicates serious material unsuited for children or unwelcome by some adults. The most conspicuous types of mature content are highly graphic sex and violence. Although this attribute is partly captured by the MPAA ratings, the latter are too broad to make appropriate distinctions. For instance, an R-rated film might contain no sex or violence, but just profanity, while a PG-13 film might contain some nudity and killing. Consequently, it is of interest to learn the impact of mature content apart from the MPAA ratings. Here the contrast between art and entertainment is quite conspicuous. On the artistic side, both critical acclaim and movie awards in the major categories are positively associated with tense family scenes, controversial topics, and, oddly, smoking – the latter perhaps a sign of a ‘serious’ film product. On the entertainment side, box office gross is positively associated with scary or tense music, frightening or tense scenes, but negatively associated with sex and nudity, profanity, and alcohol or drugs. These financial measures hold for US domestic, UK, and worldwide box office.

Although the preceding variables all have contrasting associations with the three sets of impact criteria, one attribute has been found to be positively correlated with all three, namely

runtime. Evidently, the longer the film the more opportunities it has to display the full range of cinematic effects. It then earns more money, gets better reviews, and wins more awards in all categories. Yet film length is also a rather crude indicator of screenplay characteristics.

Personnel

Shakespeare's plays can be read with pleasure and profit without seeing them on the stage, but screenplays rarely enjoy that expressive autonomy. Instead, the script must be translated to the screen, a translation that demands the direct contributions of cast and crew. The impact of the final cinematic product will also depend on those contributions. Let us start with the cast and then turn to the crew.

The cast consists of the talents in front of the camera, especially those actors in leading roles. The bulk of the empirical studies narrowed their analyses to the impact of the 'movie stars' occupying those roles. With respect to critical evaluations, there is some reason to believe that acclaimed films are more likely to feature performances by male and female actors who had previously won Oscars. Moreover, performers who have accumulated previous acting nods are more likely to deliver Oscar-winning performances. Regarding financial criteria, the impact of stars is inconsistent and unstable. Although films with star names on the marquee are likely to gross more, such films are often not cost effective. Because stars earn so much more money, the increase in budget frequently cancels out any gains in box office. One last point is of interest: the impact of male stars exceeds that of female stars. At least this holds for both financial performance and best picture awards.

Research on members of the crew has so far confined attention to producers, directors, writers, and composers:

1. Producers have only been studied with respect to financial performance, but with paradoxical results. On the one hand, producers with prior box office success are more likely to continue that success. On the other hand, the greater the number of prior films produced the lower the odds of exceptional box office for a current film.
2. A similar paradox happens to directors: prior box office performance predicts positive box office for current films but the greater the number of prior credits predicts negative box office for current films. As a result, the net effect of 'star' directors is zero. But when we turn to movie awards, these do tend to be predicted by prior movie awards: outstanding directors continue to win. Yet with respect to critical acclaim, directors display an inverted-U function of age similar to what is found in other forms of creativity. The films for which a director receives the highest critical praise tend to appear mid-career.
3. While award-winning writers are prone to write additional award-winning films, the findings are less simple for that subset of writers who also direct their own scripts. On the one side, films made by writer-directors tend to be favored by the critics, and on the other side, films written and directed by the same creator tend to do less below average at the box office. Because Auteurs are often writer-directors, these findings suggest that Auteur theory applies more to film as art than to film as entertainment.
4. Composers appear largely irrelevant to a film's financial performance. At least box office is unrelated to awards received for best score or best song. In comparison, award-winning compositions are positively associated with best picture honors. The critics are less enamored of film music, especially in the case of songs. One curious finding is that the aesthetic impact of a film composer's work is largely decoupled from the overall cinematic impact of the film. Sometimes a composer's best work is found in a lesser film.

All in all, the cast and crew make rather divergent contributions to a film's cinematic impact. The magnitude and direction of their effects depend on the specific criterion.

Distribution and Exhibition

Obviously, a film cannot even receive critical evaluations, earn a box office gross, or win movie awards unless it has some theatrical release. This leads to two final variables that are differentially associated with the impact criteria.

The first variable is the season of release. Regarding financial performance, it is patent that the big blockbusters are released in the summer months, when children and adolescents are on vacation. In contrast, critically acclaimed films as well as those with the highest odds of winning movie awards are most likely to be released toward the end of the year, during the so-called Christmas season. Interestingly, the worst movies by any standard are usually released early in the year – a dumping off period for films that do not go directly to video.

The second factor is the number of screens on which the film is exhibited opening weekend. Wide-release films not only do better on the first weekend, but also tend to gross more in the end. Yet such films are more likely to receive negative reviews from the critics, who lean toward films that do the art-house circuit, a few screens at a time. Although the number of screens is unrelated to movie awards for best picture and in the dramatic and visual clusters, wide release is positively associated with honors in the technical and music clusters. This pattern suggests that wide release is reserved for entertainment rather than for art.

Discussion

An overall pattern is apparent in the above review: films can be separated into those devoted to creative art and those dedicated to the entertainment business. The former are inclined to receive critical acclaim and movie awards in the primary categories, whereas the latter are more disposed to do a handsome box office and to earn awards in the secondary categories, such as special visual effects and sound effects editing. The two types of film can also be distinguished with respect to production costs (small vs. big), screenplay (e.g., sequels vs. adaptations, R vs. PG-13 MPAA rating), personnel (e.g., writer-directors), and distribution/exhibition (e.g., summer vs. winter release). Although there are a few variables that cut across the two cinematic types – most notably long runtimes contributed to both art and entertainment – these exceptions are rare. Often the predictors will have opposite signs for the two types.

To consolidate these findings further, it is necessary to discuss some methodological and substantive issues. This discussion can help improve the quality of future research on cinematic creativity.

Methodological Issues

The empirical findings summarized earlier represent the most common results. Nevertheless, it is important to admit that the literature is not always consistent, and sometimes outright contradictory. After subjecting these discrepancies to scrutiny, it becomes clear that they often emerge out of methodological differences. The following four contrasts are the most telling:

1. *Sampling* – Research varies greatly in the criteria used to obtain a sample of films. In the first place, studies might differ in the historical period covered, some taking films from the Golden Age of Hollywood while other studies taking only very recent films. This difference has been shown to affect the outcomes. Even when the periods spanned by the sample are the same, researchers will often employ inconsistent sampling criteria. To illustrate, the films might be defined by (a) a random sample from all released films, (b) films that received at least one nomination for some movie award, (c) those that earned a certain minimum amount at the box office, (d) those that featured at least one movie star, or (e) films that received a certain minimum number of critical reviews. Rendering matters worse, investigators do not always agree on whether to include documentaries, animations, foreign-language films, or even shorts. It is unreasonable to expect the same results to come from samples so different.
2. *Variables* – Because researchers in this area hail from a great diversity of disciplines – among them psychology, sociology, economics, management, marketing, communications, journalism, broadcasting, and statistics – they often approach the subject from rather divergent theoretical perspectives. Consequently, each study will contain a different mix of variables. For instance, marketing researchers are more likely to want to put expenditures on promotion and advertising into their prediction equations. Yet the omission of these expenditures by other investigators can alter the conclusions. For example, much of the relation between budget and gross earnings vanishes once expenses on promotion and advertising are controlled. Hence the latter provides the most proximate predictor of financial success.
3. *Measurement* – Even if two studies used identical sampling criteria and included the same variables, they might obtain contrasting results because of disagreements on how to best define the key variables. Undoubtedly, the most irksome illustration comes from the concept of the ‘movie star.’ Stars have been defined in terms of (a) best-acting awards, (b) consumer surveys, (c) box office performance, (d) total film credits, (e) investigator subjective assessments, and (f) industry-based identifications. A star by one definition is usually not a star by another definition.
4. *Analysis* – It is still possible for two investigations to concur on sampling, variables, and measurement, but obtain different findings because of divergence in how their

respective data sets are analyzed. One investigator might just look at the basic correlation coefficients while another conducts a multiple regression or constructs a structural equation model. Even a single method like multiple regression can get distinguishable results if the analysis is carried out differently (e.g., simultaneous vs. stepwise). Finally, researchers will often differ in how they handle highly skewed distributions. Such divergence is especially crucial with measures of financial performance.

Until some consensus is reached on sampling, variables, measurement, and analysis, it is too optimistic to presume that researchers will come up with identical conclusions.

Substantive Issues

Assuming that the foregoing methodological issues can be resolved, it is hoped that researchers can address a wider range of substantive issues. These can be put into two broad categories.

First, future research must greatly augment the inventory of variables that might contribute to cinematic impact by any of the three criteria. Film is one of the most complex forms of artistic creativity ever devised – perhaps the most complex ever. Although researchers often feel satisfied if they incorporate a few dozen variables into their studies, such satisfaction is quite complacent. Of special importance is a more detailed attention to the screenplay. The published studies to date deal with the most basic features of the screenplay, such as genre, MPAA rating, sequel/remake, and adaptation. Even though there have been attempts to subject screenplays (or synopses) to content analyses, these attempts are clearly exploratory. The analyses come far from capturing the rich complexities of plot, character, and other dramatic components.

Second, further inquiries should also shift the unit of analysis from the film to the filmmakers – the cast and crew engaged in creating the film product. Even if film is a collaborative product, it remains the case that collaborations require collaborators. These collaborators range from creative talents to technical experts, but they all have a responsibility for the final film. There has been some empirical attention devoted to directors, writers, actors, cinematographers, and composers, but these inquiries are rather sporadic and scattered in approach. At present, the literature lacks findings that must be considered essential. As an example, although we know how the personality of artists differs from the personality of scientists, and even how scientists practicing in different disciplines vary in their dispositional makeup, we know nothing about the distinctive personality profiles of producers, directors, writers, actors, and composers – even less the rest of the core crew. Developmental experiences, such as family background and education or training, have also been ignored.

In time, we may come to comprehend cinematic creativity in all of its manifestations. Such scientific knowledge might even enable producers to improve their product. If scientists could determine what was necessary to create a film that was acclaimed by the critics, made a big profit in the box office, and won major movie awards, more than one film-maker would take advantage of that information.

See also: Awards; Consensual Assessment.

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Ella Fitzgerald 1917–1996

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Ella Fitzgerald: The Life

Ella Jane Fitzgerald was born on 25 April 1917 in Newport News, Virginia, and she died in Beverly Hills, California on 15 June 1996, at the age of 79.

Her parents were William Fitzgerald and Temperance (Tempie), who were not married. Her birth father did acknowledge paternity; however, he left her life when she was about three. Her mother began to live with a Portuguese immigrant, Joseph Da Silva and they moved north, following the streams of immigrations from south to north of the poor to find work. Her mother found a job as a laundress, and Da Silva worked at a sugar factory while living in one room at a rooming house. A half-sister, Frances da Silva, was born and they moved a few blocks away, to an apartment house. Ella went to elementary school at a public school nearby, where she was a good student. Although the school was integrated, and she lived in an integrated neighborhood, she was a cheery girl, dancing and singing constantly among her friends. Ella also had a chance to sing at the Bethany African Methodist Church.

When she went to junior high school, she and a male friend, Charles Gulliver, would take the train into New York City, emerging at 125th street. They would go to the Savoy ballroom and dance for hours, learning the new steps, and then take the train back. They would practice on the street in Yonkers, and people would watch them and learn the steps. By the age of 15, the couple were getting jobs in local dance clubs. The radio was becoming a phenomenon in the early 1920s, so Ella listened, and imitated her favorites including Louis Armstrong and the Boswell Sisters. Ella later said, "When I was a girl, I listened to records by all the singers, white and black, and I know that Connee Boswell was doing things that no one else was doing at the time" (liner notes for Connie Boswell album, *Sand In My Shoes*, MCA MCFM 2739, cited in Nicholson, 2004: 246).

In 1932, when Ella was 15, her mother died of a heart attack at the young age of 38, and Ella's stepfather began to mistreat her so much that her aunt Virginia, who lived in Harlem, took her out of the da Silva home and into her own home. She lived with her aunt for two years, during which time she dropped out of school and began to engage in illegal numbers running. She also got some money by being a lookout for a brothel. The truant officers caught her and she was sent to Hudson, upstate, near Albany, to the New York State Training School for Girls. The place was brutal, and she experienced beatings, deprivations, and racism. She ran away in the fall of 1934, when she was 16, and went to Harlem, where she lived on the streets. She joined a crowd of street performers, dancing on the street for pennies, staying where she could. (Later on, in 1947, she would begin her lifelong charity work for abused and neglected children, working with war orphans. She founded the Ella Fitzgerald Child Care Center in Los Angeles in 1977.)

In the mid-1930s, the theaters of Harlem were in competition with each other in offering amateur shows. Every night of

the week another theater had a competition. Ella entered these competitions. One night in November 1934, at the Apollo Theater, she was waiting to go on as a dancer, but two of the other competitors were dancers, the Edwards sisters, who were well known, and who were dressed in sequins, with the proper dance shoes. Ella was attired in street clothes; she needed a bath; she had on men's boots and pants. When she saw that these sisters were going to dance, she switched her act and sang instead. She won. A little while later, at another amateur hour, she was booed off the stage. Then, at another competition, at the Apollo Theater, she again won. Despite her dirty and ragged appearance, the jaded and critical audiences loved her singing. The winner was supposed to get a job singing for the next week at the theater, but because of her appearance and lack of hygiene, Ella was not hired. However, Benny Carter, the orchestra leader at the Apollo during that time, thought she was talented and took her to audition for the band leader Fletcher Henderson. Again, Henderson was repelled by her, and refused to hire her. She continued to dance on the street and to enter amateur shows, hoping to make enough money to eat, sleeping wherever she could. In January of 1935 she won the show at the Harlem Opera House, singing 'Judy.' This time she was able to work for the promised week.

Chick Webb was a rising jazz drummer and band leader in the Harlem clubs and theaters. His group played mostly instrumentals and he realized he had to have a singer to be more popular with audiences. He hired Charles Linton, who soon got an offer to join the singing group, the Ink Spots. Webb noticed that other bands were able to charge more because they had good looking female singers. He asked Linton to try to find him a female singer. Linton asked around, and one of his female friends mentioned the singer who had won at the Apollo, whom he could find on 125th street singing and dancing on the sidewalk. When Linton brought her to Webb, Webb said, "You're not puttin' that on my bandstand. No, no, no." (Nicholson, interview with Linton, p. 35). Linton threatened to quit and Webb relented, letting Ella watch from the wings for a few weeks to see whether she could learn the music. Ella was a quick learner and could read the charts and memorize the words. Webb began to put her on stage, and the audiences responded with applause and admiration. She got paid in cash and they gave her a room at a boarding house nearby, but she did not have enough money for the proper evening clothes that female singers usually wore.

She got her first positive press that same year, from George T. Simon, a reviewer for *Metronome* magazine, who was impressed with her animation and the quality of her voice. She began recording with Webb right away. Her first recording was 'Love and Kisses' in June, 1935. Her first recordings demonstrate her ability to 'swing.' Swing was becoming a dominant form of jazz. It featured brass, winds, and percussion, which would play a basic melody. Then the instrumentalists and the singer(s) would improvise over that basic melody. A good

example is her first big hit, in 1938, “A Tisket, A Tasket,” based on the well-known children’s nursery rhyme. She introduced it during a concert in Colored Town in Miami. Ella, influenced by such musicians as Louis Armstrong, was able to recreate her voice as a musical instrument, using nonsense syllables to ‘scat.’ Her big break came right away, and she capitalized on it. When Chick Webb died at the young age of 30, she led the band and toured it for three years, even though she was only in her early 20s.

Ella Fitzgerald, at the age of 30, was one of the most popular singers in the United States. She toured and traveled nonstop, as well as constantly recording. She made her first trip to Europe in 1948, where audiences wanted her to sing more pop ballads than bebop. She gave her first concert in Carnegie Hall in 1949. Her manager, Moe Gale, disapproved that she was doing such concerts, and wanted her to continue recording for Decca where she had sold over 20 million records (Gioia, 1998). However, Norman Granz, who was the organizer of the very popular Jazz at the Philharmonic (JATP) concerts, which had begun in 1944, saw a different future for Ella. Granz was a canny and skilled jazz manager/promoter who changed Ella’s means of exposure to the world from the jazz club to the concert stage. Granz was adamant that the concert audiences be integrated and that the venues reject Jim Crow practices in the South. Ella’s popularity grew among whites as a result.

LPs and Songbooks

Ella Fitzgerald released over 6000 singles and made about 250 albums. She is mentioned in 135 entries in the *Biographical Encyclopedia of Jazz* (Feather and Gitler, 1999). In 1948, Columbia Records introduced the long-playing record, a sturdy vinyl 10 or 12-inch disc. Previously records had been 78 rpm, on shellac. Ella did not release her first LP album, *Miss Ella Fitzgerald and Mr Gordon Jenkins Invite You to Listen and Relax*, until 1954, but she released several popular singles collected on that album, including ‘I’m Gonna Wash That Man Right Out of My Hair’ from South Pacific, in the late 1940s. She continued recording for Decca until 1955, when she released her first recordings from her new record company, Verve which was run by Norman Granz. They began by issuing LP albums featuring Ella singing ‘songbooks’ of famous popular composers such as Cole Porter (*Ella Fitzgerald Sings the Cole Porter Songbook*, Verve, 1956; *Ella Fitzgerald Sings The Rodgers & Hart Song Book* (1957); *Ella Fitzgerald Sings The Duke Ellington Song Book Vols 1 & 2* (1958); and *Ella Fitzgerald Sings The Irving Berlin Song Book* (1958). These songbooks included, *Ella Fitzgerald Sings The George and Ira Gershwin Song Books* (1959), which topped the *Billboard* magazine popularity charts soon after its release, even though it was five records. The songbook series concluded with *Ella Fitzgerald Sings The Harold Arlen Song Book* (1961), and a songbook of Johnny Mercer songs. She continued the trend, with *Ella In Hollywood* (songs from soundtracks) and *Ella Swings Brightly* (and *Ella Sings Gently*) *With Nelson* (Riddle, her orchestral leader) (1962).

Subsequent albums resulted from her frequent European tours, and the 1960 album *Ella in Berlin* won her a dual Grammy, one for Best Vocalist – Female and one for Best Vocal Performance Album – Female. The live albums were

viewed as her most creative, as she was invigorated by the presence of the audience. She was the first African American to win a Grammy Award. She received 14 Grammys throughout her career.

The orchestras she sang with were legion. Among them were her husband, Ray Brown and His Trio, Teddy Wilson, Benny Goodman, Dizzy Gillespie, Louis Jordan and His Tympany Five, Gordon Jenkins and His Orchestra, Benny Carter and His Orchestra, the Nelson Riddle Orchestra, Duke Ellington and His Orchestra, the Billy May Orchestra, and the Quincy Jones ensemble. Even jazz scholars are not sure of Ella Fitzgerald’s complete discography. Many concerts and appearances were videotaped or broadcast on television or radio but not released on recording. Vocal groups with whom she recorded included the Ink Spots, the Four Keys, the Song Spinners, the Ray Charles Singers, and the Mills Brothers.

She sang with many vocalists, but made few duet albums (Louis Armstrong being an exception). The 1950s and early 1960s were the heyday of variety shows led by famous singers, and Ella was a frequent guest. Vocalists included Frank Sinatra, Ray Charles, Pat Boone, Tom Jones, Bing Crosby, Ray Charles, Glen Campbell, Andy Williams, Dean Martin, Jimmy Durante The Carpenters and John Denver among others. Her discography lists no recorded duets with females, although she did sing with Julie London on the *Ed Sullivan Show* in 1957, on the *Dinah Shore Show* in 1960 and on the *Jo Stafford Show* in 1961. She also appeared on *The Steve Allen Show*, a late night comedy show, where Allen accompanied her. However, duets with other vocalists were rare in her issued recordings. She was primarily a solo singer with various backup orchestras, including symphony orchestras (Ella Fitzgerald Discography).

A hiatus between recording contracts occurred in the late 1960s, when Verve/MGM stopped releasing her recordings and no one picked her up, even with her immense oeuvre. Fitzgerald began recording for Pablo Records, Granz’s new label, in the early 1970s, and Pablo continued to release cuts from her various concerts, for many years. She released a double album with Columbia in 1974 (*Newport Jazz Festival – Live At Carnegie Hall, July 5, 1973*). She also recorded for the Atlantic label (*Ella Loves Cole*, 1972). Her latest release was in 2009, *Twelve Nights in Hollywood (Live)*, from Verve/UGA, which has 77 songs from live concerts in the early 1960s.

She also released albums with only one instrumentalist. Ella Fitzgerald recorded four albums with jazz guitarist Joe Pass, *Take Love Easy* (1974) among them. Pass described their studio sessions. She came in and he asked her what song she wanted and what key she sang in. She hummed a few notes, he caught the key, and they began. She could change keys and “She’s there, she hears it, no problem. It’s like another musician. I play with her and she’s sort of like a horn player” (Nicholson, 2004: 218). She also recorded *Ella and Oscar* (1976) with Oscar Peterson on the piano Peterson was her long-time orchestra leader on the JATP tours, and a famous jazz pianist. The 1991 CD *The Intimate Ella*, featured a recording she did in 1960 after she appeared in the movie *Let No Man Write My Epitaph*, as a heroin addict. Here, she had just one collaborator, the pianist Paul Smith. She recorded other albums with just Smith and various bass players, including her ex husband, Ray Brown. Nicholson (2004) said that these albums with Pass and Smith were “among her finest work on

record" (p. 218). Smith said that Ella was "an accompanist's dream" because she sang the songs so consistently from session to session. "She never did anything that wasn't very musical" (Nicholson, p. 177). The reviews were not so positive for the Peterson collaboration, as critics thought it was spotty, with Peterson swaying from being a solo performer to an accompanist in an erratic manner (Nicholson).

Smith also was in a position to notice the inevitable deterioration of her voice over time, as he was with her on tour for many years. Once, when he had not heard her for 16 years, he commented, "I realized Ella's voice wasn't what it used to be" (Nicholson, p. 236). He attributed this to her lack of formal voice training. "If you don't do it correctly and don't take it easy on the voice, there comes a time when the vibrato begins to go on you" (Nicholson, p. 218).

Ella had chronic health problems stemming from diabetes, but she continued to tour the world, often ignoring her symptoms. She began to lose her eyesight and had to cut a tour short in Nice, France, in 1971 to have a cataract removed. Later, she had toes, and then both legs, amputated. In some of her last concerts she had to be led onstage and guided to a chair. But her popularity continued and she sold records. She continually tried out new songs, covering many of the latest hits, seeking to have her own number one song again. She was an enthusiastic participant in her own concerts, often giving as many as five encores. She also became a household image to people who knew nothing about her long career in jazz and pop. In 1981, she did a commercial for Memorex audiotapes, in which she shattered a glass with her voice, with the voiceover saying, "Is it real or is it Memorex?" These commercials continued for several years, and her fees provided a comfortable income.

Ella Fitzgerald tried to keep up with the times, and she also cast herself back in time. One type of song she did not sing much was the blues. However, she studied Portuguese so she could sing bossa nova better, and she listened to and attended shows by fellow musicians and easily adapted her style to include and flavor her music with their styles. Critics viewed her cover tunes of rock, disco, and soul as some of her weakest.

Grammy Awards

Fitzgerald, as a standard-bearer in jazz and as a pioneer among women in jazz, received many awards. In 1965 The American Society of Composers, Authors and Publishers (ASCAP) recognized her in its first recognition of an artist. She had been a member of this organization since 1940, and had composing credit for several songs (e.g., 'A-Tisket, A-Tasket,' 'Deedle-de-Dum'). In 1958, she received the first two of her 14 Grammy (Gramophone) Awards from the first Annual awards ceremony of the National Academy of Recording Arts and Sciences, as Best Jazz Performance, Individual, for *Ella Fitzgerald Sings The Duke Ellington Song Book* and as Pop: Best Vocal Performance, Female for *Ella Fitzgerald Sings The Irving Berlin Song Book*. In 1959 she repeated the double awards in pop and jazz, for *But Not For Me* (Pop) and for *Ella Swings Lightly* (Jazz). In 1960, she received two Best Female Pop Vocal Performance Awards, one for album (*Ella in Berlin*) and one for song ("Mack the Knife"). In 1962 she won for Pop: Best Solo Vocal

Performance–Female, for *Ella Swings Brightly With Nelson Riddle*. In 1967, she received the Bing Crosby Lifetime Achievement Award. In 1976, she again won Best Female Jazz Vocal Performance Award, for *Fitzgerald And Pass . . . Again* and she sang 'Lady Be Good' in duet with Mel Tormé, who also won a Grammy. "The standing ovation you received was the single longest standing ovation" in the history of the Grammys, the President of the Academy wrote to Tormé (Nicholson, 2004: 223). In 1979, she won again for best Jazz Vocal Performance, for *Fine And Mellow*. In 1980 she won for Best Jazz Vocal Performance, Female, for *A Perfect Match – Ella And Basie*. In 1981, she won Best Jazz Vocal Performance, Female, for *Digital III At Montreaux*, in 1983 for *The Best Is Yet To Come*, in 1990, for *All That Jazz* (http://www2.grammy.com/GRAMMY_Awards/Winners/Results.aspx). In 1987, her song, 'A Tisket-a-Tasket' was entered into the Grammy Hall of Fame. The fact that she won for both Pop and Jazz illustrates the blurring of these genres that she constantly did. Some jazz critics derided her for being too popular and accessible.

Other Awards

Universities and college gave her awards, even though she herself had not graduated from high school nor attended college. In 1974, the Ella Fitzgerald Center for the Performing Arts was named at the University of Maryland. In 1976, Dartmouth College gave her an honorary doctorate. In 1980, Howard University and Talladega College of Alabama gave her an honorary doctorate. In 1982, she received the Hasty Pudding Club Woman of the Year Award, and in 1987, the UCLA Medal for Musical Achievement. In 1990, Princeton University awarded her an Honorary Doctor of Music.

In 1979, she received the Kennedy Center Honors Award; in 1983, the Peabody Award for Outstanding Contributions to Music in America; in 1987, she received the National Medal of the Arts. In 1988 she received the National Association for the Advancement of Colored People Image Award for Lifetime Achievement. A commemorative stamp bearing her likeness was released in 2007 by the US Postal Service (www.ellafitzgerald.com).

Marriages and Children

She had had an abortion after becoming pregnant by one of the saxophonists in the Benny Goodman band when she sang with them. After this, she never had a child. She never discussed this. Her first marriage in 1941 to Bernard Korngay, an admirer of the Chick Webb band, was short-lived and ended in mid-1942 in annulment, after Ella's managers discovered Korngay's criminal past and conveyed to her that they thought he was using her. Ella met her second husband, Ray Brown, a bass player, on the first tour with Dizzy Gillespie. They were married in December, 1947. They divorced in 1953, but continued to work together over the years. They adopted one son, Ray Brown, Jr., the son of her half-sister, Frances, who died young, and to whom Fitzgerald was very close. During the years she also had several affairs, but after she and Brown divorced, she never remarried.

Summary

The literature on Ella Fitzgerald reveals little about her intimate life, the life lived with the people in her life. The books are full of accountings of concerts, trips, band rosters, albums, constant travel, awards, and the like. Picture a middle-aged, overweight Black woman, not beautiful, the darling of audiences all over the world. She is an optimist, a cheery person. She owns a mansion in Beverly Hills, California, and she lives alone sometimes, and at other times, with relatives who stop in, and with her son, who comes back after some estrangement. She is constantly traveling and recording. One night she might be in Rio de Janeiro, and two nights later she might be in Amsterdam, The Netherlands. She has a secretary who travels with her, as the details of travel would be overwhelming otherwise. (Granz thought Ella was “temperamentally unsuited to negotiating the real world – the airline-ticket-buying, hotel-reservation making, letter writing, doctor calling, musician hiring, musician firing, contract reading, interview giving, getting her age right and the everyday problems of human existence” (Nicholson, 2004: 243).)

As she travels, she likes to go out into the neighborhoods and shop for food, talk to people, even sing to children. When she is at home, she visits her charities for children and sings. She likes to watch soap operas and is an avid baseball fan. She works constantly, with about six weeks off per year, two weeks near Christmas and a month in the summer. Her health begins to suffer the ravages of diabetes, and her eyes and limbs weaken. People do not know her telephone number, and she has few known close friends. She works with all men, and so she has few girlfriends. Peggy Lee is one of them, though her friendship with Sarah Vaughan, a fellow client of Norman Granz, is often fraught with jealousy over who is better-paid.

As she ages, she continues to keep the frenetic schedule, and when the audiences cheer, she livens up, gives many encores, and opens her arms in mutual love. By the late 1980s, she is led onto the stages as she is nearly blind, and she sits down while singing, because she is weak. Still she sings. She sings when the doctor orders only three concerts a month, and then one concert. She sings until the end, and the audiences love her. Her last concert was at the Michigan Music Hall, in 1992. Her legs were amputated in separate operations in 1994, and she died under 24-hour nursing care, in 1996.

The Direct Interpreter

Over the years, critics have debated the inner meaning of Fitzgerald’s interpretation of the songs she sang. Was she truly involved in the words she was singing? Did she care about the meaning of the poetry of the songs? Did she want to interpret them? Comparisons between Fitzgerald and Billie Holiday, Edith Piaf, and Judy Garland continue to be made. The consensus seemed to be that Fitzgerald retained her sense of childlikeness and approached her songs directly, without irony, and without insinuating her own feelings upon the lyrics and music. She continued to show a breezy, happy tone of voice as she aged, and she did not deeply interpret the lyrics, but treated her part as if her voice were a musical instrument, part of a combo, and not the soloist. Her life story was full of

pain and she had risen above it to reach a state of being that sometimes made her audiences who listened to her reach transcendence. Other singers were more like movie directors, auteurs, who shaped the music and lyrics to their own emotional lives and painful experiences, but Ella seemed to hide her emotional life and her pain, singing the ballads and the up tunes without revealing her personal interior. She sang as a musical instrument does. The words do not matter. You can just as well scat them or spit them. They convey no meaning. They are just another voice in the choir. You do not put an Ella Fitzgerald album on when you want to feel the blues and wallow in self-pity. She is just the right antidote to a bad day or a mild downer. Her music says you should go on.

This controversy was written about in her obituary in the *Washington Times* (Ella Fitzgerald’s Life and Art, 1992: 18).

Having known true pain, and the healing that the love of a grateful audience could give, she chose to give pleasure to those who would listen to her. Miss Fitzgerald concentrated not on herself and her own emotions, but on creating a thing of beauty that could be a source of pleasure and solace for everyone. What an extraordinary gift that was . . . Pain is easy. Pain is everywhere. Anyone can yowl and keen in pain, horror and desperation. But how many musicians have transcended the inescapable pain of being human? Miss Fitzgerald created a rarefied, almost Platonic musical world in which suffering was trumped by beauty. Miss Fitzgerald did not express her pain, but neither did she ignore it: Instead, she triumphed over it. Hers was an ennobling vision of art, and it can only be hoped that it has not been lost with her.

Perhaps a fitting ending is the opening patter for her Grammy-award-winning single, ‘Mack the Knife’: “We’d like to do something for you now. You haven’t heard a girl sing it and it’s so popular we’d like to do it for you. We hope we can remember all the words.” And then she began the journey of the song, a journey in time, invoking Bobby Darin and Louis Armstrong, making it up and swinging as she went along.

The Voice

The quality of Fitzgerald’s voice was considered sweet, young, and pure. Her range was extraordinary. She could sing from low D-flat to high B-flat. This bottom range is very rare, even for professional opera singers. She did not have a visible voice break, as most singers do, from the middle range to the highest range. This voice immediately engaged hearers and she was noticed right from the beginning. She did not sing breathy or loud to disguise voice weaknesses. The voice changed over the years, as evidenced in the recordings, but it was always pleasant and clear to listen to. There was no dusty whiskey voice, no pained enunciation, no emotional wavering on the high notes. The straightforwardness of her voice shows its quality – and its limitations, according to some critics.

The Rhythm

Along with having an extraordinary voice quality and range, Fitzgerald also had a sure sense of rhythm. She was able to catch a beat, and to drive a beat. She could syncopate and hold a note just long enough to tip it in staccato to the next note, or

hold it long enough to just catch the curve where the next note begins. MacInnes said she had:

an inborn sense of rhythm, so strongly felt that she can vary the beat to a preposterous degree without ever for a second losing it. Clear, precise diction, and a sixth sense for pace. Easy, assured and infinitely flexible phrasing, graceful, undulating and vivacious. (in Gottlieb, pp. 247–249)

The Female Singer Situation

The situation was one female singer and various male musicians traveling the world and crisscrossing the country together. Many female singers married and dated members of the band. The list is long and includes Billie Holiday, Sarah Vaughan, Doris Day, among others. However, the female singers were popular with the audiences even though the jazz aficionados and critics valued the male instrumentalists while the public wanted to hear the singers. The female singers, however, were viewed by the male band members as marginal and replaceable, and were diminished in importance. In a deconstruction of their role, Willis discussed the place of women in jazz:

Like elusive and untranscribable blue notes, women in jazz exist, invisible, in-between the spaces, creating voices through subversion and speaking in ways that are nearly impossible to transcribe into a discourse traditionally owned by men, and where questions of gender are nearly always overshadowed by questions of race (p. 2).

Racism

In the world of jazz and popular music, racism was a major influence. Several key incidents in Ella's career may suffice to illustrate. Once, while playing in Houston, Texas, Granz, Ella, and the band were put into jail for allegedly playing dice illegally. The real reason was Granz's insistence that the concert they were giving welcome all races equally. Leab (1995) quoted a movie studio publicity release that had Ella Fitzgerald supposedly responding to a compliment on a performance with: "I'se glad I done okay, this job sho am going to change my mode of livin" (p. 130). (Ella's northern American English accent is well documented in countless recordings.)

Once, in 1945 in Columbus, Ohio, Leonard Gaskin, the tenor saxophone player, described the group having a meal after the concert waiting to go to their hotel. The hotel manager came over to them and said to Ella how much he and his wife had enjoyed their show and her voice. However, he said, he had to tell them that they could not stay in the good rooms in his hotel, but he would have to put them up in the back somewhere (Stokes, 2005). More tellingly, in 1959, on the Bell Television Hour, Ella was scheduled to play with a combo that included a white musician. Producer Roger Englander told the tale:

I remember we had a show with Ella Fitzgerald as one of the five or six acts. Her accompanist, whose name I've forgotten, was white. To have Ella Fitzgerald and the pianist in the same frame, however, was against Bell Telephone's policy, because they were afraid of Southern Bell. So, at the last minute, we had to . . . hang a very fancy drape that was slit gold-foil placed between Ella and the pianist, thus preventing your seeing the pianist (Rose, 1992: 138).

Other sources (e.g., Nicholson, 2004, say that the white person was the guitarist, Herb Ellis). To have a black person and a white person on the small screen at the same time was taboo. Soon thereafter, Norman Granz took out a two-page ad in *Variety* on 12, December 1959, to protest the practice.

Ella Fitzgerald and Creativity

Scat

Scat singing is improvisation with the voice. The singer uses nonsense syllables and moves along with the accompaniment, becoming, virtually, one of the musical instruments. Scat singing is arguably what Fitzgerald is most famous for. Porter (2002) said she made scat singing "a household term" (p. 155). She was able to improvise and range over two octaves, always perfectly in tune. Another scat singer, Mel Tormé, said of her, that "It's a god-given talent . . . here is a woman who can run through chord patterns as deftly and with as much facility as any great tenor man or trombone player or pianist or trumpet player." He commented on her "extraordinary ears," and said, "her notes float out in perfect pitch, effortless and, most important of all, swinging" (quoted in Nicholson, pp. 89–90). Her recording of George Gershwin's 'Oh, Lady Be Good' in 1947 is a classic of her scat style. Lees (1998) said that her ability to scat sing "with impeccable rhythmic imagination and accurate intonation at high speed was incomparable" (p. 141).

BeBop

Ella Fitzgerald was also credited with coining the term 're-bop,' on her recording of 'Flying Home.' The type of music became known as 'bebop.' Bebop was the form of jazz that followed swing. In bebop, the tempo is increased, and the drummer is more dominant. The players (e.g., Dizzy Gillespie, Charlie Parker, Coleman Hawkins) improvised in a way that took the music out of the constraints of the melody. Audience's ears were not used to the sound, as it was often jarring and sounded disorganized, preferring the predictability of swing. Ella traveled with Dizzy Gillespie in 1946, where she fully embraced the new music. She credited that tour with Gillespie as "my education at learning how to really bop" (Nicholson, p. 96). Gillespie and Fitzgerald gave a concert at Carnegie Hall in 1947, which Porter (2002) said "symbolized bebop's growing, albeit contradictory, cultural legitimacy, provides a window into the wide range of artistic visions and stylistic influences maintained by musicians associated with the bebop movement" (p. 77). Fitzgerald's incorporation of bop and chromatic intervals "helped to move jazz singing in new directions" (Porter, p. 77).

Creativity

Ella Fitzgerald's life trajectory is similar to those of other popular musicians as noted by Piirto (2004). Using her Pyramid of Talent Development as a framework, Piirto noted that in families of popular musicians, the genetic factor may be present in the family's playing and singing of popular music together among the generations, and noted that popular musicians often learn their instruments from their parents. This did

not happen for Fitzgerald, as she seemed to be the only one of her known genetic relatives with a propensity for music.

The emotional aspect emphasizes personality attributes. These were derived from studies completed at the pioneering Institute of Personality Assessment and Research (IPAR) in the 1950s by Frank Barron and Donald Mackinnon and others. More recent personality studies of creators by researchers such as Gregory Feist have also shown certain consonances.

Ella Fitzgerald demonstrated many of the attributes. Here are a representative sample: (a) passion for her domain of jazz music; (b) intuition in the choice of songs and collaborators; (c) motivation to create in her constant performing, even while ill and disabled; (d) perception in her decisions about orchestra leaders, band members and knowing when to make a career move; (e) perfectionism in her insistence on such while performing; (f) androgyny in that she was one of the only women to lead a band when she first began; (g) naivete, or openness to experience, in her constant inclusion of new songs and trends in her shows, and in her many guest appearances on the television shows of musicians of many different styles; (h) resilience in her ability to bounce back from early trauma and adversity, including incarceration; and (i) introversion, in that she was quite shy, and preferred to stay home except when she was performing.

Ella Fitzgerald and Improvisation

Researchers into creativity have emphasized the importance of improvisation in the creative process. For example, Keith Sawyer noted the necessity of collaboration in improvisation in both theater and jazz. The Live albums reveal an Ella Fitzgerald that the studio albums do not. Nicholson (2004) said, "The creative sparks that flew in front of an audience were rarely ignited in the studio" (p. 191). The feedback between singer and band, singer and band and audience, is palpable on the live albums. Ella Fitzgerald was a master of improvisation, and she would sometimes not even know what song was coming up until she heard the chords, and then she would scat or sing wrong words until the right words kicked in. The improvisation in the studio albums was also inimitable, however. Tenor saxophonist Sonny Rollins said:

Fitting the melodies onto other changes takes discipline. You can't take 'Sunbonnet Sue' and put it into anything anywhere. The chords have to match, and the feeling has to match. Ella Fitzgerald had it down. It's one of the tools of jazz improvisation. The beautiful thing about jazz is that it can absorb everything else and still be jazz (Santoro, 2007: 126).

Tirro (1993) called Ella Fitzgerald's improvisation abstract: "Her artistry has developed more in the realms of abstract

music – motive, melodic development, sequence, virtuosic flights" (p. 252).

In summary, Ella Fitzgerald's life as a creator is an interesting and evocative reprise of the jazz history of the twentieth-century. Born in the First World War, she welcomed the popularization of radio and learned her first licks from harmony singers and jazz trumpeters. She danced with her childhood friends to the music of the twenties, and sang when she could not dance. She was confirmed into the sound of swing and moved it along with her own interpretations. She moved from the 78 to the 33 1/3 and the 45 and commanded the 8-track, cassette, and the CD. She was a pioneer in bebop and segued into and out of pop all the while retaining the respect of both jazz and pop. She backed into rock and died before rap. All the while she entertained.

See also: Cultural Diversity and Creativity; Expressive Arts Therapy; Improvisation; Music; Talent and Creativity; Women and Creativity.

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Flow and Optimal Experience

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Glossary

Autotelic Doing something for the pleasure of doing it and not for the expectation of an external reward or benefit (autotelic derives from two Greek terms *auto* which means self, and *telos* which means objective).

Ecstasy A trancelike state of very strong feelings in which an individual transcends normal consciousness.

Peak performance Performance of an individual at an optimal level, producing his/her best.

Timelessness The experience of transcending time while being involved in an activity.

Introduction

Mihaly Csikszentmihalyi introduced flow theory in the 1970s based on research examining people who did activities for pleasure, even when they were not rewarded with money or fame. He considered artists, writers, athletes, chess masters, and surgeons – individuals who were involved in activities they preferred. He was surprised to discover that enjoyment did not result from relaxing or living without stress, but during these intense activities, in which their attention was fully absorbed. He called this state flow, because during his research, people illustrated their intense experiences using the metaphor of being carried by a current like a river flows.

Participants were motivated by the quality of the experience they had while they were engaged in the activity. The flow experience came when the activity was difficult and involved risk. It usually stretched the person's capacity and provided a challenge to his/her skills.

The concept of flow became the key element for the theory of optimal experience, since it provided the best user experience. Flow refers to a state of mind which brings together cognitive, physiological and affective aspects. Flow experience corresponds to an optimal psychophysical state: participants said it is like being in the zone, being on the ball, being in the groove. Flow also inspires peak performances so some use expressions such as 'everything clicks' and 'experiencing a magic moment'.

Csikszentmihalyi reported that flow occurred more often during work than free time. It was easier to achieve the flow state in activities such as performing music, dance and writing since they had rules and required the learning of skills. In these activities people were deeply involved and motivated because they were participating in an enjoyable experience. While almost any active involvement can potentially lead to flow, activities which are passive, such as watching television, do not normally lead to flow. However in 2007 Steven Pritzker proposed that audience flow can occur if a television show is relevant to the viewers' life.

Flow is an interdisciplinary field of research, addressed by psychologists working in the fields of positive psychology, cognitive psychology, arts, sports, science, sociologists and by anthropologists interested in altered states of consciousness, spiritual experiences, and rituals in different cultures.

Characteristics of Flow

Csikszentmihalyi (1990) identified nine characteristics of flow. These aspects were extracted from research in which different people described optimal experience in similar ways. Qualitative approaches, including semistructured interviews, were used to gather information about the absorption of people in an activity. Questions were structured in order to elicit the feelings of people during these conditions with the aim of defining the general characteristics of flow state. In addition, diaries were used, which allowed the collection of data in a more systematic form than the semi-structured interviews. The experience sampling method (ESM) was also introduced later, which consisted of asking participants to carry around an electronic paging device for a period of time (normally a week), asking them to answer a series of questions and rating a number of items about how they feel and what they are thinking about whenever the pager activates a signal. A radio transmitter triggered the pager about eight times a day at random intervals. In this way, it was possible to gather data about instantaneous moments of internal life.

The personal experiences of participants provided an account of flow in real life contexts and were used for defining the phenomenon. Flow was reported by both young and old men and women, with no difference in terms of economic status and social class. Other studies verified the influence of cultural variables. Results indicated that, people from all over the world experienced flow state, proving the transcultural validity of the flow model. However, the regularity with which people experience flow is not directly connected with the content of the activity done. Although such cultural differences were clearly present, there were several common features. The nine characteristics of flow were the following:

- Challenge and skill balance.
- Action and awareness merging.
- Clear goals.
- Unambiguous feedback.
- Concentration on the task.
- Sense of control.
- Loss of self consciousness.
- Distorted sense of time.
- Autotelic experience.

1. *Challenges and skills balance.* A good match between challenges and skills is a necessary condition. Flow is controlled by the ability of balancing challenges with skills.
2. *Action and awareness merging.* The action must be combined with awareness in order to facilitate concentration and high performance of the task. Participants need to be focused and have a great deal of control over what they are doing. Developing a link between body and mind (action and awareness) is a very good way of achieving flow.
3. *Clear goals.* There is a clear purpose and a precise idea of what to do next. For example, the painter is aware of how to choose the color for completing the painting; the musician knows what note to perform in a fragment. Although the activity advances towards a higher goal, the activity is driven by the progressive realization of the next small goal.
4. *Unambiguous feedback.* Feedback is used for controlling the progression of the activity and the achievement of the goals. It is a process that happens in real time without it being necessary to stop. This allows adjustments to be made in order to meet the objectives.
5. *Concentration on the task.* In flow, people are focused on aspects relevant to the task and distractions are excluded from consciousness. All attentional resources are used for the performance of the task which becomes the exclusive content of the working memory buffer. Narrowing the focus of awareness, it allows the introduction of a sort of filter for perceptions and thoughts which are not relevant.
6. *Sense of control.* In flow, people do not worry about failure and possible loss of control, because they are deeply involved in the activity and all the external elements, such as failure, are less relevant. They feel a sense of control over the demands of the activity without conscious effort.
7. *Loss of self-consciousness.* Self-consciousness can be considered a meta-representation involving higher order processes. In a flow state, people are too focused on an activity which requires most of their mental resources to be self-conscious. There are no other intellectual energies to process any other information such as worrying about how one appears to other people.
8. *Distorted sense of time.* In flow the perception of time can be transformed. Time generally flies when people are performing activities in which they are engaged. On the contrary, time seems to slow down when doing tasks in which they are not really involved. A sense of timelessness is also one of the features of any altered state of consciousness.
9. *Autotelic experience.* Flow is a pleasant experience which is intrinsically rewarding. This gratification is directly connected with the activity. Autotelic is a word used to describe people who are internally driven and have a purpose within themselves. They are motivated by a strong sense of intention and curiosity. The autotelic experience is a reinforcing property of the state of flow and the activity becomes its own reward.

Flow in Artistic Activities

Flow states have been addressed at length in the study of creative activities, such as painting, music, dance, and poetry, during which artists were challenged to create new concepts

and meanings. All these are structured activities which require concentration, involve divergent thinking, and offer the opportunity to go beyond the confines of ordinary experience. They stimulate a sense of discovery and introduce artists to new dimensions encouraging higher levels of performance. Some aspects of flow are common to all the artistic expressions, however music, dance, and writing are considered extensively here, because they are the fields in which the most research has been produced.

Flow in Music

Flow has been examined in many musical activities, such as composition, performance, and listening. Flow has been mentioned in some of the psychological models of musical improvisation. Musical performance and composition offer many opportunities for musicians to immerse themselves in the activity. They feel completely absorbed due to a strong sense of identification with the music.

In musical composition a number of processes and variables have been found to be associated with flow, which indicated high levels of flow are connected in many ways to higher levels of creativity and higher quality compositions. In 2006, Raymond MacDonald, Charles Byrne, and Lana Carlton examined the links between flow and the creative output of student compositions showing a significant correlation between optimal experience levels and the quality of students' group compositions as measured by creativity ratings.

A high level of absorption and concentration is also needed to have an accurate performance which in turn requires much effort. When involved in a flow state, musicians concentrate only on what they are performing without any distraction, focusing on the creative moment. Musicians who report having an optimal experience go beyond their cognitive limitations, and perform in a relaxed way. In flow state the power of their expression and imagination increases, and musicians are facilitated in risk taking and in experimenting new musical ideas.

Musicians describe flow as an ecstatic state, in which the music flows out spontaneously, without obstacles. They feel an inexplicable sense of complete harmony between body and mind. Musicians are described as being in a trance state when they produce their best performances. Flow seems to be an important aspect in enhancing high levels of performance and expression, and involves some discovery or novelty. Optimal experience is a dynamic, creative force that leads the individual to repeat the same actions in order to experience the flow again. In music performance, flow is a predictor of emotional aspects. Patrick Freer examined the experiences of six young singers and found the following indicators for flow: high levels of perceived challenge; clear objectives; deep personal involvement and concentration; self-directedness; self-awareness; direct feedback; and a lack of awareness in time constraints.

Music learning is a complex process which necessitates the acquisition of basic abilities which are necessarily involved in performing. One of the fundamental steps to becoming a musician requires hours of practice each day. Musicians spend a lot of time completely absorbed in the task, learning to master the technique and pieces of music. They are focused on the task and involved by the music. It is not sufficient for

the practice to be mechanical; it must also be internalized in order to develop awareness.

Musicians use all their mental energy to concentrate on the activity which is very complex and involves motor, cognitive, and expressive aspects. Musicians translate the visual elements of the score into acoustic signals by using motor behaviors. There is an expressive dimension in music which creates the complex dynamics of the emotional content of the piece. Musicians also have corporal and physical contact with the instruments which they consider an extension of their body. The last step of this process is the transposition of all the details of practice to the production of a fluent performance.

The ability to interact with the audience is also necessary, transferring the intense and focused practice to the concert situation. Flow can be experienced at different levels, with the highest form often occurring during the concert. It can be transcendent experience when performers play at their highest level. This process is complete when the individual aspects are functions of a whole coherent musical event. The concert activates complex dynamics with the audience, and it allows musicians to better express the flow state. The concert and the audience could be catalysts for entering into flow, giving inspiration to the performers. In live performances, such as rock concerts, the audience attends the event with similar attitudes focusing on processing the same musical signal. This joint participation produces a collective involvement and a focused attention on the music which could induce flow.

However, the appearance of flow is difficult to predict in advance because of the indefinable variables that could occur. There is also a large interpersonal variability, and in cases such as 'stage fright,' the feedback from an audience may interfere and reduce the potential ability of the performers to reach the flow state.

Flow principles were also used for observing and analyzing musical engagement. Lori Custodero developed behavioral observable indicators of flow in music, based on nonverbal communication such as gesture, expressions of interest, and energetic body movements, and it is musically evident in the production of more animated performances.

The use of flow principles has been proposed in music education for monitoring and regulating music learning, including planning tasks for enhancing the student's enjoyment. The goal is designing activities that create the right balance between skills and challenges. Defining clear and achievable goals is important in order to avoid a sense of fear of failure and in setting rewarding activities for students. It is also important to provide constructive feedback that inspires students.

Flow in Dance

Dance flow has recently attracted the attention of researchers. The main components of flow were identified and the importance of environmental, social, and physical factors was shown. Dance is considered to be a proficient field of research for flow experience, since dance, as much as other activities, has "rules that require the learning of skills, it sets up goals, it provides feedback that makes control possible" (Csikszentmihalyi, 1990: 72).

Professional dance involves practice and concentration which are prerequisites for flow. The dancers develop their

confidence through recurring rehearsals and situations which involve high challenge and high skill. Dancers try to reach perfection every day which creates ideal conditions for flow. Dancers have clear objectives about the dance they are performing. They receive direct feedback from their actions, the other dancers and the music, which give indications if they are performing accurately or they have to adjust some movements. Dance is also imaginative, inducing participants to create an alternative world in which complex feelings are activated. The complete absorption in the performance could enhance a loss of self-consciousness and time: dancers lose their idea of self and unify themselves with the activity they are performing. Dancers on stage may drop their ability to distinguish themselves from the dance.

An interpretive phenomenological analysis was adopted for examining the subjective experience of flow in nine professional dancers by Kate Hefferon and Stewart Ollis in 2006. The results showed the following three main higher order themes consistent with Csikszentmihalyi's theory: enjoyment and autotelic experience, absorption in the task, and challenge versus skill. They experienced enjoyment during flow, and they believed that flow was, in itself, an autotelic experience. The majority of the participants reported they dance 'for themselves,' suggesting that flow is an experience practiced for intrinsic enjoyment. Flow was described as an experience where dancers felt extraordinary confidence in themselves and their performance abilities. Confidence is reached with many rehearsals, commitment and definite objectives about the abilities to be developed.

Also, facilitators and inhibitors of the flow experience in professional dance were considered such as music, choreography, preperformance routines, costumes and make-up, stage setting, and relationships with others. Being comfortable with the choreography and feeling the music facilitated the occurrence of flow. Flow was greatly reduced when dancers did not have the opportunity to engage in preperformance routines which include mechanisms for controlling anxiety such as relaxation, breathing techniques, stretching and mentally rehearsing. Costumes facilitated dancers entering another reality while make-up acted as a mask while on stage. Traveling and dancing in unfamiliar environments was considered a negative influence on the ability to experience flow. Feeling comfortable and confident in the social environment – for example, receiving corrections and criticism in a constructive way from the choreographers – was reported as an important facilitator of flow. These elements could be used for developing applications to produce flow friendly environments.

Flow in Writing

Research to understand and encourage flow in creative writing has also been conducted. In 1999, Susan Perry interviewed 76 creative writers (36 poets and 40 fiction writers). She asked them questions such as "At what point in the writing process did flow begin? Did you feel more in control or out of control as you entered flow? What are your personal patterns of flow?" Writers used several metaphors for describing flow such as "moving into the movie screen," "tapping into a vein," "opening a faucet," "enter the poem," or "diving underwater" (p. 21). The idiosyncratic nature of flow in writing was shown,

since writers had different preferences such as having or not having deadlines, using or not using music during writing, working during the day or the night. Flow occurs more frequently for some writers when working on the first draft while for other writers it only appears during rewrites.

Writers face the challenge of many choices which might lead to avoidance of the task. Successful writers overcame obstacles to get into a flow state and used strategies for controlling external and internal conditions. Some writers use behavioral rituals and routines to enhance the focus on the task. Creating a predictable environment by doing routine activities such as having breakfast, going to the gym, or taking a walk helped set up a ritual to get work started. Some writers begin the day rewriting and revising the previous day's work, as a way of developing new material with a process defined as "going backward to go forward" (p. 176).

Arranging the schedule is important for entering in flow as well as having a continuous stretch of time. No one time is perfect for writing for everyone. Having a quiet environment and avoiding interruptions is crucial for focusing on the task and being able to enter in flow. Some writers have specific necessities for writing tools which seem to have special properties for helping the creative process.

There are also internal elements that could be oriented and regulated for writing. Meditation helps in focusing the attention and entering into another way of thinking, far-away from daily troubles. Anxiety is one of the most common elements that could keep a writer out of flow. Blocks are common and there are several strategies for breaking the blocks, such as forcing yourself to write whatever comes to mind, getting up earlier than usual to write, having a writing session of at least 15 minutes every day, and reflecting on your mental, physical, and emotional states.

Feelings of People in Flow Condition

Csikszentmihalyi's research reported in great detail the feelings of the people who experienced flow. This research involved over 200 people with different background such as athletes, chess masters, rock climbers, dancers, high school basketball players, and composers of music (Csikszentmihalyi and Csikszentmihalyi, 1988: 7). They were people who spent a lot of time in exhausting activities which gave them no money and little recognition. Results of the research demonstrated that flow was characterized by high involvement, deep concentration, intrinsic motivation, and the perception of high challenges matched by adequate personal skills. People involved in flow state described themselves being completely focused and attentive during the activity. They were totally involved in what they were doing. People illustrated flow as an altered state of consciousness, bringing them outside common life, as if they were transported into a new reality. They described the feeling of a sense of transcendence, in which the awareness of time disappeared and a sense of ecstasy appeared.

Flow was described as a state of mind in which consciousness is harmoniously ordered. Participants reported heightened awareness that helped inspire increased internal clarity. Attention was used to order, make sense of, and structure personal experiences as well as adequately shape their

behaviors. They were facilitated in obtaining an ordered state of mind.

Participants said they understood what they needed to do and how well they were doing. They were also confident that their skills and abilities were adequate to the task. The situation was clear without any kind of doubt, conflict or contradiction. It was likely that the participant felt in control of the situation and was able to impose a mental order. This happened because attention was focused on tangible objectives and the skills required were adequate for the activity.

There was a feeling of intense calm and no worries about anything other than performing the activity. The space-time perception was distorted and hours seemed to pass by in a minute.

Intrinsic motivation was the driving force of flow, rewarding all activities that produced flow. People wanted to continue the activity for its own sake. This is a general principle: people are inclined to replicate actions which are pleasant and generate a positive state of mind. People normally avoid tasks which generate feelings such as boredom, stress, and anxiety.

Induction of Flow

Research indicated that with appropriate training, musicians, writers, or athletes can develop control over flow experience. In 1995 Susan Jackson asked 28 elite athletes whether flow was controllable. 71% thought physical and mental preparation could help inspire flow. On the other hand, participants considered the factors that disturb the appearance of flow to be largely uncontrollable such as changes in the weather.

According to Csikszentmihalyi, it is difficult to make flow happen, but it is possible to learn how to develop a mental attitude for reaching flow. Flow occurred when: (1) people were focused and convinced that nothing was more important than the activity at hand; (2) when the skills of the person were adequate to what the task demand; and (3) when individuals demonstrated the ability to direct what happened in consciousness during the activity which required a different level of skill, effort and inspiration in each person.

Every individual can reach flow on the basis of his own individual efforts and commitment. There are individual differences in the ability to reach flow, and there are psychological characteristics which facilitate this process, such as the autotelic personality. Additional factors include level of confidence, having a mental plan for the performance, knowing in advance all the variables, and what to do in particular occasions.

There are also external and internal conditions that inhibit flow, such as unfavorable environmental and situational conditions and internal states such as anxiety and impatience. A busy or noisy environment could be a factor that prevents the concentration necessary for flow although there is a wide variation in individual tolerance. Another obstacle could be weather conditions such as a windy and a rainy day during an open air performance. The internal conditions include anxiety, which occurs when people doubt their abilities or the situation makes them uncomfortable. Another factor may be impatience which interferes with attention; according to Csikszentmihalyi, it is difficult to 'turn on a switch' and enter into a state of flow. It takes some time to get into what one is doing. It is necessary

to set in motion something like an 'activation energy' and this requires effort. The challenge is to focus on the activity and to use internal energy in the task while avoiding distractions. Being impatient and making phone calls, surfing on the Internet, and checking e-mail frequently are behaviors that take one away from the activity and the potential to enter the flow state. It is obvious that breaks are necessary in normal life: it is not possible to perform on the trombone for 24 hours a day and alternating challenging activities with more routine ones is common. A level of daily practice on instrumental technique is indispensable for musicians, and it is normal to move back and forth from high challenge/high skill activities to low challenge/low skill activities several times a day.

Group Flow

Group flow, which depends on interactions among members of the group, was observed in different contexts including sports, creative activities, and social groups. The Bosozone Japanese motorcycle gangs used expressions such as 'our feelings get turned up,' 'all of us feel for others,' and 'all of us become one' to describe flow during a motorcycle run.

Examples of group flow from sports include basketball or volleyball teams where members reported reaching a flow state. Expressions such as 'we were in sync with each other' (Keith Sawyer, 2006: 157), were used to describe team flow. Team flow stimulates the synchronicity between players, develops awareness of the environment, and thereby creates the conditions for building stronger groups focused on a definite goal.

Group flow also emerges in creative activities in the arts in which group performances are involved, such as music, dance, and theatre. Musicians employ several expressions to illustrate group flow such as 'riding a wave,' 'lovemaking,' or 'groupmind' (Sawyer, 2006: 159), which refers to a group working in the same direction focused on the same objectives. Dance is also considered to be an activity that makes participants feel part of something larger and harmonized. Group dance connects people, involves them in coordinated movements and induces articulated group dynamics.

In music, group flow performances can provide stimuli to the members of the group: they are able to create a musical universe that they would not have been possible performing alone. Musicians are inspired by the group and focus their attention and mental energy on the production of the piece. The level of collaboration seems to be an important characteristic of group flow: all the members are focused in obtaining the same result, sharing aims and objectives.

In group flow, musicians develop a strong emotional feeling, deeply involving all the members and inducing synchrony in their interactions. It is as if all the members of an orchestra are breathing together, are listening together, are tuned to the same frequency, feeling each other in a very deep way. In such a state, the performers of a jazz group might also be able to predict what the other members of the group will perform before they do it.

In creative activities, reaching group flow requires individuals to interact collaboratively with other members. Sharing emotions and feelings with the other members of the group is

important, in order to synchronize mentally and generate group strength. During flow performance there is attunement to self and other. The connection between group and individual flow creates an interesting dynamic in which the group flow provides energy to the individuals which in turn generates individual flow back to the group. Principles for managing group flow include defining clear goals and sub-goals which are shared and reachable for the group, organizing the work so there is a minimum of competition and providing support to each member of the group including appropriate feedback.

In musical performances, flow can emerge at any time, but it is usually more likely to emerge during the concert than during a rehearsal. During rehearsals of classical music, performers try to coordinate their timing and expression, whereas during the concert they look for spontaneous variations. In rehearsals, performers focus on achieving a cohesive performance and do not stray from their musical knowledge base, often playing without taking risks or challenging their individual or collective creativity. During the concert the musicians can reach flow by responding to each other in an atmosphere of risk taking and challenges which amplify their group creativity. Performers in the ensemble are able to interact musically, interpreting each other's musical viewpoints. They are focused on their collective time-keeping role, striving to achieve a unitary intelligibility of sound where each part is perceptible. They can take risks with many musical characteristics such as timbre, phrasing, timing, and dynamics, challenging each other's musical creativity. Risk taking is particularly significant in group performances because of the interactions and the challenges between members. The output could be the realization of novel musical variations when participants engage each other in challenging musical interaction. The final result is also unpredictable, since there are several levels of indeterminacy and possible combinations.

Assessment of Flow

A number of psychometric problems were considered related to measuring flow, given that it is an inner state linked to subjective experiences. Defining forms of flow assessment was a necessary step in order to develop the research and have accurate and reliable measures. Several methods were adopted, including qualitative and quantitative approaches. Qualitative approaches, including interviews and open-ended questionnaires, were used at the beginning for defining the general characteristics of flow. In quantitative approaches, flow was considered a multidimensional construct, composed of several dimensions, in order to account for the complexity of the concept. Some structured instruments were developed, such as the Dispositional Flow Scale-2 (DFS-2) and the Flow State Scale-2 (FSS-2). These are self-report closed-ended questionnaires developed for measuring flow state in sports, but they have also been adapted and applied to different contexts and with different participants, for example, for measuring the flow state of musicians, of Internet consumers or in gaming. The DFS-2 assesses the frequency of flow experience in a specific activity; the FFS-2 (which is the most well known and applied instrument for assessing flow) measures the degree of flow experienced in a particular event. Each questionnaire is

composed of 36 items (four for each factor) articulated in the following nine dimensions: challenge and skill balance, action and awareness merging, clear goals, unambiguous feedback, concentration on task, sense of control, loss of self-consciousness, time transformation and autotelic experience. The psychometric properties of the DFS-2 and the FSS-2 were tested in different contexts and activities, confirming the validity of the scales. Two shorter versions of these questionnaires were also developed, which could be used as alternatives in situations where the use of the full-length versions is not possible.

Qualitative and quantitative approaches are complementary. They provide different elements of the same phenomenon: qualitative methods are useful for understanding the general aspects and quantitative methods allow the verification of the links between flow and other psychological variables. An approach integrating qualitative and quantitative elements could be the best solution to account for the richness of flow state.

Some Flow Research Studies

Flow research flourished as it considered more complex objectives such as the associations of flow with other psychological constructs and was developed in many directions, including fields such as sports (the most prominent field) and education.

Research in sport psychology has considered the relationship of flow with athletic competitive advantage, and the relevance of flow for peak performances and the final results. It has also been shown that flow influenced movement patterns by improving coordination. Recent research also considered both positive and negative consequences of flow in athletes, such as big wave surfers. Flow was associated with positive aspects such as improved mood states, performance, self-esteem, and fulfillment, but also with negative aspects, such as the symptoms of dependence on the surfing activity. Moreover, the correlation of flow with the cognitive domain and with psychological constructs has been considered, as well as the relationships between flow and dimensions of self-concept and athletes' use of psychological skills. How to generate and maintain flow, focusing on psychological processes has included the importance of confidence, precompetitive strategies, motivation, and self-concept. Some models were developed showing that needs satisfaction and athlete engagement predict dispositional flow.

The applications of flow in sports have been addressed at both an individual and a team level. At an individual level, in sports including golf and tennis, aspects such as mental coaching and how to control concentration and attention have been considered. Possible applications at a team level include creating synchronicity between players, developing awareness of the environment, and creating the conditions to build a stronger group which is better focused on a definite goal.

The importance of flow in education has been highlighted in many studies. It has been noted that the degree of enjoyment during the classes was a good predictor for final grades of high school students. Flow also predicted semester end performance of university students, and flow was considered a mediating variable for the effect of motivation on performance. The enjoyment of teachers in teaching depends on the

attention of the students, and teachers' intrinsic work motivation was linked to the flow experienced by students. The more flow states professors encountered, the higher the occurrence of similar experiences among their students (Arnold Bakker 2005: 38). Research indicated a positive correlation between flow and perception of autonomy, competence and relatedness. Another study concluded that teacher autonomy, performance feedback, social support, and supervisory coaching had a positive influence on the balance between challenges and skills which is a basic element for inducing flow. In a research study with secondary school teachers, it was demonstrated that personal resources (e.g., self-efficacy beliefs) and organizational resources (e.g., social support climate and clear goals) facilitated work-related flow (work absorption, work enjoyment, and intrinsic work motivation); and that work-related flow had a positive influence on personal and organizational resources. Also the didactic approach has an influence on flow and a method which directly involves the students induces more flow than passive activities such as listening to a lecture.

The concept of flow has also been considered in the field of cognitive science and neuroscience, in an attempt to give a more complete and global vision than pure description in psychological terms. Flow experience has been discussed when trying to identify possible neurocognitive mechanisms. The mechanisms of flow were compared to other expressions of exceptional human experience. Arne Dietrich in 2004 stated transient hypofrontality is a necessary prerequisite to experience flow. More research is needed in this field.

Applications of Flow

Flow is not only a speculative theory developed in the academic field, but it has also led to the formation of principles which are applicable in working towards psychological well-being, the enhancement of performance, and the quality of relationships. Flow has inspired the development of school programs, the training of business managers, and the design of products and services. It has been applied in many fields, such as work and sports with the general principle that, in order to improve quality of life, it is important to improve the quality of experience.

Basic steps have been considered for enhancing the possibility of entering into flow state including defining a general objective and as many subobjectives as are practicably possible; assessing the progress by verifying the achievement of goals; using feedback to monitor the results of the activity; remaining concentrated on the activity by avoiding distractions; developing the necessary skills involved in the activity and making the task challenging when the activity becomes boring.

Some companies have tried to apply principles based on flow theory to increase productivity and the satisfaction of employees, training their managers to recognize strengths and to define with the workers clear and appropriate objectives. Flow was considered a condition for gaining both performance and enjoyment as well as helping create a sense of organizational well-being. The following points were considered: focus on the personnel (taking care of workers); setting clear

expectations and goals (through the negotiation of a performance contract with the manager); finding an appropriate level of challenge; providing feedback; not interrupting (since sudden interruptions are very disturbing for concentration and inhibit the attainment of flow).

Conclusions

Research has indicated that flow has a central role in the creative process and is directly related to optimal experience. By experiencing flow, people may exceed their cognitive limitations, allowing the expressions of their imagination and the experimentation of new frameworks. Further research should try to integrate the aspects of flow, since what is missing at the moment is an extensive theory that incorporates behavioral, cognitive, emotional, and neuropsychological characteristics of flow experience into a definitive model.

See also: Altered and Transitional States; Collaboration; Domains of Creativity; Group Creativity; Improvisation; Mindfulness; Zen.

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Food, Creativity of Recipes, Pairings, Menus

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Glossary

Creolization The contact and assimilation of two different cultures, music, art, language, or other aspect, blending together and creating a unique new form.

Culinary art Professional knowledge and technique of the arts and sciences involving food sciences, food preparation, esthetics, and food culture.

Culinary globalization The blending of culinary concepts from various nationalities and cultures, including cookery techniques, ingredients, and condiments through a process of localization in creating new food types and culinary cuisines.

Food R&D The production or modification of new recipes, formulas, and products based on the solid knowledge of

ingredients, sauces, and other foods, perception of the food market, understanding of consumer needs and preferences, and grasp of consumer trends and fashions.

Idea incubation Making ideas stronger and more viable by looking for other ways of thinking and resources, evaluating and modifying again and again in order to find new solutions.

Idea verification The realization of new or modified ideas into creative products through continuous experimentation and trial and error and by overcoming all obstacles.

Nouvelle cuisine Emphasizing authenticity, lightness, simplicity, and imagination, nouvelle cuisine reduces the use of complex, heavy sauces in traditional French cuisine, in order to bring out the food's natural flavors and freshness.

Food and Creativity

Food Identity

All creativity and innovation must be established upon the foundation of tradition. Likewise, the creative development of food is based upon the foundation of food culture. Food identity is established in order to seek *differentiation*, distinguishing features, and the orientation of local food, as well as to accentuate the unique and attractive qualities of local cuisine. As food is a part of culture, it is an important factor in distinguishing between the cultural differences of various areas and social groups. Moreover, it is an essential cornerstone of cultural identity and shows food differentiation, with examples such as German sausages, French champagne, and Italian pasta. Local food identity also fulfills the role of *symbolization*, in which the production process of traditional ingredients, dishes, menus, and cuisine are categorized and assembled into various menu and food types. Many creative foods develop or expand its traditional food identity while inserting new and popular elements, balancing innovation with the preservation of local and regional culture.

Culinary Globalization

The rise of culinary globalization is a result of the rapid movement of the world's population and resources, including the impact of tourism, relocation of immigrants and their culture, and the advancement of transportation and technology. Culinary globalization has also had a great impact on the creative development of food. Various culinary practices are joined in one kitchen, where a chef must incorporate foreign ingredients, adapting unknown cookery techniques to deal with familiar ingredients, and using unfamiliar spices in known dishes. Under these conditions, never-before-seen food types

are created through localization and a blend of ingredients from different regions, various cookery techniques, diverse food cultures, and other historical factors. For example, influenced by Western cuisine, Japanese cuisine has developed the eclectic Japan–Western cuisine, using its staple food rice to create dishes such as the Katsu-Don (fried pork chop with rice), a product of Japanese history in the late 1920s, and the Omuretsu, an adapted form of the French omelette. On the other hand, Japan has also influenced Western cuisine, leading many renowned Western chefs to adopt Japanese culinary techniques and ingredients in Western menus, creating items such as the California role. With the universality of ingredients and dishes being a major culinary trend in the late twentieth century, the process of localization creates new hybrid types. Cultural image is used in food industries to produce variety among existing food types. The *creolization* of ingredients, cookery techniques, flavor, and eating habits continues to provide stimulation for the culinary arts.

Nouvelle Cuisine

In the late eighteenth century, the concept of *modern cuisine* began to surface in the French culinary world; renowned French chefs began to view their status as that of an artist, and their cuisine and dishes as works of art. The later rise of *nouvelle cuisine*, whose name can be traced back to the 1730s, continued to emphasize the spirit of innovation. Adhering to the four main principles of authenticity, lightness, simplicity, and imagination, nouvelle cuisine favored simple cookery techniques, reducing the use of traditional heavy sauces, and introduced the concept of healthy dishes, in order to bring out the food's natural flavors and freshness. Chefs of the nouvelle cuisine style began to abandon the rigidity of the traditional French cuisine and find inspiration in exotic and regional

cooking techniques and ingredients. Adapting concepts of Italian and Moroccan cuisine to traditional dishes, they created a new style for French cuisine. For example, the traditional dish, *pot au feu*, which originally used beef as the main ingredient, was updated by trading the beef for fish. The influence of nouvelle cuisine can be seen in the ingredients and menus of many Michelin-star restaurants, in which the chefs apply *avant-garde* concepts for French cuisine. The pursuit of innovation and experimentation in the culinary arts, as well as the various combinations of cooking methods, provide customers with a delightful dining experience and a feast for the five senses.

Food Research and Development

Research and development of foods and dishes, including modification processes, are crucial to the success of many food organizations and corporations, such as those in the food industries, fast food industries, and chain restaurants. Due to the ever-changing needs and trends in the food market, researchers study market analyses, transform trends into products, and predict future development and needs. Research teams combine the knowledge of culinary training, food sciences, and food chemistry to create innovative new standard recipes and menus using formulas, proportion, mass production, and cooking techniques. In addition, research is also applied to scientifically analyze the various characteristics of existing food in order to modify or design newer and better products. During the research and development process, the researcher creates a prototype production according to the proposed formula, which then undergoes sensory evaluation, using human senses or scientific instruments to test qualities such as color, flavor, smell, and texture, in order to ascertain the product's quality. Taste tests are conducted on clients in order to collect more feedback regarding modification. After a series of experiments and analysis, the final product is

then quantified into detailed and accurate data, creating a standardized production procedure to ensure the uniformity of the product.

Molecular gastronomy is a scientific discipline involving the study of physical and chemical processes that occur in cooking. It pertains to the mechanisms behind the transformation of ingredients in cooking and links the social phenomena, artistic and technical components to culinary activity. The molecular gastronomy study tries to explore existing recipes, introduce new tools, ingredients and methods into the kitchen, invent new dishes, and use molecular gastronomy to help the general public understand the contribution of science to society. Many Michelin-star chefs are joining the ranks of molecular gastronomy, this "tasty, novel, and fun" culinary revolution.

Creative Cuisine and Recipe

Generally speaking, creative culinary works must carry the attributes of originality, usefulness, and balance. Original dishes have the ability to surprise and provide a novel sensory experience; the usefulness of a dish includes the possibility of commercialization, customer satisfaction, market acceptance, and cost consideration and production feasibility; balance of a dish includes harmonious flavor and appearance. These three attributes interact with the five elements of culinary products, namely professional technique, flavor and seasoning, esthetic appearance, ingredients, and conception (see [Table 1](#)), and bring the content of the creative cuisine and recipe together.

Professional Technique and Innovation

Knowledge of the characteristics of ingredients and their application is fundamental to innovation. The understanding of the

Table 1 Creative culinary product criteria matrix

	<i>Originality (novelty; originality; newness)</i>	<i>Usefulness (value; appropriateness; significance; utility, adaptability)</i>	<i>Balance (harmony)</i>
Professional technique	Nontraditional techniques or tools	Good solid cooking Excellent skills	(Prepreparation, cutting technique, size of portions, cooking method and garnish in balance)
Flavor and seasoning: aroma, taste, and texture	Unique aroma, taste, texture	Matches customers' favorite flavor(s), 'less is more,' natural	All flavors are matched and in balance, harmonious flavor
Esthetic appearance: colors, modeling, arrangement	Unique colors	Appetizing colors, natural colors	Harmonious colors
	Unique and elegant modeling: arrangement, shapes	Amount, size, position of dishware appropriate, well-crafted (strong lines), slicing in sequence, pleasant facing and flow	Balance of dishes
Handling of ingredients	New, extraordinary and diversified ingredients	Seasonal and local ingredients; good understanding of the special features of ingredients, foods well-balanced in size, texture and quality, digestible	Fine balance of ingredients
Conception	Original interpretation of traditional cuisine, introduction of different culture(s), attractive, alive, tells interesting stories	This idea has practical value; the culinary product or dish has an easily remembered name	This artist has created a harmonious feast

physical and chemical changes during the preparation and cookery process, including the different cuts, heating methods, and the resulting style and flavor from various combinations of ingredients and garnishes, are key to creating richer variations of ingredient mixtures and dishes. In addition, the use of nontraditional kitchenware, equipment, and tools have been instrumental in breaking through old cookery techniques. The advancement of technological progress has brought about constant changes in the culinary arts and propels the modification of products. For example, the invention of the Combi oven has improved upon the design of traditional ovens, allowing for the preservation of moisture during the baking process. However, only with solid, basic culinary skills can one begin to innovate and realize one's creativity.

Aroma, Taste, and Texture

Creative dishes are a combination of unique aroma, taste, and texture. First and foremost is the harmonization of flavors, including the arrangement of strong and mild tastes and the balance between sour, sweet, bitter, spicy, and savory tastes. Coupled with complementary textures, the suitable combination of aromas provides a harmonious satisfaction of taste and texture upon eating. Taste is the core of culinary art; it is the overall sensory stimulation achieved through the use of food, spices, condiments, and cookery methods. By using condiments only to assist or accentuate the presentation of the ingredient's natural flavors, good creations are able to bring out the inherent value in a food's simple, natural taste.

Unique Appearance of Cuisine

A creative and esthetic appearance of cuisine provides visual enjoyment and elevates the dish to a work of art. The natural color of the food itself should be used and colors which whet the appetite should be chosen based on concepts from color psychology, creating a harmonious effect between the colors of different ingredients. The unique form of the dish should be based on the cut and size of the portion, the size and style of the dishware, as well as the orientation, positioning, placement, and number of dishware. Many creative dishes are presented upon unique dishware, which emphasizes or complements the food and achieves an overall look.

Handling of Ingredients

Food is the cornerstone of cuisine, and fundamental skills for creative cuisine include knowledge in choosing ingredients, understanding their features, and the handling of ingredients. Depending on the season, location, or weather, ingredients may

have different characteristics. Creative dishes should use suitable ingredients in order to produce new styles. Clever combinations of local and exotic or specialty ingredients often result in creative cuisine, which brings out a unique cultural style or flavor to the dish. The joining of local culinary techniques and exotic ingredients also produces culinary variety.

Culture and Conception of Creative Cuisine

The concept and spirit of the creator is often imbued in creative cuisine, emphasizing the essence of the creation and its interaction with the eater, as well as providing the culinary work with deeper meaning and vitality. Creative cuisines use storytelling methods and cultural backgrounds to increase the value and attraction of the dish, which draws the attention and interest of customers. At times, creative cuisines may present cultural stories, such as the melding of various cultures through the suitable combination of food cultures or the emphasis on adapting local culture to produce a dish of local flavor. In general, creative cuisine should provide a rich feast for the senses of sight, taste, smell, touch, and hearing.

Creative Culinary Process

The creative culinary process can be seen as the evolution of thoughts, which will lead to truly creative culinary products. The process can be divided into several stages: preparing the new ideas, idea incubation, idea development, and verification of culinary work (see Figure 1).

Preparation for New Ideas

New ideas for the culinary arts come from a variety of channels. The personal culinary experience of the culinary artist is a direct source of inspiration. Innovative chefs use words and pictures to document and analyze their experiences in different restaurants, locations, or countries to form a database from which to transform external stimulation into internal creative potential. In addition to enriching one's knowledge, culinary books and recipes all serve to stir up inspiration by providing new ideas or reinterpreting old ones. Many ideas can be found not only in food itself, but also in culture and art – fashion, art, music, and historical artifacts – whose creative concepts can often be transformed into culinary elements.

Idea Incubation

During the idea incubation period, the creator draws upon a database of past experiences, knowledge, and inspirations and comes up with many diverse culinary ideas through divergent thinking, a process which is often swift, automatic, and

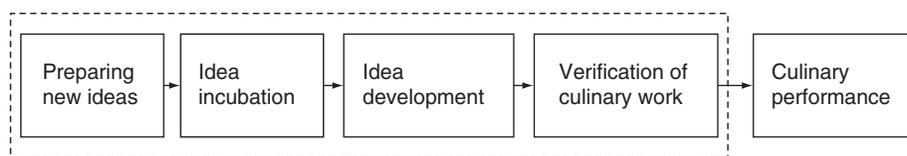


Figure 1 Model of creative culinary process and culinary performance.

subconscious. The culinary artist may at this time put ideas aside due to present difficulties, make due considerations, evaluate various opinions, incubate ideas, or give them up in order to search for other ideas. This constant evaluation, modification, and adjustment of perspective will continue to produce new solutions. Then, after thorough analysis and comparison and through convergent thinking, a feasible idea will emerge.

Idea Development

At this phase, the design and concept of new culinary ideas are interpreted into actual drawings or words. Technical difficulties may be encountered during the refinement of the idea, but a surprising breakthrough may often be reached after more thorough introspection or consulting additional information and others' opinions. Obstacles often provide opportunities to improve upon the culinary idea and its feasibility by clarifying the concept and direction.

Verification of Culinary Work

After the development of the idea, it must be executed into an actual culinary work. Initial prototypes often undergo a series of evaluation and modification in taste, production method, ingredients, and cost. Constant testing, comparison, and revision is needed, including a trial of different solutions, modification of cookery techniques, or adjustment of food content, in order to realize the ideal product.

Factors Influencing Food Creativity

Individual and environmental factors have an enormous influence on food creativity (see Figure 2). The environmental factors can be positive or negative. Creativity is nurtured through the interaction between human beings and the environment. Therefore, the environment is an important factor that needs to be considered carefully.

Personality

An innovative culinary artist embodies personal characteristics which are conducive to creative development, including: imagination, curiosity, sensitivity, openness, having a broad array of interests, huge appetite for art, being passionate, self-confidence, taking reasonable risks, achievement-oriented, perseverance, a sense of honor, and having strong motivation. In addition, the artist must straddle creativity in both art and science, think independently and outside of the box, and possess rich professional knowledge and life experiences.

School Environment

An important developmental environment for the culinary artist is the school, the place of nurturing for their ingenuity. The sense of achievement derived from the performance in related courses, activities, and competitions motivate students to invest more time and effort in the field of culinary arts. Participating in culinary activities and competitions in and

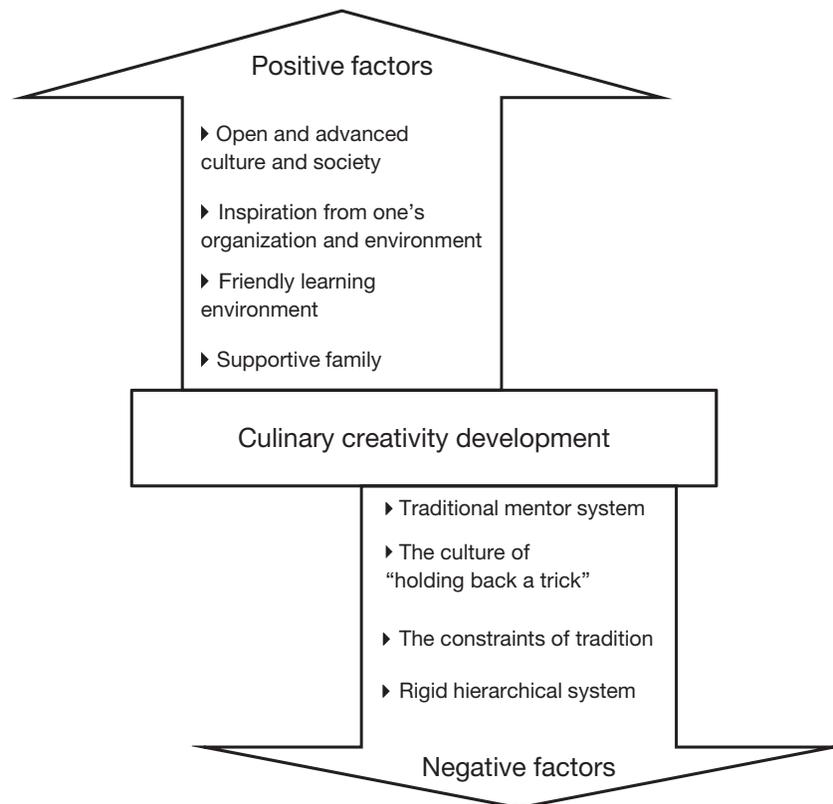


Figure 2 Extrinsic factors in the development of creativity.

out of school provides great opportunities for the students to realize their creativity and learn more about the culinary arts through the guidance and support of teachers. Thus, the school's educational style, courses, teachers, and activities all play a part in the continued development of the student's culinary creativity.

Working Environment

Rich working experience in the culinary arts and in various working environments, such as in Western and Eastern cuisine, pastries, and Japanese cuisine, is beneficial to the development of culinary creativity. Drawing upon the knowledge and skills acquired in various areas of culinary art, the artist can then cleverly and harmoniously blend them in a new conceptual product. Adopting an open leadership style in an organization can nurture a creative environment and stimulate innovation. Creative role models can inspire their peers through the Pygmalion effect, forming a virtuous cycle of self-motivation and improvement. On the other hand, traditional kitchens often operate like a military environment using a hierarchical system which rarely allows lower level chefs to realize or express their creativity.

Social and Culture Environment

In a multicultural region or country, the tastes of various culinary and food styles blend and mesh to create a new flavor. Influenced by a multicultural environment, chefs often have a broader world perspective and more creativity. In fact, many innovative master chefs have experienced more than one culture and created their own unique style out of a multicultural mix. In recent years, the status and image of chefs have become more and more visible as many chefs are transformed into public figures and the main attraction of restaurants. With increased respect for personal culinary style in today's culture, a chef's ability to continue creating astonishing new works is key to his or her success.

Creative Menu Design

A creative menu not only expresses the character of a restaurant, but also serves to attract customers. Creative menu design can be categorized into the following: menu content and layout; and menu presentation and formal design.

Menu Content and Layout

The content of a creative menu should not only be expressed in a language the customer understands, but also introduce creative concepts which fulfill the customer's needs, such as functional foods (environmental or healthy foods), introduction of new eating methods, and foods with rich stories or symbolism. The layout of a creative menu can be arranged in order of the courses, such as appetizer–entrée–dessert, aperitif–appetizer–entrée, or entrée–beverage, etc. Another layout method is to create new combination dishes, such as a wine dine menu.

Menu Presentation and Formal Design

A creative menu with a strong formal design can accentuate a restaurant's characteristics and boost sales by presenting dishes in a way that entices the customer's appetite and desire. Creativity in menu presentation and formal design can be realized in a number of ways, but should always take into consideration the restaurant type, dining psychology, and changes in consumer attitude. Different presentation methods can be adopted, such as booklet form, suspended menus, blackboards, or presenting daily specials in electronic format. Some restaurants even choose not to present a menu, preferring instead to have the culinary artist directly consult and decide on a course based on the customer's desire and needs, and on the fresh ingredients available on that day. Creative elements for the formal design of the menu, including a variety of material, paper, type, font, numbers, and symbols, can all be combined in an infinite amount of possibilities.

Conclusions

Food creativity provides variety and richness in our dining experience and invigorates our food culture. Based on solid cookery techniques, creative food and menus modifies traditional methods, utilizes technological breakthroughs and cleverly combines different ingredients into harmonious and astonishing flavors, presented in an overall display of artistry upon carefully chosen dishware to relate traditional cultural or multicultural concepts. Creative cuisine combines food sciences, knowledge of food preparation, cookery techniques, esthetics, and food culture into a final product of both art and science. During the creative process, the culinary artist draws upon a broad database of knowledge and past experiences and comes up with culinary ideas in the beginning of the creative process through divergent thinking. The idea is interpreted, modified, and refined into a feasible culinary concept, which is then transformed into a product through a series of experimentation. A number of factors affect a culinary artist's creativity, including personality, educational role models, encouragement from related competitions and courses, the work environment, creative atmosphere resulting from open leadership, and the social and cultural environment. A multicultural environment is more able to stimulate new ideas and works from a culinary artist.

See also: Creative Environments, Conditions, and Settings; Design; Incubation.

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The Four Ps of Creativity: Person, Product, Process, and Press

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Glossary

Alpha press Environmental pressures that have an impact on behavior independently of the individual's interpretation of them.

Beta press Environmental pressures that have an impact on behavior only if perceived by the individual and meaning is assigned to them.

Four Ps Person, product, process, and press (or place) approaches to the study of creativity.

Persuasion The view that creative individuals and products change the way that people think.

Potential The capacity for something, such as creativity, but not actually employing that capacity. A person has the potential for creativity *or* performs in a creative fashion, but not both.

Introduction

Creativity has been tied to everything from artistic achievement to entrepreneurship to cultural evolution. It may very well represent one of the most basic and important human capacities, as evidenced by its role in so many and such diverse domains and endeavors. The list of endeavors and domains would go on for pages if given in its entirety. No wonder there is so much research on the topic – and an *Encyclopedia of Creativity*. Given the large amount of research on the topic, it is also not surprising that there have been several attempts to organize the field. Perhaps the best known effort is that of Mel Rhodes, who in 1962 published *'An Analysis of Creativity,'* within which was an organizational framework that is still widely cited, even 50 years later. There have been modifications to this framework, which are summarized below, after Rhodes' original scheme is presented. This review of Rhodes' 'Four Ps' and subsequent organizational approaches has several functions. Not only does it provide a way of distinguishing the different perspectives on the topic of creativity. It also suggests where new research might be needed.

The Four Ps

Rhodes is famous, within creativity studies, for his identification of the Four Ps. These are categories, or what he called strands, in the creativity research. Each strand represents a unique perspective on creativity. The four Ps are Person, Process, Product, and Press. The last of these is now often called Place, though this is not entirely consistent with what Rhodes meant. He used the term 'press' because it was common before 1961 to view influences on human behavior as pressures. Murray seems to have gone into the most detail about press factors and distinguished between alpha and beta presses. The former are a part of the objective world. The latter have an impact only when an individual interprets them as significant. This distinction is entirely consistent with what the cognitive sciences say about perception. It is a matter of interpretation, and events and stimuli generally have no impact unless the individual attributes significance to them.

Person and Personality

Research on the creative person often looks to personality. It may also examine intellect, temperament, physique, traits, habits, attitudes, self-concept, value systems, defense mechanisms, and even idiosyncratic behaviors. Much of the research is intended to identify creative individuals, often by comparing someone with the profile of a highly creative person. Obviously there is no guarantee that if one person shares traits with a creative individual that he or she will also be creative. In fact, just because one person has demonstrated creativity there is no guarantee that he or she will continue to do so. It could be that the individual had the potential to be creative, perhaps because of certain traits, and when in the right environment was in fact able to perform in a creative fashion; but when removed from that environment, the support may be lacking and creativity is less likely. This is close to what personality psychology calls the Trait X State interaction. The idea is merely that traits interact with situational states to govern actual behavior. Actual behavior is not controlled by one or the other, traits or states, but only by the interplay of them both.

Interviews, personality tests, and in-depth case studies have all been used to identify the core characteristics of creative individuals. Each approach has strengths and weaknesses. Personality tests, for example, are often self reports, and as such may be biased by honesty, memory, and socially desirable responding. Case studies allow triangulation and detail but there are sampling biases and few controls. That being said, there is a fair consensus about a few characteristics, including intrinsic motivation, wide interests, curiosity, autonomy and independence, and flexibility.

Even here, domain differences need to be taken into account. A great deal of research suggests that the traits that are common to one domain, such as mathematics, may differ from other domains, including the arts, science, and so on. Additionally, there are several reports of creative persons having paradoxical personalities. These are apparent when creative individuals have one tendency, but also the opposite tendency! A good example of this is psychological androgyny, which is defined as being open to both stereotypically masculine and feminine tendencies. The androgenous

person may, for example, be sensitive but also quite independent.

It is possible that this capacity, and perhaps even the more general appearance of a paradoxical personality, is a reflection of some overarching trait, such as flexibility. The person might be flexible, or perhaps tolerant, and as such goes through life spontaneously, where ever that leads, without worrying about maintaining a consistent stance. If this reasoning is accurate, it implies that the paradoxical personality is the result of some deep tendency and not necessarily the determining factor in creative performances. Both creativity and the paradoxical personality could both be the results of flexibility or tolerance of ambiguity, just to name two possibilities.

The Creative Process

While the 'person' approach to creativity focuses on 'who is creative', the process approach asks 'how are insights and new ideas found?' Often the question of 'how' is answered by pointing to the stages of work and thought. In fact, this brings us to another famous resource in creativity studies, to go along with that of Rhodes – namely *The Art of Thought* by Graham Wallas. He described four stages of creative process: preparation, incubation, inspiration, and verification. Preparation is composed of the steps of observing, listening, asking, reading, collecting, comparing, contrasting, and analyzing information so that the individual is ready or 'prepared.' Incubation, the second step, is supposedly necessary, however, and this means that the person takes time away from the task and allows the subconscious to operate. Part of the benefit here seems to be that many of the constraints and censors imposed by the conscious mind are relaxed during incubation so a wider range of options can be considered. Then there is the third step, which is illumination. This is where the insight actually makes itself know. There is an 'ah ha' as the original idea pops into consciousness. Interestingly, the sudden appearance of the idea may imply that insights are quick or sudden, but Howard Gruber's careful research on discovery indicates that they are actually protracted and cover quite a bit of time. Since the person is incubating, and not conscious of the work on the topic, he or she does not realize that insights are protracted. They feel sudden but are not. The last stage, for Wallas, is verification. Here the idea is tested and applied. There may be recursions, however, if the idea falls short. The individual might revisit earlier stages, preparing anew or taking more time for incubation.

There is an interesting overlap of process and personality perspectives on creativity. Personality research often identifies flexibility, openness, and risk tolerance, for example, and each of these is easy to relate to creative thinking. Flexible ideation, for example, may very well lead to original insights and allow an individual to avoid the ruts and routines that make creative problem solving difficult. Openness allows ideation to move into different and perhaps divergent directions, and tolerance allows the person to consider unusual, unconventional, and contradictory lines of thought. These same points of overlap have also been identified in research on creative places and the press factors that support creative thinking.

Press Factors

The term, *press*, refers to factors that have a potential influence on behavior. Some things in the environment have an influence regardless of the individual's interpretation of them. Loud noises, for example, lead to reactions and can certainly be distractions. In fact, the best examples of such 'alpha press' factors are those that depend on our sensory systems, for these operate reflexively. The human cognitive system begins with such sensory information, but the individual only becomes aware of what is in the environment if something demands attention and is then processed further into the system. Meaning is assigned at that point and an interpretation constructed. Many environmental factors depend on interpretation. Noises that are not loud enough to be disruptive, for example, might be music to one person but aesthetically unappealing to his or her parents! Environmental factors which depend on interpretations are beta press factors.

Most environmental influences on creative behavior are more beta than alpha press. Admittedly obnoxious sensory stimuli will preclude creative thinking via distraction or perhaps even discomfort, but at least among the factors examined in the research, interpretations are critical.

Many press aspects of the classroom environment have been examined. At least as many press aspects of the organizational setting have been investigated. These suggest that resources can be quite important. They include material resources, as well as social resources. Time is especially important, in part because original ideas may require incubation or at least time to associate and consider alternatives. Time exemplifies the idea of press since people can be under pressure from deadlines. Note also that some people work well under pressure, while others prefer to take their time and are distracted by deadlines. The key social press factors include support for new ideas, challenges, trust, and permissiveness and latitude that supports risk taking.

Studies of press factors have demonstrated that there are both supportive aspects of the environment, such as those listed above, but also things that can inhibit creative efforts. Ruth Richards, in her article on the 4Ps that appeared in the first edition of the *Encyclopedia of Creativity*, described how in some settings, including education, it can be difficult to support innovation and creativity. After all, there is quite a bit of accountability in current education, at all levels, and educators must have clear objectives and objective assessments that can be used with all students. There is pressure on conventional knowledge as well as conventional behavior, and to accomplish what is required by the mission of a school system, uniqueness and individuality are frequently relegated. Richards also made the important point that innovation and adaptability, two benefits of creativity, are of increasing importance. Things are changing at an accelerated rate, so creative talents are of even more importance today than ever before.

Products

The term, *product*, refers to a tangible form converted from idea. Creative products may be paintings, poems, novels, inventions, designs, or patents, or they may take another form. Sometimes performances are considered to be products,

in which case they are not really tangible, though they can still be counted. That is probably the outstanding virtue of products: they allow highly objective analysis. The problem is that they may not be very predictive. Sometimes the past is indicative of future efforts, but not always. Additionally, products say little about the actual creative process.

Some research on products is intended only to examine the product and draw no inferences about the creative process or the talents and efforts that went into the product. The Creative Product Matrix, for example, contains a list of dimensions that allows comparison and ranking of various kinds of products.

Many studies of creative products involve eminent persons or experts. This makes sense because they are very likely to be productive. Consider, for example, the research on scientific creativity. Products may be publications and citations to them. The latter would be indicative of the quality of a scientist's work because higher quality research is the most likely to be cited by others working in the field. Studies of publications as products suggest that there are advantages to interdisciplinary work – some highly creative scientists being polymaths – and that a minority of the field produces the lion's share of the research. This last finding is known as *Lotka's Law*.

Persuasion

Various lines of research have suggested that the actual insight, produced by an individual, is only one part of creative achievement. Clearly, there are social factors involved in creativity, and some of the most important are the judgments and attributions to a new idea or product. Dean Keith Simonton took a social perspective on creativity and defined it specifically in terms of *persuasion*. This label fits nicely into the alliterative scheme (as a fifth P), but more importantly acknowledges social and historical factors. Put simply, from this perspective, creative achievements are those that change the way that others think. They are in that sense persuasive.

Simonton's extensive empirical research on social factors also supports Lotka's Law, but goes well beyond that. He has tested a large number of cognitive, developmental, and historical hypotheses and derived several compelling *nomothetic theories* about creativity and its impact. Nomothetic theories apply broadly, often across historical eras and, to a certain degree, across cultures. They parallel what are sometimes called universals and can be contrasted with *idiographic theories*, which focus on how individuals differ from one another.

Persuasion is also assumed by social theories that focus on attributions as part of the creative process. Attributions of creative value may be given by judges and individuals making up a field of study. The idea here is that an individual may produce something with creative potential, but if judges do not attribute creativity to it, very likely it will have no impact and may very well be ignored and forgotten. If this line of thought holds up, there would be reason to direct one's creative efforts not just to the product, but also to impression management that will increase the likelihood of favorable attributions. This notion has been criticized since it suggests that an individual might benefit from taking time away from creative work so there is time to manipulate attributions. Still, case studies sometimes confirm that eminent creators tend to care a great deal about how their work is received.

Creative Potential

Each of the perspectives reviewed have been organized into a hierarchical framework. This is presented in **Table 1**. Of most importance may be the placement of creative potential and creative performance at the top of the hierarchy. The rationale for this is that many factors, including those describing the creative person and the press factors, may influence creative effort, but do not always do so. They therefore describe creative potential but do not guarantee actual creative performance. Products, on the other hand, are end results. An actual performance is required. Similarly, new ideas and products are only persuasive if they are complete, or at least manifest. A performance is again required and potential has been fulfilled, or at least actually utilized. There is, then, a fairly clear separation between perspectives on creativity that describe potential and those that describe actual performance. It is even possible that a chronology of sorts can be hypothesized, with particular traits providing creative potential that is then supported by various press factors, the result being that a product is created and it earns social attributions of 'creativity.'

There are advantages to the study of those things categorized in **Table 1** as indicative of creative potential. The most notable is probably that something might be learned about how to fulfill potentials and thereby increase creative productivity. Given the role of creativity in psychological and physical health, and in technological and cultural evolution, this is definitely a desirable objective. No wonder there are so many programs, techniques, and theories about enhancing creativity. The advantage of research on actual performance and those things on the right side of **Table 1** is that there is a high level of objectivity. There is often a consensus about creative things, for example, and little ambiguity. The problem with some performance approaches is that, to apply what is learned we must draw inferences from the past to the future. Sometimes these are warranted, but other times there is a risk in inferring that just because Hemingway enjoyed travel or Einstein played a musical instrument that travel and music will benefit everyone and always enhance creativity.

Table 1 Hierarchical framework for the study of creativity

<i>Creative potential</i>	<i>Creative performance</i>
Person	Products
Personality	Patents, inventions, publications, works of art
Traits, Characteristics, Idiosyncrasies	Ideas
Process	Persuasion
Cognition	Historical impact
	Systems
	Individual-Field-Domain
Press	Attributions and Social Judgement
Distal influences	
Evolution	Interactions
Zeitgeist	State X trait
Culture	Person X environment
Immediate influences	
Environments and settings	

Conclusions

There are several intersections among the six Ps reviewed in this article (person, process, place, product, persuasion, and potential). This is clearest in the case of products and persuasion; both apply nicely to eminent creators and assume a social component. Another example involves process and person categories of research. Personality research has identified several tendencies (e.g., flexibility) that have also been uncovered in studies of the creative process. Press and place research fits here as well since it points to factors in the environment that support the same traits. Importantly, environments that support creative efforts offer certain things and avoid others. There are both supports to creativity as well as barriers. Both should be taken into account to facilitate creative efforts. Also recall that the impact of environmental factors is frequently moderated by perceptions and interpretations. These are by definition constructed by each individual, so recommendations that apply across all people or settings and organizations are difficult to make.

The hierarchy in [Table 1](#) is skeletal but nonetheless underscores the fact that some perspectives on creativity assume that only manifest performances are important, while others recognize the more personal side. It is possible to

take both into account, almost in a developmental manner, such that what is important at first is creative potential, but if the supports are present (perhaps in creative press and places), that potential might be fulfilled and actual creative performance result. The creative performance may very well be apparent in actual products, and perhaps in performances that have impact and persuade an audience to change the way it thinks. This certainly is a practical implication of the various perspectives on creativity; it would be to everyone's advantage if creative potentials were in fact fulfilled and creative products and performances common occurrences.

See also: Creative Products.

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Sigmund Freud 1856–1939

Psychiatrist

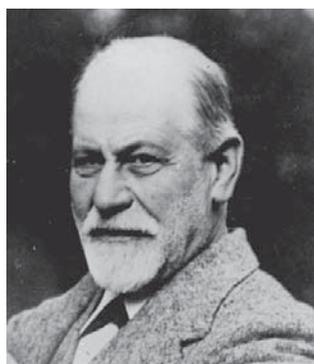
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SIGMUND FREUD was the creator of psychoanalysis. Psychoanalysis is a form of psychotherapy, a set of methods for collecting data on human behavior, and a system of psychological theories. Freud developed a variety of concepts that have become central to the understanding of creativity, including unconscious motivation, sublimation, defense mechanisms, and the resolution of neurotic conflicts through creative activity. Though Freud's ideas have been often modified, criticized, and challenged since his death, psychoanalysis remains the most broadly influential approach to the study of creativity.



Sigmund Freud. Used with permission from Snark /Art Resource, NY.

Background

Freud was born on May 6, 1856, in Freiburg, Moravia (now Příbor, Czech Republic). His father Jakob was a 41-year-old wool merchant who had two adult sons from a previous marriage. Freud's mother, Amalia, was 21 years old at the time of his birth. Sigmund, her firstborn child, was followed by six more children, five of whom survived to adulthood.

The Freud family moved to Vienna amid serious financial difficulties when Sigmund was nearly four. As Jews, they lived in the Jewish ghetto of a predominantly Roman Catholic city. Sigmund remained in Vienna for all but the final year of his life. Though he proclaimed his hatred for it, the city was a center of European culture, science, and politics. Sigmund was his mother's favorite child, whom she called her "golden Sigi." She often repeated a gypsy woman's prediction that he would be a great man. His father was not so optimistic; when the 7- or 8-year-old Sigi urinated inappropriately in the parental bedroom, Jakob Freud exclaimed, "The boy will never amount to anything!" Sigmund soon began to fulfill his mother's expectations. In Vienna he attended a classical German-style *gymnasium* (an advanced secondary school), where he was inspired by the

works of such great writers as Goethe and Wordsworth, plus scientists such as Darwin. His school performance was outstanding; at age 17 he entered medical school.

Early Adulthood

As a medical student at the University of Vienna from 1873 to 1881 (with a year out for required military duty), Freud received not only a basic medical education but some of the best training in scientific research that Europe had to offer. The professors with whom he worked closely were distinguished in their fields, and Freud was expected to follow their paths in anatomy and physiology: Carl Claus, Hermann Nothnagel, Theodor Meynert and Ernst Brücke. However, in contrast to much of today's scientific training (especially in psychology), the research skills Freud developed there were not experimental or correlational but observational, mainly involving dissection and microscope work. Freud became a scientist without ever performing a controlled experiment. His initial interest was in physiological research; his first published paper answered a long-standing question by establishing the presence of testes in the male eel. His other research topics included the nerve cells of fish and crayfish. Freud was one of the first scientists to suggest the general outlines of the modern neuronal theory of the nervous system. Later in his life, long after he had abandoned physiological research altogether, Freud continued to compare his explorations of the deeper layers of the unconscious to the process of peeling away surface layers of skin or tissue—the kind of thing he had done as a physiologist when he was trying to get at a nerve cell.

Though Freud was regarded by his professors as a promising neurophysiologist, this was not a career in which he could make enough money to support a family. He had already fallen in love, not long after he completed his research training, with a young woman named Martha Bernays. Therefore his professors advised him to go into clinical practice, specializing in neurological problems. Getting the necessary clinical experience and establishing a practice took him four years beyond medical school, during which time he and Martha remained engaged though often apart. Among the factors that frequently separated Freud from his betrothed was his continuing effort to obtain the most progressive training available. He traveled to Paris to observe the treatment of hysteria and other psychological syndromes by the great Jean Martin Charcot, and to Nancy (also in France) to study the hypnotic techniques of Hippolyte Bernheim. In his own early psychiatric work, Freud became an expert on aphasia (an assortment of syndromes involving the inability to speak) and a respected authority on childhood paralyses. When

he began to treat patients whose main symptoms were evidently psychological rather than physical, Freud administered the latest therapies—such as electric shock and hypnosis—but found them unsatisfactory. Then he tried a technique developed by another prominent scientist, Josef Breuer, who was already a fatherly friend and mentor to Freud. Several years earlier Breuer had treated a friend of Martha Bernays, with some success. That patient later became a pioneering social worker under her real name of Bertha Pappenheim, but she has gone down in psychological history under the pseudonym of Anna O.

The Beginnings of Psychoanalysis

When she came to Breuer for treatment, Anna O. was suffering from a variety of paralyses, aphasias, inhibitions, and periods of confused thinking. Breuer found that if he asked Anna under hypnosis to talk about the original circumstances associated with each of her symptoms, she reexperienced the circumstances vividly and her symptoms were thereby relieved. When Freud subsequently tried a similar procedure on his own patients, he soon gave up hypnosis. Instead, he simply (or perhaps not so simply) insisted that his patients tell him, as fully and with as little mental censorship as possible, what came into their minds whenever they began to think of their personal problems. Thus was born the practice of free association, the earliest element of psychoanalysis as a general therapeutic technique.

Over the next several years, Freud developed an array of techniques that became essential both to psychoanalytic psychotherapy and to Freud's accumulation of psychological data as a foundation for his development of psychoanalytic theory. While encouraging free association, Freud found that his patients were often more willing to free-associate to their recent night dreams than to events of the day. When he got them to free-associate to each element of a dream, he saw emerging patterns that revealed the patient's underlying motives and psychological conflicts. In the process of engaging in such dream interpretation, as well as having patients free-associate to slips of the tongue, to temporary forgetting of names or words, and to other psychological anomalies, Freud developed a general approach now known as the "intensive study of the single case."

Freud did not try to study large numbers of similar individuals at one time, as in the standard psychological experiment or survey. Instead, he closely examined one patient at a time. "Intensive study" has two meanings here. One is that Freud obtained a great deal of information on any particular individual. He typically saw each patient for three to six hours per week for anywhere from several months to several years. During the hundreds of hours of each patient's free associations, then, Freud could observe changes in the patient's behavior and memories, could double-check his developing hypotheses, and could alter those hypotheses as new developments emerged. The other meaning of "intensive study" is that Freud was not content to accept new information from a patient as it first appeared, or to categorize it in terms of superficial criteria. If certain information supplied by the patient seemed to have no immediate significance, Freud probed further into the patient's memories and free associations. He checked out possible connections with other material

provided by the patient, and generally tried to relate the information to an organized and coherent picture of the patient's personality. Freud constantly evaluated the material's internal consistency—the omissions and contradictions evident in the patient's statements. He sometimes compared himself to the great fictional detective Sherlock Holmes, tracking down tiny clues that might lead to the solution of a crime—or in Freud's cases, tracking down clues that would lead to a fuller understanding of a patient's psychological problems.

In addition to dream interpretation, free association, and the intensive study of the single case, Freud developed two other techniques to obtain data salient to his theories. He was quite aware that his severely neurotic patients were not a random sample of the human race, and that he could not base a general theory of personality entirely on them. Neither, however, could he reasonably expect mentally healthy individuals to volunteer the most intimate information about their psychological functioning as part of a research study. Therefore Freud turned to other sources of data that were readily available: first, himself, and second, works of art.

His self-analysis was, according to his friend and biographer Ernest Jones, "one of the two great deeds of Freud's scientific life." (The other great deed was the development of the free association method.) The German researcher Hermann Ebbinghaus had already discovered several basic laws of learning and memory by studying himself as he learned and forgot emotionally neutral stimuli. Now Freud proposed to examine, as objectively as possible, his own memories of such highly unneutral topics as his love and hate toward his parents and siblings, his most repulsive desires, and his most shameful behavior, all the way back into early childhood. When Freud found the same kinds of emotional conflicts and irrational urges in himself that he had discovered in his most neurotic patients, he came to feel that his hypotheses about personality were essentially correct and broadly applicable.

Freud was aware, of course, that even adding himself to his sample of late-19th century Viennese patients did not provide sufficient basis for generalizing his conclusions to all humankind. But Freud also read and studied a wide range of the world's creative writers, from the ancient Greeks and Romans (especially Homer, Sophocles, and Virgil), through more recent masters (including Shakespeare and E. T. A. Hoffmann), to such contemporaries as Mark Twain, Fyodor Dostoyevsky, Rider Haggard, and Arthur Schnitzler. Their work teemed with detailed depictions of psychologically complex characters, who exhibited much the same motives and behavior as Freud kept finding in his patients and himself. He saw such literary creations as valuable confirmation by other brilliant thinkers of his own hypotheses. When even mediocre writers offered characters who described their dreams and fantasies in detail, as in the German novelist Wilhelm Jensen's popular romance *Gradiva*, Freud took such works as additional instances of unconscious motives expressed in conscious behavior, both by the fictional characters and by the writer.

A core concept in Freud's early psychoanalytic theories is named after a literary work: the *Oedipus complex*. Freud's reference here is to Sophocles' play *Oedipus the King*, written 2300 years earlier. The play depicts what modern audiences typically perceive on first viewing as a strange set of events: a Greek king, warned by an oracle that his newborn son will

eventually kill him, takes the baby into the countryside and leaves him to die. The infant Oedipus is saved by a shepherd and is then raised by adoptive parents. As a young adult, Oedipus finds himself in circumstances where, unaware of the family relationships involved, he kills his father the king and takes his mother the queen as his wife. Upon discovering that he has committed patricide and incest, Oedipus blinds himself in shame over his terrible acts.

Why, Freud asked, does this ancient play from an unfamiliar culture remain so disturbing to us? Because, as Freud answered his own question, Sophocles captured in the play's characters and symbolism a set of feelings that most of us experience in childhood but have driven deep into our unconscious: a desire to monopolize the body and the attention of our opposite-sexed parent, and to eliminate our chief competitor, the same-sexed parent. Freud saw a similar emotional pattern in the most powerful work of the greatest English-language writer, Shakespeare's *Hamlet*. From early in his psychoanalytic practice, Freud had been aware of the power of sexual motivation, as well as of his patients' struggles to keep it under control. They often tried to avoid thinking about sex altogether, though without complete success. The repression of distressing childhood sexual experiences was so consistently a problem among his patients that Freud formulated what he called the "seduction hypothesis": the idea that severe neurosis always originates from a child's "seduction" or sexual initiation by an older sibling or adult. In repressing such memories of early sexual abuse, the child removes important aspects of his or her sexuality from conscious access, with various unfortunate impacts on later adult behavior and psychological functioning.

After several years of psychoanalytically rescuing these early memories of sexual abuse from repression, Freud began to doubt their literal truth in a number of cases. They were just too frequent, he felt, and in certain instances they appeared to be contradicted by other kinds of biographical evidence. Freud therefore gave up his initial seduction hypothesis in large part (though he never abandoned it completely, as some critics have charged). He turned instead to his newly formulated concept of the Oedipus complex. Freud now argued that the child naturally comes to focus sexual and aggressive feelings on the most convenient and emotionally charged objects, his parents. He proposed that the four- or five-year-old child typically fantasizes about sexual or sensual contact with the opposite-sexed parent, and that the child as adult later recalls such fantasies as real events (under pressure from the eager psychoanalyst). Freud was thus the first person to recognize that some retrospective reports of abuse are actually signs of what is now called a "false memory syndrome," just as he had been the first person to pay serious attention to the long-term psychological effects of childhood sexual abuse. He has also been the only person to be criticized from both sides of the current controversy over such matters—that is, to be criticized both for treating his patients' reports of childhood sexual abuse as sometimes false, and for treating them as sometimes true.

During the course of considering the role of sexual motivation in personality development, Freud came up with another concept that remains important in discussions of creativity: the process of sublimation. Sublimation was not an entirely original concept with Freud, but he made it his own, and he

considerably elaborated earlier and more casual uses of the term. According to Freud's initial conceptualization, sexual urges that are not permitted direct expression will go in one of two directions: they may be converted into anxiety and other neurotic symptoms, or they can be expressed in creative work and other culture-building acts. The process of redirecting sexual energy (as well as, to some degree, aggressive energy) into creative acts was what Freud called sublimation. It can never completely satisfy an individual's sexual desires, according to Freud; only actual sexual intercourse can do that. But he viewed sublimation as certainly a better way to gain indirect sexual satisfaction than through neurotic symptoms, and at the same time he regarded sublimation as the chief source of human cultural accomplishments.

Freud had personal reasons to consider the effects of incompletely expressed sexual urges at this time. He and his wife had quickly established a family; Martha gave birth to six children during the first eight years of their marriage. Sigmund and Martha Freud had attempted by various means to prevent the conception of the later children—especially the sixth, the daughter they named Anna—but every birth control method they tried had failed. Finally, after Anna's birth, husband and wife simply stopped having sexual relations. Sigmund was 39 at the time and Martha was 34. During the first several years after their sexual relationship ceased, Freud experienced an explosion of creative ideas. It is probably no accident that one of these ideas was his concept of sublimation as the creative transformation of unexpended sexual energy. (Certain of Freud's critics, beginning with C. G. Jung, have accused him of conducting an affair with his sister-in-law during this period, and have argued that the supposed affair may have influenced his ideas about sexual motivation and other matters. The evidence for such a relationship is highly speculative at best, and there are much clearer sources for Freud's principal theoretical concepts.)

Psychoanalysis: The Middle Years

For Sigmund Freud, psychoanalytic theory was not a static body of ideas but a constantly growing and changing structure. Freud first conceptualized the personality as composed principally of consciousness, of a deep unconscious that contains our basic urges and repressed memories, and of a preconscious that includes temporarily forgotten or ignored memories. As his theories developed, Freud began to differentiate aspects of the psychological structure more clearly: the id, a completely unconscious mass of primitive biological urges which insists on immediate sensual gratification; the ego, largely conscious but with unconscious components, mediating between the id and external reality; and the superego, the internalized representative of the parents' (and through them, of society's) moral standards. In this middle-phase formulation by Freud, the id controls most of the personality's psychological energy; the relatively weak ego struggles constantly to delay or redirect the id's demands, through repression and other psychological defenses; and the superego tries with limited means to block the id's more outrageous demands completely.

As his theories changed, Freud's therapeutic treatment objectives shifted as well. Where he had sought mainly to encourage the patient to express previously hidden memories and desires,

he now began to analyze the patient's transference of early emotional patterns onto Freud himself. Freud had at first experienced such transferences as an annoyance and an embarrassment, since they often took the form of female patients falling in love with him and even throwing themselves at him physically. In time he came to recognize that he was serving these patients as a target of displacement for feelings originally aroused by parents and other figures from early childhood. (Freud's male patients redirected their emotional patterns toward him too, but they more often did so by making him the object of unreasonable hostility.) By bringing to a patient's attention the transference patterns expressed toward the therapist, and by working with the patient to develop an understanding of the patterns' origins and their current inappropriateness, Freud felt he was able to gain much more extensive and lasting therapeutic success than through his previous efforts.

It took him a while longer to recognize that in addition to each patient's transference of emotions onto him, Freud was engaging in a constant process of countertransference of his own long-established emotional patterns onto the patient. This recognition enabled Freud to overcome previously unacknowledged or uncontrolled difficulties in the therapeutic interaction. Finally in this sequence of new recognitions, Freud came to realize that transference and countertransference are not limited to the interaction of therapist and patient, but extend through all human social interactions beyond those of child and parent. With this recognition, Freud finally achieved what he regarded as a general psychology of human personality. For several years before and after his 50th birthday, Freud felt that he had become creatively exhausted and was experiencing a decline into old age. During this time he revised his ideas about sublimation to say that only students were able to make effective use of unexpended sexual energy, and then only to fuel their studies; sublimation was of no use to creative artists or theorists. Then Freud experienced a brief resurgence of his own sexual urges, and at the same time he began to write his longest treatment of creativity, his psychobiography of Leonardo da Vinci. [See DA VINCI, LEONARDO.]

According to Freud, Leonardo as a child lived with his single mother, felt sexually aroused by her before he could deal effectively with such feelings, and at the same time strongly identified with her. In attempting to manage such complex emotions, Leonardo as an adult became a celibate homosexual, expressing his sexual desires both for his mother and for young boys mainly through his painting. Eventually his super-ego forced him to steer away from even the indirect artistic expression of these morally and socially unacceptable urges. Leonardo shifted his attention to focus for a while on his scientific research, a less obviously sexual use of his psychological energy. Then, at about the same age that Freud had reached at the time of writing, Leonardo experienced a rearousal of his repressed desires for his mother, stimulated by the woman now known as Mona Lisa. Leonardo thereby regained his artistic creativity in midlife, and maintained that creativity into old age. Freud too experienced new creative urges at this time in his own life, and over the next three decades he formulated further important revisions in psychoanalytic theory.

In addition to a degree of sexual renewal, Freud experienced another kind of psychological stimulus in midlife: the acquisition of a band of disciples, who endorsed Freud's ideas and

who practiced therapy under his tutelage. The most important of these followers was Carl Gustav Jung, a Swiss psychiatrist who was Freud's closest friend and colleague from 1907 to 1912. Jung influenced Freud to give more weight, for a time, to ideas about inherited symbolic configurations and behavioral tendencies, which Jung called arche types. But after 1912, Jung went off to advocate a distinctive version of psychoanalytic theory and therapy, in which creative activities were seen largely as variations on those inherited archetypes. Freud then reemphasized his own previous concepts of creative patterns as emerging out of the crucible of the individual's early family life.

Psychoanalysis: The Later Years

Though Freud continued to worry about the effects of age and illness on his own creativity, the years from his late fifties into his seventies were among his most productive. In terms of broad theoretical tendencies, he placed increasing emphasis on the power of the ego to control the unruly id, and on the psychological importance of the person's interactions with other individuals—emphases that were amplified and modified by later psychoanalytic theorists, who called themselves ego psychologists or object-relations theorists. In terms of his thinking about creativity, Freud moved from: (a) early concepts about artistic works principally as symbolic expressions of unconscious motives and conflicts, to (b) artistic works as also involving the artist's conscious manipulation of the audience's aesthetic responses, in order to lead the audience into close contact with potentially disturbing latent content, to (c) the artist as using his or her art to confront and creatively resolve the artist's own psychological problems. Freud discussed both Leonardo and Michelangelo as examples of the latter process, which has been referred to by later theorists as a restitutive or restorative use of art by the artist.

Freud's essay on Michelangelo's statue of Moses, in which Freud appears to identify strongly with Moses as a man who has reached an inner peace after the backsliding of his followers, was written on the eve of World War I. The war brought great physical deprivation to Freud and his family, as well as anxiety about his sons who were fighting in the war and distress over the deaths of relatives, friends, and ex-patients. Freud had already begun to elaborate his concepts of the id's basic drives, which he had originally conceptualized as including both self-preservative drives and species-preservative (sexual) drives. Now he perceived a new division, between the life instincts (self- and species-preservative drives together) and the death instincts (including self-destructive and other-destructive urges). The horrors of the war solidified the position of this new drive schema in Freud's theoretical system. In his first postwar book, *Beyond the Pleasure Principle*, Freud proposed that a more basic urge than the desire for pleasure is the "compulsion to repeat" earlier states of being, even unpleasant ones—a compulsion that ultimately drives us to restore our original state of being, which is zero stimulation or nothingness. This theoretical postulate (or, as Freud described it, this "speculation") led Freud to his grimmest pronouncement: "The aim of all life is death." But in spite of his assumption that the death instincts will triumph within all of us in the end, he maintained the companion assumption that the life

instincts will continue to struggle against the death instincts for as long as possible, and can give us considerable pleasure along the way. In the 1920s, Freud achieved worldwide fame as the greatest psychological theorist of all time—much to the dismay of Jung and other theoretical dissidents. Freud's ideas had increasing impact on novelists, poets, painters, sculptors, and filmmakers, who incorporated Freudian dream symbolism or free-associational content into their work. As W. H. Auden put it in a famous poem, Freud was "no more a person / now but a whole climate of opinion / under whom we conduct our different lives."

But Freud's fame did not prevent the Nazis from targeting him as a Jew, or from burning his books. Freud narrowly escaped from Austria as the Nazis solidified their hold there in 1938. He and his daughter Anna moved to London, where Freud continued to write during the final year of his life—working especially to complete a speculative work that he first titled, *The Man Moses: A Historical Novel*. Translated into English as *Moses and Monotheism*, this book was not really a novel, but a creative consideration of the origins of the Jewish people. Had Moses really been born as a Hebrew slave and raised as Egyptian royalty (as the Bible says), or had he been born and raised as a member of the Egyptian royal family, who then adopted (and was adopted by) the Hebrews as their spiritual and political leader? In proposing the latter answer to his own question, Freud developed a preliminary theory of charismatic leadership that has been elaborated by Saul Friedländer and others.

Freud died of cancer in 1939, in the midst of work on a final *Outline of Psychoanalysis*. After his death, his major ideas and certain minor ones have retained their power to stimulate the thinking of many other theorists and psychological

practitioners—and to provoke what Freud called "continued resistance" to these ideas. (Others would call it criticism or hostility.) Though few psychologists and psychiatrists now wholeheartedly accept Freud's specific versions of theory and therapy, most current personality theories and psychotherapies incorporate his broad positions at some level. His influence is most strongly visible in two areas: first, in the academic practice of critical and cultural theory, plus psychobiography and psychohistory, and second, in our society's most widespread conceptions of personality, which include many "pop psychology" versions of unconscious conflict, the retention of the "inner child," psychological defenses such as denial and reaction formation, and the variously named contrasts between male (rule-oriented) and female (relationship-oriented) personality patterns. Every few years—sometimes every few months or even weeks—a new book or magazine article announces that Freud is dead and that his ideas are in total disarray. But such repeated insistence on his death suggests that Freud is still a very lively ghost, continuing to haunt our most anxiously and aggressively defended ideas of our own basic nature.

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Friendship and Creativity

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Glossary

Collaboration To work with another or others on an intellectual or creative endeavor, focused on a product or performance.

Conflict Mental struggles based on opposing or incompatible internal needs, desires, or feelings as well as on external forces, such as competition or power.

Domain A body of organized knowledge, skills, and traits underlying a discipline, requiring specific preparation to reach high levels.

Eminence A position of high rank or prominence socially bestowed by the field of endeavor.

Follower One in the service of another; a fan, devotee, or enthusiast.

Friendship A voluntary caring relationship between two or more persons who are not kin that is emotionally based, nonrational, and promotes mutual support, feelings of interconnectedness, and self-esteem.

Peers Belonging to the same group in society, typically by age, status, or culture.

Power Possession, control, or influence over others.

Validation The process of confirming, supporting, and accepting the value of another's work or being.

The role of friendship in the lives of creative individuals has had very little systematic research attention. In fact, friendship is a neglected research topic throughout the social and behavioral sciences, according to philosophers Sandra Lynch and James Grunebaum, and it has been overlooked in research on collaboration as well. Although most biographies of eminent individuals discuss friends and relationships, little attention has been given to the role of friendship in creative lives.

Defining Friendship

Definitions of friendship vary, depending on whether we are talking about business relationships, childhood buddies, or best friends, each with a set of norms and demands. Early definitions from the ancient Greeks idealized friendship as a virtue and viewed it as only possible between good men. More current views recognize its complexity. Jan Barkas described friendship as a relationship that is voluntary and caring between two or more persons who have no kinship or legal bonds that reinforces self-esteem and a feeling of being needed or liked. Robert Wubbolding viewed friendship as based on the deepest human need for belonging, interconnectedness, and the satisfaction of power. According to James Grunebaum, friendship is based on caring, with willingness to assist or benefit the other. One treats one's friends well, helps and does not harm them. Friendship involves responsibility to receive personal confidences and thoughts, the promise to do one's duty and not defraud or wound. In friendship, there is concern for each other, the sharing of passionate interests, and giving to each other wholeheartedly based on affection and fondness.

Sandra Lynch stated that friendships involve a mutual and reciprocal emotional bond that is at its core nonrational. It involves not just feelings, but knowledge of each other's character, affairs, and personality. On the other hand, she noted that friendship is not necessarily free of self interest. The experience of pleasure, personal gain, or support may motivate such engagement. At the same time, friends are vulnerable to

disappointments, pain, or hurt in their relationships, so trust is important. There are both rewards and challenges in these voluntary relationships.

Professor and creativity scholar, Alfonso Montouri, described his own close friendship, which allows open-ended conversations, exploration of ideas, concepts, feelings, fears, and joys in a spirit of mutual respect, caring, and affection. He noted that through walks and talks with this friend, intuitions and ideas, self-expression, and points of difference and agreement are aspects of their bond that lead to a union of knowledge and are vitally important for creative thought. Yet, he lamented, both organizational and academic cultures in their bureaucratic and often adversarial approaches, mitigate against such exchanges, relegating friendships to the private sphere. He suggested that the safety of exploring not-knowing with an intimate friend, or a discourse as a collective improvisation based on trust, caring, and excitement at being together is a valuable opportunity. For Montouri, as people develop trust and take risks together, are vulnerable and open and admit uncertainties, the quality of knowledge and inquiry is greatly improved and creative capacities supported.

Collaboration and Friendship

Although there are numerous biographies of eminent persons that describe the importance of individual friendships and detail exchanges of letters and ideas, there has been little in the creativity literature that focuses specifically on this important aspect. Jock Abra and Gordon Abra noted that even collaboration among creative individuals has been rarely studied, which they considered strange, given that almost every creative act involves working with others. A book on the topic by Vera John-Steiner, published a year later, addressed the importance of collaboration in creative work and viewed creativity as a social phenomenon, rather than an individualistic one, wherein the collaborative relationship scaffolds the construction of new ideas and also strengthens the creator's sense

of self, providing support in overcoming self doubt and vulnerability.

Abra and Abra specified that most creators communicate with an audience of some kind, implying a kind of collaboration. They also suggested that collaborative relationships may be intimate (such as Watson and Crick) or remote (an orchestra that does not meet the composer). They may be homogeneous (same service, i.e., musicians in an orchestra) or heterogeneous (different, such as the composer, conductor and orchestra members). Collaboration may also be horizontal (democratic, with equal weight, as in Gilbert and Sullivan's productions) or hierarchical, with differences in power and dominance, such as Jerome Robbins' final say in choreography and direction.

However, collaboration is more a required or necessary relationship, such as that between a choreographer and a dancer, or among a group of scientists working on a problem, while a friendship has no formal requirements but results in caring and reciprocal bonding. While collaboration may grow into friendship or vice versa, the two are not synonymous.

Role of Peers

Jean Piaget considered the period of early childhood as the most creative as the child invents the world, trying it out before assimilating through symbolic play and imagination. Likewise, Russian psychologist Lev Vygotsky described the origins of creative imagination and later creativity in the early play of childhood. Play with peers allows the making of errors without sanctions, the stretching of imagination, the trying on of roles. Although some researchers find creative children crave solitude, they also describe the desire and emotional satisfaction that comes from being with others and having friends in order to 'try on different hats.'

Psychologist Howard Gardner, in his study of highly creative lives representing each of the Multiple Intelligences, delineated the crucial aspect of informed peers, who play a supportive and caring role as an essential element in the creative process through their beliefs in the revolutionary ideas of the creators. At the same time, the seven eminent individuals he studied had problems forming deep emotional attachments or close friendships. Friends, spouses, or lovers were important, but more for their contributions to the needs and purposes of the creator, rather than for their inherent value. These creators benefited from supportive relationships during periods of major work toward breakthrough, but caring others were less important once the breakthrough occurred and were sometimes discarded. This implies that the friend or significant other's personhood was less central than his or her supporting role. However, "what has been overlooked is a discussion of supportive persons themselves as creative forces in their own right with the 'object' of creation being the development of others for the greater good: *engendering*", according to Erin Miller and LeoNora Cohen, creativity researchers.

Although more typical among peers, friendships can also be cross-generational, especially those that develop between mentors and their protégées. The relationships can blossom into friendships if values and interest are shared, as noted by Vera John-Steiner.

Domain Basis for Friendships

Often, friendships of creative individuals come from the same or related domain of endeavor. "People become friends because they are passionately and emotionally involved in the same pursuits. They have common ground and become friends because of their common interests," according to creativity scholar, Jane Piirto. Although adult creators often describe great loneliness in childhood, they may develop strong peer friendships in late adolescence, particularly if they are able to learn or work together in their domain, which may sustain them throughout life.

Friendships among creative children are important for development of self-esteem and for intimacy, particularly as students become teenagers. To share passions with like minds is important for well-being, as well as for generation of ideas, testing novel ideas, and growing cognitively and creatively. However, such friendships may be fraught with problems. Creative young people have the need to be valued and to share their interests with others. At the same time, there is a need to have time and space alone to focus on their own work. There is also the competition for the same scholarships or awards, for accomplishment, and the need to be 'the best,' especially among young performers. Such conflicts may lead creative young people to eschew one aspect for the other. How to find a balance that is both personally satisfying and allows for the freedom to create is a challenge.

A Look at One Domain: Music and Friendship

Some fields, such as music, are more conducive to collaboration and possible friendships. Alfonso Montouri and Ronald Purser noted:

Music is an emergent property of other relationships in a group. The organic nature of musical groups can ideally create a situation where the collaboration is enormously enriching, and the music emerges out of the constant interplay of musicians rehearsing, performing, and recording.

At the same time, as noted earlier, there may be a tremendous level of competition, especially among aspiring young musicians where only the best succeed. While the friendships incubated in the conservatory evolve from passion for their craft and field, there is both the need to beat out the competition and the simultaneous need to share the joy of music, according to Judith Kogan and Lauren Sosniack, scholars of music development.

In western music, particularly orchestral, there is a natural tripartite: the composer, the conductor, and the soloists or orchestra. Musical creativity is complex, occurring within a given timeframe and place, involving all three roles, wherein the music is cocreated. This suggests that the relationships among these three types of musicians would necessarily be collaborative, while those relationships among specific instrumentalists (such as violinists) might be more conflicted. Although conductors and soloists certainly play works of dead composers, the dependence of the living composer on the conductor and soloists to get heard is central.

In a study of the friendship between two Brazilian composers, Heitor Villa-Lobos and Walter Burtel Marx, LeoNora Cohen found that the relationship started badly, with perceptions of each other on the one hand as unschooled and wild and on the other as an upper crust snoot overly concerned with form. However, Marx, sent to Europe at age 18 to study piano, composition, and conducting with the musical masters there, grew to love the deeply Brazilian works of Villa-Lobos and began to emulate them, also championing Villa-Lobos' works through conducting them in Rio and across the United States. Villa-Lobos grew to value Marx, dedicating two works to him. Trust to critique each others' compositions evolved, but it was a lopsided friendship, with Marx, younger and less eminent, deferring to Villa-Lobos.

Benefits and Problems in Friendships of Creators

Friends benefit creators not only in sharing new ideas and stretching cognitive growth, but also in validating and sustaining them on a personal level, helping them to overcome self-doubt, a characteristic that creative personality researcher Frank Barron found characterizes creative individuals, expressed as concern about personal adequacy and motivation to prove oneself. Friendship can provide emotional strengthening and a sense of confidence, enhancing the creator's self-esteem. Difficulties also arise, including conflicts and power issues.

Validation

Safety and social validation of creative products are a major function of friends and work place collaborators. They provide creative individuals a safe space where they can break rules without sanctions, as well as offering them a positive perspective on themselves; for instance, that their ideas are not crazy but creative. Friends and colleagues can help foster the courage to test limits, according to psychologist and creativity researcher Arthur Cropley.

David Harrington, known for his work on the ecology of creativity, discussed the role of advocates such as parents, friends, or mentors who champion creative individuals and provide them with help or needed resources. He noted that explicit encouragement is almost always helpful, stating:

Creatively effective people have often described a positive impact which words of encouragement in understanding from credible sources have had upon the creative work, particularly at times of unusual creative challenge and stress.

He observed the importance of feedback that encourages revision without embarrassment or feelings of inadequacy.

Conflicts

But there are also conflicts in friendships and close relationships for creative people, particularly when the friend is not supportive of a creative idea, the creator feels judged or rejected, or power issues arise, such as who gets credit for the new product or idea. Although, as Robert Sternberg and

colleagues noted, "creativity requires a risk-taking personality", the taking of risks by putting a new idea 'out there' can be daunting, especially if not supported by friends, colleagues, or contemporaries.

Although collaboration may lessen the fear of ridicule for innovative work, organizational creativity researcher Teresa Amabile found that when one believes one's work will be judged or evaluated by others, creativity suffers. For example, Howard Gruber, in discussing the risk Darwin felt in expressing new ideas, noted, "Darwin had a real need to ingratiate himself with others to avoid sharp personal controversy, to feel that he'd made the effort to avoid conflict." According to Gruber, although the essence of his understanding of the theory of evolution was complete in his 1837–38 notebooks, it took some 20 years to publish, in part because Darwin was aware of the intellectual and religious forces arrayed against him.

Teresa Amabile also described how peer pressure is an inhibitor of risk taking, which discourages the presentation of new or different ideas. Among school children, John Dacey and Kathleen Lennon found that classmates may negatively impact creativity. They discuss the fourth grade slump described by Paul Torrance, suggesting pressure to conform to peers as a reason.

Twila Tardif and Robert Sternberg noted that in addition to the conflict between criticism and confidence, there is also a conflict or paradox between social withdrawal and social integration tendencies. For creators, there is often both a lack of fit to their environments and the need to maintain distance from peers, avoid interpersonal contact, and resist societal demands. Psychologist Gregory Feist stated that creative people often have the "desire and preference to be somewhat removed from regular social contact" and to focus on their craft. "A unique trait of creative people is their disposition to be autonomous and independent of the influence of the group." They may be introverted and prefer solitude.

Yet there is a drive for accomplishment and recognition, a need to form alliances, a desire for attention, praise, and support, and there may also be an emotional expressiveness, charisma, honesty, and courageousness. These dualities may be temporal aspects, according to Jock Abra and Gordon Abra, who stated that creators have time periods when there is greater need for relationship and feelings of intimacy, and other times for aloneness, although there is considerable individual variation.

Fear of intimacy or rejection can also make for focus on creative work rather than relationships. Gail Lewis reported conflicting studies about peer relationships, speculating that tension develops from the contradictory needs for solitude, working alone, and self discovery and at the same time, for recognition, affirmation, and social support.

Power Differences: Stars, Followers, and Friendship

Stars, whether musicians, scientists, sports heroes, politicians, or eminent creators attract followers, fans, and sometimes sycophants. Highly creative individuals are sought after by such individuals who believe in the greatness of that creator, or may seek favor, affection or even self-aggrandizement, but who often contribute to the creator's success. The follower wants to be a friend of the eminent or potentially eminent

creator and enthusiastically supports the star's growth, sometimes as benefactor, at other times, affirming the creator's ideas. The creator may identify the follower as a friend, but the relationship is often grounded in an imbalance of power, wherein the eminent person gets needs satisfied but does not always give back.

This may be a pattern in friendships among highly creative individuals, the more eminent in the dyad being dominant, wherein the friend is more a support than a beloved person to the dominant creator. In the case of Villa-Lobos, almost all of his friends were musicians or critics who championed Villa-Lobos's career and aspirations. More rarely they were equals, such as the famous pianist, Arthur Rubenstein, who was inspired by Villa-Lobos's music and played it often.

Future Research on Friendship and Creativity

Systematic study of friendships in creative lives is needed. Studies of friendships within particular domains, such as those among mathematicians, or across domains, such as a scientist and a painter, would be valuable, perhaps using cross-case methodology through studies of biographies or among living creators. Friendships that fail but stimulate creative output through criticism, such as that between Van Gogh and Gauguin, as well as friendships that are consistently supportive should be pursued. Friendships that are more equal between the creator and another and those that are less so need to be analyzed. What are the benefits to the friend of the creator, is there satisfaction in supporting creative growth, and is engendering of others' potential a type of creativity are questions to consider. How a friendship can grow out of collaboration or vice-versa needs study. It is not just the work-related collaboration or the intimate connections with spouses or lovers, but the emotionally satisfying,

mutually supportive, power-related, and irrational aspects of friendships that need to be better understood in creative lives.

See also: Collaboration; Creative Environments, Conditions, and Settings; Emotion/Affect; Social Psychology.

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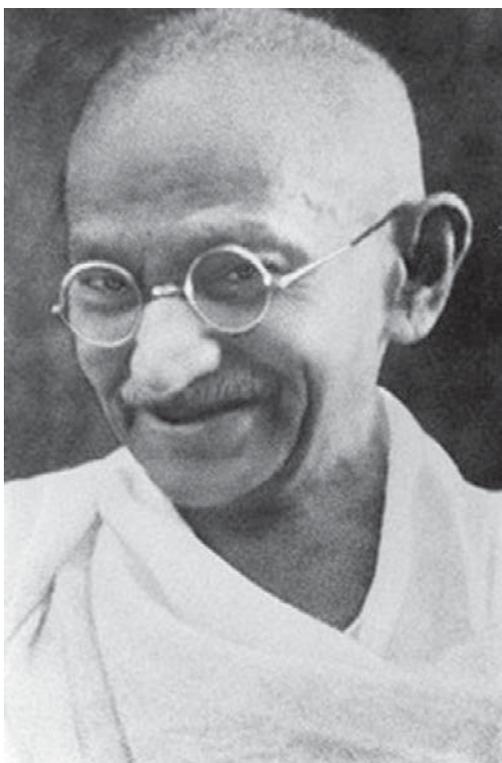
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Mahatma Gandhi 1869–1948

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Mahatma Gandhi

Introduction

Revered in India as 'Mahatma' or 'the great soul,' an epithet conferred upon him by the Nobel Laureate Rabindranath Tagore, Mahatma Gandhi, is internationally famous as the initiator and leading exponent of 'militant nonviolence' against British imperialism in India. Considered one of the 'most ingenious spiritual militants,' he was the product of a critical juncture in the history of the twentieth century (and, arguably, in the history of civilization itself), providing new dimensions to the meaning of concepts such as 'truth,' 'nonviolence,' 'protest,' 'celibacy,' 'struggle,' 'morality,' 'welfare,' 'untouchability' even 'vegetarianism,' 'cooperative farming,' and 'industrialization.' Gandhi was an incessant and tireless reformer through words and, above all, action.

Inherently a dreamer, thinker, and visionary, Gandhi mapped the outlines of a 'free India' by drawing on the rural traditions of its epically rich past to produce the concept of a 'Swaraj.' This 'scrawny little man' developed certain concepts that seem apparently simple yet revolutionary, in a language that itself marked a creative breakthrough of a totally different nature. A source of dissent, as Ashis Nandy noted, he upheld principles in public life. His thoughts (sometimes known as Gandhism) have been influential in one way or another for activists all over the world including some of the great names of our time: Martin Luther King Jr., James Lawson, Steve Biko, Nelson Mandela, Lech Walesa, Khan Abdul Gaffar Khan, The Dalai Lama, Petra Kelly, Benito Aquino, Albert Luthuli, and Aung San Suu Kyi. In the brutally violent world of the 'war on terror,' Gandhi appears more germane than ever. Long ago he asked us to "Imagine the whole nation vivisected and torn to pieces; how could it be made into a nation?" Despite the skepticism of some, who have labeled him as a 'totalitarian' politician of a specialized order or as 'the shrewd Bania' (merchant), Gandhi remains 'a practical idealist' whose creativity goes beyond his own political career (and the Indian context) to have universal significance.

The essential greatness of Mohandas (alias Mahatma) Karamchand Gandhi (known affectionately to Indians as *Bapu* meaning 'Father' in Gujarati), lies in the fact that he did not merely devise principles, he embodied them. Emphasizing that God appears not in person but in action, he claimed: "Action is my domain, it's not what I say but what I do that matters." Becoming a high-stakes performer, "he integrated within himself his life's message of sanity, spirituality, and the eradication of poverty," and in the process "emerging as a personality, a point of hope for the human future in a strife torn world."

Gandhi's life as he described it fell into four main periods, each with its characteristic lessons and experiments with Truth. During the first, from his birth in 1869 to the end of his Indian schooling in 1888, he learned the Hindu Dharma, or way of life, discovering something of its strength and weakness. Next he trained for the English bar in London from 1888 to 1891, where he discovered principles of national greatness, democracy, and of Christianity. Then came the 20 years of struggle in South Africa, from 1894 to 1914, during which he is working out his three fundamental principles of *Satyagraha*, and *Ahimsa*. The last period were from 1914 to 1948, when he was the acknowledged leader of India, and applied his three

principles in working for *Swaraj* and Swadeshi goods, through the boycott of British goods and institutions.

Childhood and Youth

Mohandas Karamchand Gandhi “was born of propitious parents, at the appropriate place, and at the inevitable time” on 2 October 1869, to a Vaisya (merchant) family of Modh Bania subcaste. The respectable traits attributed to the ‘Banias,’ as Erik Erikson described, are enterprise, caution, realism, compromise, and shrewdness. His father was ‘diwan’ (Prime Minister) to the raja of three small city-states annexed to a minor princely state in the Kathiawar Agency of British India. Mohandas perhaps inherited the qualities of truthfulness and leadership potentials from his family. Gandhi’s mother Putlibai, Karamchand’s fourth wife, was an intense believer and he was raised by his deeply religious mother with whom he had a strong emotional attachment. He was also raised in a mixed ‘bhakti’ tradition, and Islamic and Jain ambience. He assimilated quite early many of the influences that would play an important role in his future. Gandhi’s father, apparently indifferent to his son (in accord with the societal norms of his class), was, deep within, fondly affectionate to him, as testified by Gandhi himself in his *Autobiography*. Though biographers generally portray the young Gandhi as a shy, awkward, and, indeed, unimpressive boy who detested sports, other contradictory evidence is also available that attests to his childhood and adolescent mischief – stealing gold, playing truant, and engaging in clandestine practices such as eating meat, visiting a brothel once – all these acts being conscious attempts on his part to reconfigure his character in accord with the perceived ideals of British masculinity, as much as overriding adolescent inclinations and curiosities. Gandhi inevitably confessed all his misdeeds to his father in writing and clearly felt enormous shame and guilt. However, as Raja Rao noted “the father returned the boy’s courage with awesome understanding. . . . This was indeed the beginning of his experiences with truth.” This behavior, is typical of colonial ‘double-think,’ was an inconsistency Gandhi tried to resolve throughout his life.

Education and the Intimate European Contacts

Academically, Gandhi was an average student. His college days were far from pleasant (he dropped out once during the first term and reenrolled in the second). Since his childhood ambition to become a ‘doctor’ was considered ‘unlawful’ for his caste, his father persuaded him to study law instead. We can speculate that he compensated throughout his life by attempting to ‘cure’ humanity metaphorically from every possible ‘disease.’ In May 1883, the 13-year-old Mohandas was married to his 14-year-old neighbor Kasturbai Makhanji in a strict custom-bound child marriage.

On 4 September 1888, Gandhi set out for London, England, to study law and complete his apprenticeship as a barrister at University College, London. Before the voyage, however, he had to swear to his mother, that he would remain faithful to his religious upbringing and abstain from taking meat, alcohol, and sex. However, in England, he dressed in the style of a Victorian dandy, took up dancing and briefly

experimented in creative arts. He adopted ‘English’ customs – learning Latin and the violin and taking a short trip to Paris.

He finally abandoned these customs, and found solace, and a public platform, in vegetarianism. Gandhi believed that a vegetarian diet would satisfy the requirements of the body and serve an economic purpose by being cost-effective: he thus regarded it not only as a spiritual practice but also as a practical one. He wrote *The Moral Basis of Vegetarianism* as well as several papers. In his *Autobiography*, Gandhi noted that vegetarianism was the beginning of his oath to *Brahmacarya chastity or celibacy or sexual abstinence*: to achieve *Brahmacarya*, one should first learn to overpower gastronomic desires. Strangely, at times he indulged in faddish dietetic experiments that sometimes came near to killing him.

Some members of the Vegetarian Society were also members of the Theosophical Society. This Society established in 1875, was dedicated to the study of Buddhist, Christian, and Hindu scriptures. They encouraged Gandhi to join them in reading the *Bhagavad Gita*, both in translation as well as in the original; it is here he first read Edwin Arnold’s translation of the *Bhagavad Gita* that left a permanent impression upon him. Above all, from reading Tolstoy and Ruskin, with their commitment to pacifism and an ethical life, Gandhi began to formulate his own critique of the materialist West. At the same time, he found a way to come to terms with his own heritage. Repudiating the association of ‘feminine’ qualities with weakness, he began to construct a ‘new courage’ in which nonviolence, and passive resistance, were transformed into strength. He would be strong, he proclaimed, as a woman was strong. In fact, he advocated if nonviolence is the law of our being the future is with woman.

As a young law student in England, he looked into the teachings of Christianity: “The Sermon on the Mount, which went straight to my heart. I compared it with the Gita. The verses ‘But I say unto you that you resent not evil, but whosoever shall smite thee on the right cheek, turn to him the other also’ . . . delighted me beyond measure. . . . My young mind tried to unify the teachings of the Gita, the Light of Asia, and the Sermon on the Mount. That renunciation was the highest form of religion appealed to me greatly.”

Gandhi returned to India in 1891 as a Barrister of the Inner Temple only to learn that his mother had died while he was in London, his family concealing the truth from him. An anguished Gandhi received solace from his spiritual teacher Raychandbhai, a highly successful pearl dealer who nevertheless managed to remain completely detached from his activities. Gandhi learned from him the basic lesson that life itself is equivalent to pure meditation: there is no abstract entity such as the inner being – the body and the mind operate in terms of one’s *Karma*, comparable to *Bhagavad Gita*’s – ‘activity in inactivity and inactivity in activity.’ The childhood values embedded in *bhakti* (*devotion*) merged with the doctrine of *Karma* (*selfless deeds*) following the dicta of the *Bhagavad Gita*. The process of the amalgamation of *Bhakti* and *Karma* that began in England reached its culmination at this point.

In the Wilds of Africa

Gandhi remained jobless for a brief spell after his return: he desired to practice law in Mumbai but couldn’t find work.

He applied for a part-time job as a high-school teacher but was rejected there too. Finally, in April 1893 Gandhi accepted an agreement from an Indian firm, to represent them legally in Pretoria, the capital of the Transvaal in the Colony of Natal, Union of South Africa, then a part of the British Empire.

Immediately after his arrival in South Africa, Gandhi was forcibly ejected from a train at Pietermaritzburg after refusing to move from a first-class to a third-class coach. Although he possessed a valid first-class ticket, he was not allowed to travel first class for racial reasons. This brutal incident of racial discrimination intensely affected him and possibly motivated him later to publish and edit a newspaper *Indian Opinion* which reflected the viewpoints of Indians in South Africa. In an indignant letter to the *Natal Advertiser*, he asked: "Is this Christian-like, is this fair play, is this justice, is this civilization? I pause for a reply." In 1894, Gandhi established the Natal Indian Congress and, through this organization, forged the Indian community of South Africa into a coherent sociopolitical force. Raja Rao wrote:

But here in the wilds of Africa . . . (remember it was the time of Kruger and Rhodes, of Smuts and Churchill) Gandhi was only a coolie, a coolie barrister. He was not even a Christian. . . . Thrown out of his compartment, Gandhi sat in a dingy cold room in a vast world of hills and spaces, with no one to turn to. Then he turned into himself, and that was, he says, the most creative experience in his life. (Rao, 2005: 66–67)

However, he again extensively read *Bhagavad Gita*, as well as works by Ralph Waldo Emerson and Henry David Thoreau (in particular, his essay on *Civil Disobedience*). He was also considerably enlightened by his correspondence with Leo Tolstoy and by John Ruskin's *Unto This Last*. As a result of this program of reading, his personal philosophy went through a radical transformation. After reading Ruskin he decided to build a commune called the *Phoenix Settlement*. He also created a cooperative commonwealth for civil resisters on an 1100-acre plot, 20 miles from Johannesburg: the Tolstoy Farm. In addition, he translated Ruskin's work into Gujarati as a draft proposal for his future economic strategies. Gandhi began observing one day each week (generally Monday) as his *day of silence*, when he refused to speak, as he believed that silence leads to inner peace. He drew this idea from the Hindu religious principles of *mauna* (silence) and *shanti* (peace). On that particular day he would communicate with others by writing on paper. From 1906, for three and a half years, Gandhi also refrained from reading newspapers since they did in no way help find creative solutions to his inner conflicts: he felt that the turbulent state of affairs worldwide caused him more chaos than his own inner strife.

In addition, Gandhi began to perform communal prayers for the economically impoverished marginal castes, fasted for self-purification, and dedicated himself to live a life of voluntary poverty. Known for austerity and the eccentricities of his personality, around 1905 he abandoned Western dress and life styles completely (an indirect result of reading John Ruskin's work) and took to the dress he is identified with in history – the loincloth *dhoti*, shawl, and sandals. This earned him the infamous Churchill label of *half-naked fakir, stirring up sedition*. However, Churchill was also conscious of Gandhi's strength – he said Gandhi certainly knew how to fight.

A notoriously paradoxical eccentric, "the flesh-and-blood Gandhi was a most unlikely saint. This was one of the century's great revolutionaries whose strange figure swayed millions with his hypnotic spell. His garb was the perfect uniform for the kind of revolutionary he was, wielding weapons of prayer and nonviolence more powerful than guns." Ultimately, in 1906, he adopted *Brahmacarya the oath of celibacy* as both a means of natural birth control and an approach to divine purity.

At the same time, he was involved in a number of struggles against the British authorities and thus was able to examine the practical value of his principle of nonviolent protest. Influenced by Henry David Thoreau's idea of civil disobedience, it was in Johannesburg that Gandhi first adopted his evolving weapon of *Satyagraha* at a mass protest, on 11 September, 1906. Gandhi wrote: "*Satyagraha is not predominantly civil disobedience, but a quiet and irresistible pursuit of truth.*" It is the practical expression of a higher reality: a moral code and a self-discipline that requires the control of the senses, especially the control of sexuality; the control of anger and violence; and a dedication to the cause of justice and truth. His *Satyagraha* was designed not only for India, but also for the whole world; it could transform relations between individuals as well as between communities and nations.

In 1907 Gandhi petitioned all Indians in South Africa asking them to contravene a law that demanded their registration and fingerprint impressions. Gandhi was imprisoned for some time, handcuffed with a book of Tolstoy between his hands. He was released when he made the rulers agree to voluntary registration. Gandhi's techniques met with further success when the South African government promised to eradicate racial discrimination against Indians; a law was enforced which legalized Indian marriages and the abolition of tax from a certain section of the Indian working-class laborers. This was the blueprint of the 'Gandhian' method of struggle. Gandhi returned to India, in January 1915. Smuts, South African prime minister and one of Gandhi's staunchest enemies and admiring friends, made an exasperated comment on Gandhi's departure. "The saint has left our shores," he said, "I sincerely hope forever."

Back Home to India

The principles that had been applied in expediency for the first time in South Africa were strengthened and sharpened after Gandhi's return to India, where he remained for the rest of his life. On returning to India, Gandhi immediately undertook the mission of laying down the foundations of a new India. As B. R. Nanda noted:

With the genesis of the Gandhian movement for the freedom of India which was based on *Satyagraha* or the holding on to truth, came not just India's independence but also emerged a personality, a point of hope for the human future in a strife torn world. (Nanda, 2002: 54)

Gandhi's first major achievements came in 1918 with the Champaran agitation and *Kheda Satyagraha*. To combat the fraught situation in Kheda in Gujarat, Gandhi established a hermitage, mobilizing his old hands and supporters and bringing in brand new volunteers from the region. He made a

detailed study and survey of the villages, recording the various atrocities and appalling episodes of suffering. Relying on the confident support of the villagers, he began leading the cleaning of the villages, the building of schools and hospitals, while encouraging the village leadership to condemn the various social evils. However, his major impact was felt when he was arrested by police on the charge of instigating unrest and was ordered to leave the province. Several thousand people protested and rallied outside the jail, police stations, and courts demanding his release, which the court reluctantly granted.

In 1919, Gandhi persuaded the Congress Party to launch a Non-Cooperation Movement that snowballed into a countrywide agitation that received widespread participation from all levels of Indian society. During the next five years Gandhi devoted himself to constructive social programs aimed to uplift the subjugated and to build Muslim–Hindu unity. One of his main modus operandi was the *fast*. He undertook a 21-day fast to bring the two communities together and a further fast in support of a strike by mill workers in Ahmedabad. The weapon of the *protest march*, however, gained a much higher prominence than the fast – politically, morally, and historically.

He launched the Civil Disobedience Movement (1930–1933) which began with the famous Dandi March and the Salt *Satyagraha*. The latter was directed against the Salt Law which made it against the law for an Indian to make salt. Gandhi's protest culminated in the famous Salt March to Dandi from 12 March to 6 April 1930. Gandhi marched 400 km from Ahmedabad to Dandi, Gujarat to make salt himself. Thousands of Indians joined him on this march to the sea. This campaign was one of the most successful against British India. The action along with other protests resulted in thousands of arrests, including that of Gandhi himself.

The government, represented by Lord Edward Irwin, decided to negotiate with Gandhi. The Gandhi–Irwin Pact was signed in March 1931. The British Government agreed to free all political prisoners in return for the suspension of the Civil Disobedience Movement. As a result of the pact, Gandhi was also invited to attend the Round Table Conference induced in London as the sole representative of the Indian National Congress. The conference was a disappointment for Gandhi and the nationalists, as it focused on the Indian princes and Indian minorities rather than the transfer of power. The failure of the Round Table Conference induced Gandhi to undertake another fast resulting in the Poona Pact in 1932 by which untouchable leaders renounced separate representation and instead remained within the Hindu fold.

In 1934, Gandhi moved to his ashram in Wardha (his foremost home and hermitage being Sabarmati Ashram in Ahmedabad) and concentrated on the 'constructive program' until 1940 when he briefly resumed leadership of the Congress at a time when India had been at War. In the late 1930s, when the forces of war were gathering momentum in Europe, he reaffirmed his faith in nonviolence. He asserted: "I have nothing new to teach the world. Truth and nonviolence are as old as the hills." Through pages of his weekly paper, *Harijan*, he expounded his approach to political tyranny and military aggression. He advised weaker nations to defend themselves by offering nonviolent resistance to the aggressor. During the early 1940s, he expressed strong antifascist feelings and

condemned Hitler for the genocide of the Jews and for "propounding a new religion of exclusive and militant nationalism in the name of which any inhumanity becomes an act of humanity." "If there ever could be a justifiable war in the name of and for humanity," he wrote, "a war against Germany, to prevent the wanton persecution of a whole race, would be completely justified."

This declaration to support the war effort was provided on the condition that the Congress would receive a firm guarantee of independence. The rejection of such a promise by the colonial government led the Congress to launch a Quit India Movement in 1942. This national movement was ruthlessly suppressed, and Gandhi was kept in detention at the Aga Khan Palace until 1944.

When Gandhi emerged from prison, he sought to forestall the creation of a separate Muslim state of Pakistan that Muhammad Ali Jinnah was demanding. The whole politics of partition and its violent consequence aggrieved Gandhi deeply. He wanted Hindus and Muslims to learn to live together or he would die in the attempt. Gandhi's last major act as a national political leader was to fast for peace amidst the growing sectarian conflict between Hindus and Muslims.

Gandhi's Celibacy and Androgyny

Gandhi's experiments in *Brahmacarya* raised vehement opposition even from his dedicated followers. But he was convinced that sex diffuses human energy, which should be conserved and sublimated. He believed that woman's role in sex was entirely submissive and self-sacrificing, and he assumed that women derived no pleasure from such activity.

When he was 16, Gandhi tending to his father nearing death, engaged in sex:

This shame of my carnal desire even at the critical hour of my father's death ... is a blot I have never been able to efface or forget, and I have always thought that although my devotion to my parents knew no bounds ... yet it was weighed and found unpardonably wanting because my mind was at the same moment in the grip of lust. I have therefore regarded myself as a lustful, though a faithful husband. It took me long to get free from the shackles of lust, and I had to pass through many ordeals before I could overcome it. (Gandhi, 1927: 16)

In comparison to the 'masculinity' of the leaders of the West, Gandhi's image was perceived as 'androgynous.' Androgyny is one of the personality traits of eminent creative people. His 'bisexually-toned passivity' meant that he was unable to overcome his colonial identity. Gandhi's maternal attributes were evident in his assertion that men need to learn to care more the way women do if the human condition is to be improved. Erikson noted: "He undoubtedly saw a kind of sublimated maternalism as part of the positive identity of a whole man, and certainly of a *homo religiosus*." Gandhi's main virtue in his later life was care: an interest in producing life and maintaining it.

Gandhi's Creative Vision

Gandhi wrote *Hind Swaraj* or Indian Home Rule (1938), a booklet which has been dubbed 'the Bible of nonviolent

revolution.’ Yet, it is also an extremely difficult book to stomach, with its uncompromising attacks on the British parliament, on machinery, on railways, doctors, lawyers, and English educated elites. *Hind Swaraj* seems to be a last-ditch stand in favor of a premodern, traditional civilizational ethos, which exalts manual labor, self-restraint, and the pursuit of virtue and sacrifice, instead of pleasure and profit.

This embodied a sharp criticism of Western materialistic preoccupations and the encouragement of fierce competition to fulfill those needs. The *man versus machine controversy*, identifying industrialization with materialism, was what troubled Gandhi most. For him machinery “the chief symbol of modern civilization” represented “a great sin.” The alternative vision he cherished, for the ideal economic independence of the villages, was where the individual, not economic productivity, would be the prime concern. For him, economics and self-reliance were essential to lead a winning campaign. Instead of the ‘aberrant’ mechanized modern civilization of the West, he promoted the ideal of simplicity and innocence rooted in the ancient or traditional village where every member selflessly cares for others.

Gandhi’s goal of *Village – Swaraj* consists of various indispensable stages: his striving to establish the Kingdom of God (*Ram Rajya*, expressed vocally by a musical chanting – *Ramdhun*) through his nonviolent application of Hinduism, following the dictates of the *Bhagavad Gita*, the spiritual backbone of the religion. After its successful deployment against the British, Gandhi’s idea of *Satyagraha* reached a phase of command, insisting that self (*atman*) and truth (*Satya* or God, who is the supreme being *sat*) are identical, and that this unity or oneness ought to lead to harmony and nonviolence (*ahimsa*) and passive resistance against opponents. Most importantly, *Satyagraha* became the ideal way to resolve conflicts, which usually summon an ideological disagreement between two opponents: beneath every struggle lies another clash, a deeper one, an altercation between two views that are each, to some extent, true. Every conflict, to Gandhi, was on some level a battle between differing angles of vision illuminating the same truth. When his wife lay dying, and he was in jail, this is what Gandhi wrote to her: “If you die even that death of yours will be a sacrifice to the cause of *Satyagraha*. My struggle is not merely political. It is religious and therefore pure. It does not matter much whether one dies in it or lives. I hope and expect you will also think likewise and not be unhappy.”

Concept of Truth

Gandhi’s concept of ‘truth’ is multidimensional and often puzzling to comprehend. The essential meaning of truth for Gandhi was loyalty or reliability, and its context, its *Sitz im Leben*, was that of an ideal traditional Indian village where truth is inseparable from community bonds.

Satyagraha, hence, would be the most advanced weapon to fight injustice because it knowingly avoids the drawbacks in other methods and seeks a new position instead, one which is more inclusive than the old ones, and moves into it. The latter, in turn, would result in the welfare of all (*Sarvodaya*) which is the practical expression of a higher reality: a moral code and a self-restraint that requires the control of the senses, especially

the control of sexuality, anger and violence; and a dedication to the cause of justice and truth. *Sarvodaya* – or welfare for all – included the emancipation of the Untouchables, whom Gandhi called Harijans – the ‘children of God/Lord Krishna.’ The plight of the Untouchables could, in Gandhi’s vision, only be alleviated by nonviolence and by holding fast to the truth. To eradicate the plight of the untouchables, he made himself an Untouchable, and he faced ridicule in order to transform his country’s abysmal sanitary conditions. “The bathroom is a temple,” he said, and anyone was welcome to chat with him there. If we closely examine his life, we notice not just how radically Gandhi modified and reformed the Hinduism that he had inherited, but also how deeply he renewed and burnished it. Gandhi’s *Hinduism* signifies a religion of strong ethical commitment to social justice and truth that he identified with God, displaying little interest in ritual or Hindu mythology except as they have bearing on ethical issues he was concerned about. There is little concern for the aesthetic and sensual aspects of Hindu culture – Gandhi has never been referred to as a puritan – but it is the Renaissance Hinduism, of which Gandhi is a part, which has found articulate expression in the modern world. His program was fundamentally focused on a free, united India; and it began with the revival of the spinning wheel, cottage industries, and the production of hand-spun fabrics (*khadi* or *khaddar*).

In 1931, while discoursing with Charlie Chaplin, Gandhi declared that he was not necessarily antitechnology but his priorities were different. His emphasis was on indigenous tradition, naturopathy, artisan and craft-based productions, using low energy and decentralized production system. His *swadeshi* movement had social, cultural, and technological dimensions as well as political objectives. To some extent, this can be seen as a precursor of modern ecological movements. However, his social movement for *swadeshi* did not create a new intellectual breakthrough; it did not direct individual creativity into opening up new areas of research and development.

The Creative Master

The theoretical bases of Gandhi’s vision and most creative actions were that no racial or ethnic group is intrinsically superior to any other, that conflicts need to be settled through nonviolence, and that compromise can strengthen both parties. Reflecting on Gandhi’s political innovation, Gardner noted:

Gandhi is a prototypically creative master ... in his chosen domain (the moral domain) ... he shared fundamental insights that were both simple and revolutionary; no racial or ethnic group is inherently superior to any other, conflicts need not be settled with violence, compromise can strength both parties. Perhaps most revealingly, the experiences surrounding the strikes and fast at Ahmedabad have familiar ring of core components of a creative breakthrough ... the tentative working out of a new language. (Gardner, 2001: 121)

Gandhi was the creator of a radical style of politics that proved effective in fighting against various forms of social division within India and elsewhere in the world. Historians and social scientists, as well as contemporary commentators, have tended to concentrate on Gandhi’s philosophy of life.

However, according to them, his philosophy of life had only a limited impact on the people. It was as a political leader that he was important: through his political strategy and his tactics of struggle he moved millions into political action.

Theorists have emphasized the 'dramatic' or 'performance-oriented' element of Gandhi's political persona through his verbal or linguistic expertise as a kind of comic combination of *folksy* and *canonical* forms of Hinduism. They also noted the *hypocritical blend* of effective protest and the *minimum gesture of protest* in the political style of Gandhi. A veteran Indian leader noticed in Gandhi an even more characteristic trait: "He has in him the marvelous spiritual power to turn ordinary men around him into heroes and martyrs." This was possible primarily through his books and speeches. An example is one of the talismans he gave to the masses:

Whenever you are in doubt, or when the self becomes too much with you, apply the following test. Recall the face of the poorest and the weakest man [woman] whom you may have seen, and ask yourself, if the step you contemplate is going to be of any use to him [her]. Will he [she] gain anything by it? Will it restore him [her] to a control over his [her] own life and destiny? In other words, will it lead to *swaraj* [freedom] for the hungry and spiritually starving millions? Then you will find your doubts and your self melt away. (Nayyar, 1958: 65)

This is so clearly described in his favorite devotional song, 'Vaishnav Jan . . .' (the true man of the Lord is the one who can empathize with the pain of another).

Gandhi's ideas were formulated in terms of a larger vision of an alternative society, one that emphasized mutual respect, resistance to exploitation, nonviolence, and ecological harmony. Politics was only one of the many fields in which Gandhi sought to activate this peculiarly personal vision. Its practice involved experiments in relation to various opponents. From representatives of the British imperialism to Indian advocates of violent resistance; from fundamentalist religious leaders to spokesmen for caste concessions, Gandhi confronted immovable groups and their ingrained ideologies with a deceptively simple ethic of verbal resistance. He even rejected completely and sharply the colonial educational practices that negated truth and nonviolence and put forward a radical alternative called 'basic education' which some classified in the tradition of Western radical humanists like Pestalozzi, Owen, Tolstoy, and Dewey.

Gandhi was a self-described anarchist, and his vision of India meant India without an underlying government. He once said that "the ideally nonviolent state would be an ordered anarchy." While political systems are largely hierarchical, with each layer of authority from the individual to the central government having increasing levels of authority over the layer below, Gandhi believed that society should be the exact opposite, where nothing is done without the consent of anyone, down to the individual. His idea was that true self-rule in a country means that every person rules his or herself and that there is no state that enforces laws upon the people. This would be achieved over time through nonviolent conflict mediation, as power is divested from the layers of hierarchical authorities, ultimately to the individual. This would come to embody the ethic of nonviolence.

A free India for him meant the existence of thousands of self-sufficient small communities (an idea possibly from

Tolstoy) who rule themselves without hindering others. It did not mean merely transferring an established administrative structure derived from the British into Indian hands. This, he said, was just making *Hindustan* into *Englistan*. He was conscious of the limitations of the existing political organizations that he refused to join, reasons explained in his own words:

At my time of life and with views firmly formed on several matters, I could only join an organization to affect its policy and not to be affected by it. This does not mean that I would not now have an open mind to receive new light. I simply wish to emphasize the fact that the new light will have to be specially dazzling in order to entrance me. (Ghose, 1991: 108)

Gandhi in Action: Rise to the Mahatmaship

Gandhi, as Barbara D Metcalf and Thomas R Metcalf noted in 2002, sought a moral, not simply a political transformation of human society. He could not accept the view, common in many nationalist movements, that the end – of freedom – justified whatever means might be necessary to bring it about. He believed that politics in our times yielded *yugadharma* or codes of conduct appropriate for our times. His search for self-realization, as Nandy noted, therefore led him not to mysticism, but to social and political activism. . . . When Gandhi thus defined politics, he had in his mind not so much conventional politics, but the politics of awareness – that liminal world where you create through civil disobedience a space for critical self-awareness, while venturing outer-directed social criticism. You test your categories of knowledge when trying to dismantle the categories of others.

His advocacy of nonviolence was so powerful that at the close of his autobiography he wrote: "In bidding farewell to the reader, I ask him to join with me in prayer to the God of Truth that He may grant me the boon of *Ahimsa* in thought, word and deed."

Similarly, the transformative love that Gandhi held out as the basis of a new India must encompass not only all Indians, from the wealthy zamindar to the despised untouchable, but the British as well. No one, whether Muslim, Hindu, or Christian, was inherently unworthy. If Smuts sent Gandhi to prison, Smuts became a life-long friend. Gandhi was ever a loyal subject. "I implicitly believed," he wrote later, "that the sum total of the activities of the British Empire was good for India, and for humanity."

Gandhi was cited several times in Lord Robert's dispatches. The Queen sent him a medal. His principles in action are reflected practically in all his achievements. Though he "adopted the ascetic mode as the pattern for a great nationalist revival," it was not his philosophy of life that had any major impact on the life of the people but his political strategy and tactics of struggle based on moral principles that moved millions into political action. Gandhi was shocked at the use of the atom bomb by the United States against Japan; he described it "as the most diabolical use of science." Interestingly, Einstein indicated the parallel evolution of the nuclear bomb and Gandhi's nonviolent technique of Satyagraha respectively, almost from decade to decade since the beginning of the twentieth century.

Gandhi and Tagore: Aristocracy of the Sensitive

The two leading Indian thinkers of the twentieth century were Rabindranath Tagore and Mahatma Gandhi. Interestingly, Tagore had anticipated and welcomed the emergence of a figure like Gandhi and when Gandhi entered Indian public life, few gave him such unstinted sanction. However, they had many disagreements on a variety of subjects, including nationalism, patriotism, the importance of cultural exchange, the role of rationality and of science, and the nature of economic and social development. "Tagore did recognize that Gandhi did not have to be the best Gandhian on all issues." Despite differences, Tagore bequeathed his visionary rural university at Shantiniketan to Gandhi. In his moving tribute to this "morally inquiring and unafraid man," Tagore noted:

He stopped at the threshold of the huts of the thousands of the dispossessed, dressed like one of their own. He spoke to them in their own language; here was a living truth at last, and not quotations from the books. For this reason the 'Mahatma', the name given to him by the people of India, is his real name. . . . At Gandhi's call India blossomed forth to new greatness, just as once before in earlier times, when Buddha proclaimed the truth of fellow-feeling and compassion among all living creatures. (Nandy, 2001: 223–224)

Tagore knew that he could not have given India the political leadership that Gandhi provided, and he was never parsimonious in his praise for what Gandhi did for the nation and yet each remained deeply critical of many things that the other stood for. That Gandhi has received incomparably more attention outside India and also within much of India itself makes it important to understand 'Tagore's side' of the Gandhi–Tagore debates. When Tagore breathed his last, Jawaharlal Nehru wrote in his prison diary on 7 August 1941: "It is not so much because of any single virtue but because of the *tout ensemble*, that I felt that among the world's great men today Gandhi and Tagore were supreme as human beings."

Four Gandhis

People can be intimidated and overwhelmed not only by the enormity of Gandhi's accomplishments but also by the complexity, inconsistencies, and eccentricities of his personality and philosophy. He will continue to be analyzed, admired, and deconstructed by people from diverse disciplines. No surprise that according to Nandy there are four Gandhis who have survived Mohandas Karamchand Gandhi's death. It is because of the resilience, force, and potency of Gandhi's ideas, which have the capacity to adapt themselves to unusual circumstances and times, that he is classified as a postmodern thinker and he remains as media-savvy after his death as he was during his life. Both Richard Attenborough's Oscar-winning epic *Gandhi*, and Rajkumar Hirani's *Lage Raho Munna Bhai*, unforgettable motion pictures, celebrate a hero who combined intense spiritual ardor and flawless command of showmanship. One might recall Einstein's comment:

The moral influence which he has exercised upon thinking people through the civilized world may be far more durable than would appear likely in the present age, with its exaggeration

of brute force. For the work of statesmen is permanent only in so far as they arouse and consolidate the moral forces of their peoples through their personal example and educating influence. We are fortunate and should be grateful that fate has bestowed upon us so luminous a contemporary—a beacon to the generation to come. (Einstein, 2007: 71)

Arnold Toynbee predicted:

It can already be forecast with some confidence that Gandhi's effect on human history is going to be greater and more lasting than either Stalin or Hitler's. (Toynbee, 1961: 617)

"Gandhi may have had brilliant or scatterbrained ideas," wrote Howard Gardner, "but in the end it was his capacity to appear credible to his followers, and to the rest of the world, by virtue of his example at specific historical moments, that constituted the central aspects of his creation. . . . In Clifford Geertz's famous phrase. 'It's a form of very 'deep play'.' Further, in search of truth, as Raja Rao noted, Gandhi was ever the pilgrim, which made him surrender himself to truth, to nonviolence, to celibacy, to control of the appetite, to poverty. In fact, he mentioned in his autobiography that "[I]t is not my purpose to attempt a real autobiography. I simply want to tell the story of my numerous experiments with truth, and as my life consists of nothing but those experiments, it is true that the story will take the shape of an autobiography . . .," he adds in the introduction. And hence the title *My Experiments with Truth*. However, he further noted that ". . . [the experiments] will of course include experiments with nonviolence, celibacy, and other principles of conduct believed to be distinct from truth." He dedicated his life to reading religious scriptures, to humility, to honesty, to fearlessness against oppression and against conflict between Hindu and Muslims.

In Gandhi's psyche, political and religious aims, means, and ends became identical. As a "pilgrim on his quest for Truth, quiet, peaceful, determined, and fearless" and as a political leader who, "demonstrated that a powerful human following can be assembled not only through the cunning game of the usual political maneuvers and trickeries but through the cogent example of a morally superior conduct of life," Gandhi compounded "ancient Hindu religion and culture and modern revolutionary ideas about politics and society."

Reviewing his autobiography, Kenneth Saunders noted "Never before in history have these principles of India's ancient Rishis been applied in the sphere of politics, or the Sermon on the Mount been made to work on an imperial scale." Romain Rolland saw him as not merely a revolutionary, but also as a builder of a new humanity. In 1926, Gandhi wrote:

If we are to make progress, we must not repeat history but make new history. We must add to the inheritance left by our ancestors. If we may make new discoveries and inventions in the phenomenal world, must we declare our bankruptcy in the spiritual domain? Is it possible to multiply the exceptions so as to make them the rule? Must man always be brute first and man after, if at all? (Nanda, 2002: 54)

His words, like his visual symbolism, were mesmerizing, his symbolic actions swayed hundreds of millions in India. Through his fasts, protest walks, and acts of passive resistance he also eventually won over the imperialists. Given how

he regarded himself — “My life is my message” – Gandhi invites us to be read in terms of a consistency in his *anubhav*, *vichar*, and *achar*. He was neither God nor ‘Christ reincarnated’: with all his political astuteness, there were also the paradoxes and contradictions, the complexities, incredible contrasts, the inherent moral ambiguities, the tragic and sublimely comic aspects of his existence. Some even talk of a ‘Billion Gandhis.’

It is important to note that Gandhism, as Ashis Nandy pointed out, is greater than Gandhi was. Gandhi himself more or less admitted so, when he gave the entire credit for his ideas to ancient wisdom. In his introduction to autobiography, Gandhi wrote: Tradition declares, he only could be liberated, established in the Truth, who has met his Guru. “I believe in the Hindu theory of the Guru . . . True knowledge is impossible without the Guru.” Gandhi never met his Guru but he had immense ancient wisdom to guide him.

The partition plan that created Pakistan and Kashmir was approved by the Congress leadership as the only way to prevent a wide-scale Hindu–Muslim civil war. A devastated Gandhi gave his consent. After partition in August 1947, Gandhi returned to Delhi to help restore harmony among Hindus and Muslims. In the process, Gandhi’s activities aroused much hostility among Hindu extremists: his moral and physical resistance appeared to the fundamentalists as a pro-Muslim stance. This culminated in Mahatma’s assassination on 30 January 1948, approximately six months after India achieved freedom. He was going for a prayer-meeting, by the 35-year-old editor of a Hindu extremist weekly, who admired Gandhi but thought of him no politician. On his death Raja Rao reflects: “He died as he would have wanted, the last gesture of Gandhi was blessing his own assassin.” When Gandhi died, Smuts his old adversary said: “A Prince among men is dead.” And Einstein remarked: “It is hard to believe such a one has walked the earth in our time.”

See also: Genius and Greatness; Leadership; Motivation.

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Gender Differences

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Glossary

'Big C' creativity Creative performances or products of a grand scale, which are socially judged to merit recognition and approval.

Creative performance The actual transformation of creative abilities into a measurable achievement or product.

Creative potential The likelihood of an individual to produce creative acts, thoughts, or products.

Criterion problem The difficulty of identifying an appropriate criterion to be measured when attempting to assess creative ability.

Divergent thinking One's ability or capacity for original thought when presented with a stimulus or initial idea.

'Little c' creativity Creative performances and products which are developed to address everyday problems or tasks and do not typically receive social recognition.

Nature or nurture The classic question of whether biological factors or environmental factors play more of a role in shaping an individual.

Psychological androgyny A personality trait describing individuals who possess equal levels of traditionally masculine and feminine psychological characteristics.

Psychometrics The scientific measurement of personality, abilities, aptitudes, attitudes and knowledge.

Introduction

Throughout human history, and continuing even to the present day, gender roles and expectations have continuously defined much of what individuals are expected and able to accomplish. Cultures and societies have often pushed males to excel, create, and take risks, while encouraging females to maintain a focus on the family and fulfill more domestic obligations. These rigid expectations have historically influenced every facet of cultural life, typically funneling resources and support to young men while adding barriers and obstacles in the paths of career-minded young women. As a result, females with great potential were often kept from the education and materials necessary to nurture their abilities, resulting in wide gaps between the visible accomplishments of men and women in terms of both popular history and creative endeavors. In recent decades, progress toward equality between the sexes has made great strides around the globe, and a substantial amount of academic research has been conducted regarding the root causes and ultimate effects of the persisting differences. Significant work has been conducted specifically in the creativity field as well, exploring the questions of whether males and females differ creatively and why this may or may not be the case.

Much of the research concerning gender and creativity has revolved around two intriguing questions worthy of such scrutiny: how gender impacts creative potential and creative performance, and why a gap between the two should even exist. Creative potential, typically measured in this case through tests of divergent thinking ability, attempts to quantify an individual's likelihood to produce creative acts, thoughts, or products. Creative performance, on the other hand, refers to the actual manifestation of those abilities, measuring the quality and significance of the resultant creative achievement. Understanding this distinction is of great importance to comprehending the body of research concerning gender differences in creativity, as demonstrating creative potential does not

necessarily imply that meaningful creative performance will result. For any number of reasons, countless individuals have shown creative promise yet failed to develop their skills, and for many women through history a specific lack of support, education, and resources likely deprived their potential of nurturance. In spite of this however, some eminent women did manage to achieve great creative accomplishments, yet the number of females historically recognized for such talents has been small when compared the long lists of famous male scientists, artists, and thinkers.

One additional reason for this historical disparity stems from what is known in creativity research as the criterion problem – the difficulty of identifying what exactly should constitute and define a creative act. While nearly everyone can agree that painting the Mona Lisa was a creative act, it becomes more difficult to reach consensus when we consider that not every creative act need appear monumental or grandiose. If it was creative for da Vinci to paint, is it creative for a child to do the same with his fingers? If the famous chefs of Paris are being creative when they combine exotic ingredients to prepare new and exciting gourmet banquets, is it creative for a hurried mother to rush home and quickly prepare her children dinner from what has been sitting in the refrigerator? In each of these examples, the complexity of selecting and evaluating creative criteria becomes evident, and historically this difficulty has greatly affected the recognition of women's creative contributions. Modern creativity theorists often distinguish between what is known as 'Big C' creativity (socially lauded creative acts, such as the Mona Lisa or invention of the light bulb) from 'little c' creativity (creative acts to address everyday challenges, such as quickly preparing a nutritious dinner), but all too often the public retains an outdated notion that creativity need be spectacular. This common mistake can cause one to overlook the creative contributions of females through history, in that a person may stretch the observation that most historically eminent creators have been men to a faulty assumption that only men are capable of such work.

Having introduced the historical creative inequalities between the genders and explained the foundational concepts central to the debate, we now turn to an exploration of modern research concerning the topic. This article will first examine the question of what creative differences do and do not exist between the sexes, through examining both data concerning creative performance and creative potential. In recent decades almost 100 published studies have searched for differences in potential between males and females, with almost all of them testing schoolchildren, and the mounting data have steadily built to a number of generally agreed upon findings. The article will then attempt to explain any differences between the sexes' creativity through detailing both relevant biological and socio-cultural theories. Included in this portion will be discussions on biological factors such as prenatal hormone exposure and the effects of psychological androgyny on creative performance, in addition to socio-cultural theories regarding historical resource allocation and complexities regarding the evaluation of creativity. Finally, a brief examination of the interplay among gender, creativity, and personality traits will follow, as personality is shaped both by biology and society and plays a crucial role in many creative arenas and endeavors.

Do Differences Exist?

The topic of differences between the sexes can be difficult to discuss, due to its controversial nature and tendency to stir the passions. On one hand, differences between males and females has been painfully obvious on a historical and cultural level, with centuries of overrepresentation of males in nearly every creative field, from the sciences to the arts. On the other hand however, little credence can be given to traditional interpretations that this disparity was the result of mere biological factors alone, as creative women were so often denied the social support and resource level necessary to transform potential to reality. Modern creativity researchers have instead attempted to approach the gender gap from a psychometric perspective, administering tests of divergent thinking in the hopes of finding, or not finding, a significant difference between the creative abilities of males and females that could explain the historical divergence. We now turn to a more in-depth discussion of gender differences in creative performance and creative potential, outlining what such researchers have come to learn.

Creative Performance

Historically, pronounced differences have certainly existed between the sexes in terms of creative accomplishment and achievement, even if the past 100 years saw a great leap forward in terms of gender equality and fairness of opportunity. For many centuries men were overrepresented in nearly all creative endeavors and fields, and in almost all cultures and geographic regions. Not only did this inequality exist at the basic levels of creative production and involvement, such as the question of who was provided with training, time, or opportunities to engage in creative activities, but the historical trend is even more undeniable when one considers groupings of historically eminent figures through time. Male composers, painters, sculptors, musicians, scientists, and philosophers all

earned celebration and fame at a much higher degree than their female counterparts, who were often few and far between. Even more so, those creative women who were able to break through social expectations and generate opportunities to hone their creative craft usually met with fierce resistance, if not from their families then from their compatriots in the field. Consider for example that many famous and highly creative women even went to great lengths to obscure their identities as females, such as the acclaimed writer 'George Sand,' who adopted a masculine pseudonym and quickly gained widespread renown for 'his' literary ability.

Fortunately, the past century has done much to correct these cultural double standards and advocate a higher degree of gender equality throughout much of the world. That is not to say, however, that legacies of creative difference between the sexes no longer exist. Recent research into male/female participation rates throughout the creative domains has consistently found lasting patterns of gender specific overrepresentation by field, even though these trends do in some cases seem to be slowly lessening in severity. Males, for instance, are still found in significantly greater numbers throughout the fields of scientific publishing, engineering, mathematics, mechanics, musical composition, and painting. Females, however, have come to numerically dominate in certain other creative endeavors, including those of literature, musical performance, dance, and the dramatic arts. While decades of increased support and access to creative fields has helped to mitigate the gender gap and propel greater numbers of females to develop their creative potential, it is important to note that stark differences still do remain at the highest levels of eminence. Male scientists continue to publish scholarly work at a rate over double that of their female counterparts, and earn tenured professorships at a much higher rate as a result. Female artists now garner social support, fame, and recognition at levels previously unseen in western history, yet males continue to be overrepresented as art critics – a powerful fact that some have surmised continues to work against creative females' potential for success.

Additionally, momentum for equality-minded change has not spread evenly among the globe, and creative women in various cultures continue to receive distinctly uneven levels of support and nurturance. As a result, even greater levels of disparity continue to exist between creative women and men internationally, with several studies having shown that the gender gap widens and constricts according to a culture's level of gender equality and modernization. Compounding this effect are the impacts of regional economics and social class structures, as poorer regions and those with more traditional and rigid social class hierarchies also display heightened differences between males' and females' levels of participation and degrees of success across the spectrum of creative endeavors. Regardless of which nation one examines however, at least some gender gap may be easily observed in creative performance and accomplishment, even if the overall trend is one of gradual improvements toward equality.

Creative Potential

While examinations of creative performance between the genders are forced to deal with a lasting legacy of stark differences, modern creativity researchers have been free to investigate

creative potentials from a more empirical and data driven perspective. Academic interest in the topic has ebbed and flowed over the past five decades, but a large number of studies have in fact been conducted to quantify and compare the creative potential of males and females, in the hopes of explaining the real-world effects previously discussed. Almost 100 published studies have collected comparative data on the genders, and when taken together they provide adequate evidence to support some basic conclusions. It is important to note, however, that the vast majority of these studies have utilized only assessments of divergent thinking capability as their indicator of creative potential, in contrast to other forms of creativity assessment instruments that might quantify or measure differing aspects of the creative process. Over 80% of the published studies chose to adopt such an assessment measure, and while evaluating divergent thinking capability has long been regarded as an important and reasonable method of creativity assessment, future researchers investigating this topic may wish to adopt an alternate approach. Additionally, a second caveat worth mentioning pertains to the fact that almost all of these studies have utilized samples of school-age children, with very few actually searching for differences among a sample of adult men and women. Considering that creativity requires nurturance to develop and bloom, this lack of a temporal dimension may be concerning to some, and the potential for gender differences to change or develop over time certainly stands as an area in need of much further research. Finally, it is also crucial to understand that while divergent thinking tests have been shown to be reasonably reliable predictors of creative production, divergent thinking is not in itself creativity *per se*. These tests are thus valuable indicators of creative potential and creative individuals have been shown to score higher on such tests than less creative individuals, but we cannot claim that an individual subject who scores highly on these tests is necessarily more creative as a matter of fact. In other words, divergent thinking assessments provide valuable information, but this information is only one piece of the creativity puzzle.

Of the approximately 100 published studies regarding gender differences in creative potential, roughly one half found there to be no observable gender effect. The remaining studies were typically mixed, with studies finding small degrees of advantage by female test-takers actually outnumbering those finding an advantage for the males by a 2-1 margin. Most of these differences were not statistically significant however, and a growing consensus thus argues for the position that a reliably measurable gender difference in creative potential does not appear to exist. This conclusion is of great academic importance for a number of reasons, first and foremost in that it raises serious questions as to the root causes behind the gender gap in creative performance. Historical explanations for differences between the sexes in terms of socially recognized creative accomplishment were often centered on biological explanations alone, a position that now seems more tenuous in light of the recent data. More likely, a combination of biological and socio-cultural factors, or socio-cultural factors primarily, is responsible for perpetuating the gender gap. These potential explanations will be more thoroughly discussed in the following portion, including both the biological and socio-cultural theories. Additionally, the gendered disparity between creative

potential and creative performance also hints at meaningful revelations concerning the environment creativity requires to blossom. If both genders truly begin with an even skill set yet arrive at predictably distinct results, much information may be inferred as to how creativity in an individual of any gender may best be nurtured and encouraged. Finally, while very few studies have searched for a difference in creative potential between working-age men and women, it is heartening to see that consistent conclusions can be drawn from both studies involving young children and studies involving adolescents. This stability of results throughout the early years of the lifespan acts to support the overall findings, even if the literature would surely benefit from more dedicated research involving the adult population.

Explaining the Differences

Research on gender differences in creative process and production has seemingly brought to light a major conundrum: If no significant difference between males and females can be found in terms of creative potential, how can the historical and modern creative performance gap between men and women best be explained? This question, like so many others in the social sciences, has attracted theories from both biological and socio-cultural viewpoints. In these offered explanations, the age-old question of 'nature or nurture' constantly presents itself, asking whether genetics and natural gendered physiology and psychology differences are more responsible for the gap or whether males' and females' destinies are more meaningfully shaped by their environment and cultural influences. Theorists from both camps have presented rational arguments and chains of evidence, advocating for their positions and rebutting alternate views. Ultimately, it is likely that both biological and socio-cultural factors may play a substantial role.

This section of the article will attempt to present some of the major arguments, both biological and socio-cultural, that have been advanced to explain the cause of the creative performance gender gap. It will begin by examining the major biological arguments, before exploring the major socio-cultural theories. In recent years biological arguments have somewhat slipped in favor and support, partly for evidence-based reasons and partly for political rationales as well, yet they remain worthy of serious consideration and contemplation. It should be understood however that with fewer researchers being interested in the biological perspective, as compared to the social viewpoint, more of the biological position remains theoretical in nature and still requires a greater degree of future empirical research. The socio-cultural positions, in contrast, have seen a greater number of relevant research studies conducted and thus have more data-driven evidence to support their claims. Raising this distinction is not meant to cast one side in a more favorable light, but rather to make clear that a great deal of potential research still remains ripe in this field.

Biological Arguments

Biological theories regarding gendered differences in creative performance have tended to cluster along four main groupings:

Family-focus arguments, field-difference arguments, hormone-based arguments, and inquiries into the effects of psychological androgyny. The first of these refers to a collection of traditionalist viewpoints that women are inherently more focused on family life and/or interpersonal relationships than men may be, possibly as a result of evolutionary processes. As a result, the argument continues, greater proclivity to a domestic focus would complicate (but certainly not preclude) creative achievement. These claims have been almost entirely theoretical in nature, with no empirical foundations, yet point to anecdotes that females may be more apt in interpersonal situations than males on average and may even benefit from increased instinctual knowledge regarding childcare. The viewpoints are however somewhat based in cultural frameworks on their own, and thus find difficulty in deflecting criticisms that social influences could equally have shaped such a family orientation mindset in females (if it does exist). Additionally, such claims overlook the serious possibility that interpersonal relationships and family life may carry additional opportunities for creativity as well, even if these opportunities are more likely of the 'little c' creative variety. Finally, these arguments are not generally popular among academic theorists, and clearly do not fit well into the prevailing social and political mindsets of our day.

A second class of biological argument regarding the creative performance gender gap is that of field-specific differences, in the sense that certain claims have been drawn from the fact that males and females tend to predictably outperform each other in particular creative endeavors but not in others. For example, males have long been overrepresented in most creative fields, but significant evidence does exist that females' work quality in certain creative activities has outperformed that of males for possibly even centuries. Consider the case of creative writing: Males undoubtedly were overrepresented among Europe's lists of lauded authors throughout the centuries, but historical evidence that females' reading and writing abilities on average outpaced those of males has existed since at least the time of John Locke (1632–1704), who once wrote that he had cause for great concern regarding boys' comparatively poor performance in the language arts. This concern is still very much alive today, as a significant gender gap in reading and writing exists in nearly every modern nation in the world, with young women clearly outpacing their male counterparts. As a result of such long histories of evidence, theories have been advanced that females and males may actually possess biological advantages in various creative fields which could make them more likely to succeed by virtue of their gender and the compatibility of their chosen domain. Contrarily, rebuttals have also been offered that these distinction may have less to do with genetics or innate biological predispositions however, and may have more to do with questions of resources and historical mores regarding the 'appropriateness' of certain fields of interest for young men or young women.

A third category of biological arguments has emerged in recent years from research conducted on the effects of prenatal hormone exposure to developing fetuses. To some extent it is shocking to think that major elements of our personality and destiny are shaped months before we take our first breath, but growing evidence from the fields of neuroscience and human development routinely illustrate just how true this is.

The presence of androgens such as testosterone (which are present at higher levels when a male fetus is *in utero*) are believed to have many significant effects upon brain development, distinct from that which occurs within female fetuses. The hormones signal changes of both a structural and functional nature, and their continued presence is thought to contribute to everything from increased aggression in males to increased anxiety in females. It is important to note however that hormone-driven, gender-based differences in brain size, shape, and development do not carry a connotation of superiority in either direction – but they are thought to have predictable effects upon the personality, aptitudes, and possibly even the preferences of the individual in question. Consider, for example, that in cases where female fetuses are exposed *in utero* to androgens (as in the case of different-gender fraternal twins), they have been found on average to display more traditionally 'masculine' traits and behaviors later in life, including even a higher rate of incarceration for violent crime. Controversial arguments have been put forth that gender-distinct hormone differences may be responsible for changes in hemispheric lateralization and dominance as well, a factor that could potentially help to explain some portion of differences in creative accomplishment. If, as postulated, hemispheres develop at differing rates and females rely more strongly on their 'verbal' left hemisphere while males rely more heavily on their 'spatial' right hemisphere, this could shed light on observable gender patterns in linguistic and mathematical creative performance. Although this line of research is empirically driven and scientific however, it is deeply contested among scholars and will require more investigation before its claims should be taken more seriously.

Finally, a fourth strand of biological argument hypothesizes that creative accomplishment must be at least partially biological due to substantial evidence that 'psychologically androgynous' females may possess more potential for advanced creative performance. Psychologically androgynous individuals, who possess both traditionally masculine and feminine psychological attributes equally, have been found to benefit from a wide range of positive adaptations in psychological health and well-being, including both social and intellectual advantages. They are known to possess higher levels of cognitive flexibility on average, with the ability to quickly shift viewpoints and approaches, and generally report higher degrees of self-esteem, achievement orientation, and personal satisfaction. They tend to resist entrenchment in any one manner of thinking, and remain open to new ideas and concepts more so than peers with a traditionally masculine or feminine personality. As might be expected, these traits lend themselves well to creative problem solving tasks, and several research studies have found evidence to support the notion that psychologically androgynous individuals may perform more creatively in certain endeavors. Interestingly, the prevailing methods of identifying androgynous individuals have begun to include salivary hormone level testing – with some evidence suggesting that females with higher levels of testosterone do potentially achieve at higher creative performance levels. Limiting this argument however is evidence that androgyny is not only beneficial to the creativity of women, but is an equally positive trait for males as well. If both genders are equally able to benefit from thinking more like the other, less can be inferred

about why a gender gap in creative performance currently exists. Additionally, while unambiguously creative women have been shown to refute gendered stereotypes on average, no study of creatively eminent women and psychological androgyny has yet been conducted, mainly due to difficulty of getting eminent individuals to participate in academic research. Further work will be necessary to explore these issues, but recent advancements in hormone testing may at least provide a more reliable method of conducting empirical studies of biological factors influencing creative accomplishment.

Socio-Cultural Arguments

Contrary to biological theories regarding creative performance, socio-cultural arguments choose instead to focus on the environmental and culturally-guided developmental influences that shape young women and men and the ways in which they behave. These theories find serious flaw in the biological assumption that humans exist independently from one another and can be studied in a cultural vacuum, claiming instead that people are greatly shaped by their culture and social expectations and cannot be easily torn or examined apart from this interconnected fabric of being. To illustrate, while researchers advocating a biological examination of hormone influences might discover that creative career women have increased levels of testosterone and conclude that these hormones have led to increased achievement orientation and career focus, socio-cultural theorists would dispute the chain of causation. Instead of concluding that the hormones have led to greater creative success, they might ask, might it be that increased social participation and creative work led these women to experience higher levels of stress, ultimately resulting in increased levels of testosterone production? Androgens are generated in higher quantities at times of intense stress in both males and females, making this flip of causality appear plausible.

This section of the article will examine three major clusters of socio-cultural arguments regarding the creative performance gender gap, each of which offers possible explanations as to how social forces and expectations may contribute to the problem at hand. These three categories of arguments each revolve around the importance and effects of human interaction upon an individual, framing the person's behavioral choices as the result of external pressures and shaping agents. First, we will examine arguments involving historical patterns of resource denial and inequality of support between the genders. Next, arguments that social forces have led males and females to show interest in different elements of the creative process will be considered. Third, questions concerning product evaluation and a creative performance 'glass ceiling' will be offered, before moving on to a discussion of the biological and social interplay among gender, creativity, and personality factors.

The most commonly repeated and well supported of the socio-cultural arguments is one which explains the modern creative performance gap as the result of centuries of unequal treatment of males and females, including marked differences in levels of social support, encouragement, educational and training opportunities, financial backing, and other resources. Nearly all worldly cultures traditionally considered the workplace and public domain as exclusive arenas of male

participation, while females were expected to remain domestic and look after the home, children, and family affairs. Such expectations were typically quite rigid, often with religious or philosophical arguments underpinning and validating their existence. More so, social structures worked to promote and maintain these gendered expectations, and women who dared to become too involved in public affairs or socially recognized creative endeavors were treated very harshly indeed, resulting in scorn, ridicule, punishment, and in some cases much worse.

Several socio-cultural theorists have offered evidence linking this historic denial of resources to present day gender gap effects, including examinations of various world nations that compare their degrees of modernization and social support for females to women's level of active public participation in the creative fields. Taken collectively, these studies have offered a number of similar conclusions. First, it has been well established that prevailing social, political, religious, and philosophic currents do have a substantial effect on the level of cultural and creative participation that women have been able to experience. Second, it has been clearly documented that financial support and increased access also plays a role, as higher numbers of women in modernized wealthy nations are apt to participate in creative sciences and arts while countries with fewer resources and more traditional gender role expectations predictably see lower levels of involvement. Third, it has been shown that even in the most modern of nations levels of support for women's public participation in creative avenues can vary throughout the lifespan, as gender gap effects still exist but have begun to emerge at later stages of life. This subtle trend most likely occurs as a result of generational changes regarding the average age of first marriage, as modern women now expect full participation in public and creative life yet begin to experience a greater degree of tension once they have started a family of their own.

A second socio-cultural argument that is commonly advanced also stems from the effects of historical inequalities, but focuses more clearly on the adaptive effects that these stringent restrictions have led many women to undertake as a result. Social rules and expectations do not only act upon individuals, these researchers argue, but cause behavioral changes and modifications that later impact society as a result. Each step causes further effects, like a chain of falling dominos, except that later results curl back and help to create the next generation of environmental expectations and influences. In the case of expectations regarding creative participation and performance, it is thus argued that centuries of domestic expectations have forced generations of women not to refuse participation in creative endeavors, but rather to modify the ways and means by which they satisfy their creativity and find socially appropriate outlets. In doing so, they modify the environment and expectations provided to them, creating pockets of 'socially acceptable' creative activities for females. These alternate ways of being creative – such as cooking, gardening, and even focusing on growth in interpersonal relationships – have become viewed as feminine in nature, and while they certainly are creative in their own right society has gradually devalued them and failed to recognize the degree of creativity which they can inspire. Additionally, because most creative avenues that generated publicly shared creative products were closed to women for so long, most of these pockets of acceptable activity

are either private and domestic, or more process-oriented rather than product-oriented. This distinction harkens back to the difference between 'Big C' creativity and 'little c' creativity previously discussed, as most people imagine grandiose products when they think of creativity, while overlooking the less obvious and typically more process-concerned avenues of creative participation and expression that have seen higher degrees of female involvement.

A third explanation for the creative performance gender gap has only recently begun to gain empirical support, but presents a series of intriguing questions regarding the effects of gender on the evaluation of creative products. It has long been recognized that even in creative fields where women are numerically overrepresented, male participants typically receive greater recognition as experts along with higher levels of status. For example, while painting is believed to be a field of numeric gender equality or female overrepresentation, a majority of professional art critics are actually men. Some evidence has been presented to show that males and females may possibly prefer different shape and color schemes on average, potentially leading to a disadvantage for female artists when their work is evaluated by a male critic. Additionally, studies have shown that males are more likely to take creative risks while females are more likely to stifle originality in order to conform to an evaluator's expectations, potentially placing them at an additional disadvantage. Finally, a growing body of sociology and psychology research has strongly demonstrated that individuals typically under-perform or over-perform to meet expectations if they believe a stereotype to exist about their identity group's aptitude for the task at hand. While these studies have not specifically addressed the issue of creativity related stereotypes, their conclusions do strongly suggest that if young women perceive their gender as being less creative than men, their performance would subconsciously suffer as a result. This is a worrisome idea, as some published evidence does purport that a majority of school-age females do believe that males are naturally more creative, even if their teachers disagree.

Personality Factors

One further area in need of discussion, whose potential explanations regarding the creative performance gender gap lie theoretically between the biological and socio-cultural camps, is that of personality differences. Gender, creativity, and personality share a number of meaningful interplays and associations, and the resulting effects may greatly impact an individual's creative potential and performance. Gender has long been known to affect personality, and seemingly influences creativity, while certain personality traits are highly correlated with creative potential and also appear more regularly in individuals of either a certain gender and/or of specific creative interests. To illustrate, consider both the personality traits of psychological androgyny and males' increased frequency of creative risk taking, each of which has already been discussed. In each case, personality, gender, and creativity are so intertwined that it is difficult to guess as to which is more responsible for the final behavioral pattern. Are androgynous people more creative because of their personalities, or are their personalities being shaped by their creativity? Do males prefer to take risks because they are creative, or are they considered creative because they

prefer to take risks? Similarly, these complex three-way interactions are also impossible to classify as strictly biological or socio-cultural in nature, as both nature and nurture weigh heavily on the construction of each.

Regardless of the circular interplays however, psychologists and sociologists have in fact conducted hundreds of studies examining gender and personality, and several conclusions have been reasonably established. Although not universally accepted, significant empirical data suggest that males are more aggressive, ambitious, willing to take risks, assertive, and confident on average than their female peers. On the other hand, the data suggest that females on average possess greater degrees of interpersonal ability, self-awareness, communicative expression, cautiousness, anxiety, and modesty. These gendered differences in personality are likely to have sizable effects upon an individual's creative performance, as many of these personality traits (among others) have also been shown to correlate with creative ability within specific domains. Artistic creativity, for example, appears well connected to emotional instability, nonconforming tendencies, anxiety, and imagination among others. Scientific creativity, on the other hand, seems more closely tied to personality traits such as introversion, independence, and aloofness to emotions. It is important however to note that the personalities of artists and scientists share much more in common than they have in difference, but these differences certainly must play a role in making specific creative endeavors more or less appealing to particular individuals. As a result, it is possible that men or women (on average) may find their equally creative personalities pulling them toward different domains of creative expression.

Conclusions

The ultimate question of gender differences in creativity quickly splits into two distinct inquiries, with one examining creative potential and the other creative performance. Decades of research has firmly established that no meaningful difference exists between the sexes in terms of potential, but centuries of history clearly illustrate that differences in performance have and do exist. As such, we are left with an intriguing question: if indicators of potential tell us that no difference should exist, how can we best explain why one actually does? Psychometricians, psychologists, and sociologists have long struggled with this problem, and their proffered theories have largely come from biological or socio-cultural viewpoints. For some, it is the fault of nature, and men and women were simply created to be distinct. For others, it is the fault of society, and men and women have been taught and shaped to make different choices in creative expression. In all likelihood however, the truth may lie somewhere between the two, incorporating both biological and socio-cultural elements.

Continued research to address these questions is of great value and importance, because of the real-world nature of the problems being discussed. If men and women should be achieving on an equally creative level, yet are not, one reasonable inference is that a great degree of creative talent is being neglected and going to waste. Creativity in any domain is a valuable and precious resource, and finding ways to maximize its development and application in both males and females carries meaningful implications for individuals and society as a whole.

See also: Everyday Creativity; Genetics; Nature/Nurture and Creativity.

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Genetics

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Glossary

Allele Alleles are alternative DNA sequences at the same gene locus.

Heterozygous Having different alleles at a certain gene locus. This is only possible if the gene locus is polymorphic.

Homozygous Having the same alleles at a certain gene locus.

Polymerase chain reaction (PCR) Molecular genetic technique invented by Kary Mullis in 1983 for which he was awarded the Nobel prize in chemistry ten years later.

Mullis work has revolutionized the field of molecular genetics. PCR allows quantification of DNA fragments without cloning.

Polymorphism A polymorphism is a mutation that occurs in more than 1% of the population.

Single nucleotide polymorphism (SNP) A SNP is a polymorphism that is defined by an exchange or a deletion of a single nucleotide/base at a distinct locus in the genome.

An Introduction into Behavioral Genetics

The question whether cognitive abilities are heritable has concerned mankind constantly and is still a matter for debate. During the last decades the public opinion on this issue has changed due to unequivocal evidence from scientific studies demonstrating strong genetic effects on general cognitive ability. However, the downright importance of cognitive abilities especially for job performance, as described by Schmidt and Hunter in 1981, makes it difficult to accept that environmental influences (e.g., training, education, upbringing) can only boost cognitive functioning within a certain framework determined by our genes. The scientific discipline that addresses this issue, behavioral genetics, has a long tradition starting in the nineteenth century when Francis Galton, a first cousin of Charles Darwin, published a two-article series on high intelligence and other abilities, which he later expanded into the first book on heredity and cognitive ability, *Hereditary Genius: An Enquiry into Its Laws and Consequences*, published in 1869.

Behavioral genetics can be divided into two subdisciplines: quantitative genetics addressing the question whether a certain phenotype is heritable and how large the genetic effects are, and molecular genetics, a very young discipline that tries to identify those gene loci that constitute the molecular basis of individual differences in behavior. Interestingly, quantitative genetics has nothing to do with the molecules that form our genome. It is a discipline that applies quantitative statistical models to decompose the variance of a given phenotype into proportions of variance accounted for by genes, environment, and gene–environment interactions. With respect to the genetic effects, additive and nonadditive gene effects are distinguished. ‘Additive’ means that small effects of single gene loci are numerically summed up whereas ‘nonadditive’ refers to gene–gene interactions, so-called epistasis effects. On the side of environmental influences, shared and nonshared environmental effects are separated (see below). Methods by which the phenotype is assessed often lack reliability. Therefore, measurement error needs to be considered along with environmental and genetic effects when heritability estimates are calculated.

In humans, quantitative genetics uses twin and adoption studies to disentangle genetic and environmental effects. The first study addressing the heritability of cognitive abilities was published in 1924. The method using twins was applied to find out whether identical twins were markedly more similar with respect to IQ than fraternal twins, a result suggesting a strong genetic influence on general cognitive ability. The rationale behind these findings is as follows: in twin studies, heritability is estimated by comparing correlation coefficients between mono- and dizygotic twins. Due to the fact that monozygotic twins share 100% of the same genome and dizygotic twins have only 50% of the genetic material in common, a simple formula which estimates heritability (h^2) of a given phenotype is twice the difference of the intrapair correlation coefficients of mono- and dizygotic twins ($h^2 = 2(r_{MZ} - r_{DZ})$). However, this Falconer formula is only precise under the prerequisite of the ‘equal environment assumption’ that assumes that environmental influences are equally strong for monozygotic and dizygotic twins. In practice, this assumption cannot hold due to the higher similarity of monozygotic twins as compared to dizygotic twins; monozygotic twins are more likely to be treated the same by their surroundings. Then later in life, the greater genetic overlap between pairs of monozygotic twins will increase the possibility that these twins actively choose the same environments with the consequence of decreasing the effects of nonshared environments. Another popular strategy to estimate heritability in humans is the combination of adoption and twin studies. In such designs, monozygotic twins separated by birth and reared apart are investigated. The intra-class correlation over pairs of monozygotic twins is a direct measure of heritability because the genes are identical and the environment is assumed to be different. However, the latter assumption certainly cannot hold because of selective adoption strategies of the public authorities, placing children only in adoption families with a certain socioeconomic status. Therefore, these combination designs result in an overestimate of heritability. Moreover, these samples of monozygotic twins separated by birth and reared in different environments are extremely rare.

Studies from Quantitative Genetics

Findings from quantitative genetics indicate that Intelligence (also referred to as IQ or general cognitive ability (g)) is the most heritable psychological phenotype known. Heritability estimates from twin and adoption studies indicate that up to 70% of the variance in intelligence is determined by genes. Many studies from applied psychology have demonstrated the importance of intelligence for academic achievement and job performance. The influence of creativity on scientific and industrial progress, inventions, and on the creation of outstanding art and music has been widely acknowledged. However, this had no salient impact on creativity research. In comparison to intelligence, research on creativity is rather orphaned. According to Sternberg, creativity research has "taken on the role of a prodigal stepbrother to research on intelligence." Obviously the neglect of creativity research is mainly due to methodological problems concerning reliability and validity of creativity measures and also due to disagreements in the definition of creativity. Some researchers preferred the *product*, others the *process* criterion to investigate creativity. The *process* approach assumes that creativity is a trait that is normally distributed in the general population, whereas the *product* approach defines creativity in terms of exceptional real-world creative production, which very few individuals manage to achieve. Therefore, supporters of the process/trait approach – like Guilford who followed the assumption that components of divergent thinking, namely originality, flexibility, and elaboration are at the core of creativity, and that these components are also manifest in a normal population – attempted to discover the underlying processes of creativity and tried to develop appropriate instruments to measure it.

Both intelligence and creativity are broad constructs of higher cognitive abilities but where are the differences or similarities? Getzels and Jackson stated that there is no relationship between intelligence and creativity. This view was criticized by several investigators and studies that found pronounced correlations between intelligence and creativity in unselected populations of school children. To account for these discrepancies a threshold model has been suggested that there is a relationship between IQ and creativity up to a level of about 120 IQ points but that above this level creativity is not necessarily correlated with intelligence. Guilford postulated that intelligence is a mandatory prerequisite for creativity but that not all intelligent people are necessarily creative. Items in intelligence tests always have one distinct solution whereas the achievement in creativity tests is defined by the originality and the number of diverse answers to a given problem. It is obvious that the criteria diversity and originality depend on the subjective views of the different raters resulting in poor reliability estimates. This lack of reliability in addition to different conceptualizations (process versus product approach) has made creativity research less popular than research on intelligence. Interestingly, in some intelligence models creativity or divergent thinking are facets of intelligence. Therefore, creativity should also have a strong genetic basis and should be – in a similar way as intelligence – normally distributed in the population. This assumption is in line with the process/trait approach. However, little is known about the genetic basis of

creativity and its heritability. A first seminal twin study of creativity in 1973 yielded an average correlation of 0.43 for identical twins and 0.31 for fraternal twins across different measures of creativity. Here, significant differences between MZ and DZ twins were only detected in the Word Association Test. A review of ten twin studies on creativity originating from the 1970s yielded an average correlation of 0.61 for identical twins and 0.50 for fraternal twins. According to this study the genetic influence of about 20% (Falconer formula: see above $H^2 = 2(0.61 - 0.50)$) is primarily due to the correlation between creativity and IQ. When IQ is controlled, identical and fraternal twin correlations for creativity tests were scarcely different. However, some of these studies deal with methodological problems concerning the reliable measurement of creativity and therefore, results are difficult to compare across studies. Unfortunately, no recent studies from quantitative genetics are available. Obviously the small effects and the above discussed problems in creativity research have discouraged scientists to carry on with this interesting research.

Short Introduction into Molecular Genetics

Molecular genetics is a very young discipline. The biggest milestone here was the invention of the polymerase chain reaction (PCR) technique by Kary Mullis in 1983 for which he was awarded the Nobel prize in chemistry ten years later. The work of Mullis has revolutionized molecular genetics and from there on it has become one of the most technical, industrialized, and fast developing disciplines in science. The progress in this field is breathtaking. Shortly after the mouse genome was decoded in 2002, the human genome was completely sequenced. Every few months new machines are introduced that allow an even faster genotyping or sequencing of the genome.

Molecular genetics directly ties into the results of quantitative genetics. It tries to answer the question of which genes make up the genetic basis of heritability. As outlined above, heritability is assessed by means of correlations. However, the size of a correlation is determined by the variance of the phenotype under investigation and variability accounted for by genes is caused by genetic diversity. Interestingly the overlap between the mouse genome and the human genome is tremendous: 99% of the mouse genome has an analogon in the human genome and 96% of the human genome has an analogon in the mouse. Consequently the overlap between the genes of two unrelated humans is >99%. Therefore, tiny differences in the human genome must have huge effects on the phenotypes. These differences in the genome across individuals are called polymorphisms if they occur in more than 1% of the population. In other words, polymorphisms are common mutations in a given population that constitute the genetic basis of variability in the phenotypes (e.g., behavior). The most frequent sort of polymorphisms are single nucleotide polymorphisms (SNPs) that are caused by an exchange of a single base (nucleotide) in the genetic sequence. The human genome comprises three billion base pairs (pairs due to its helix character), whereas the genetic code only consists of four different bases; arginine, cytosine, guanine and thymine.

Therefore, a SNP is a very small alteration in the human genome that in some cases can have a strong effect on the gene product encoded in our DNA. A polymorphism that leads to alterations in the gene product is labeled functional. Such functional polymorphisms are most likely located in the coding region of our DNA, that is, in an exonic region, or if it is located in the so-called promotor region of a gene that initiates its transcription. SNPs occur every 100–300 bases along the three-billion-base human genome. The information representing our genome is located in nearly every cell of our body, to be more precise in the nucleus of our cells. Therefore, a geneticist is confronted with the problem of making a bit of information, a SNP, visible. Similar to other techniques from the neurosciences, for example EEG, this is achieved by amplifying the raw signal of the data. It is here that the PCR comes into play. A PCR machine is nothing but a copy machine for DNA without cloning. In three steps defined by different temperature conditions the process of DNA self-duplication that takes place in the living organism at any time is imitated by PCR in a test tube. The first step is the denaturation of the DNA at 95 °C. Denaturation means that by simply heating the DNA the double-helix is disentangled with the result of having two single strands of the original DNA. Only single strands can be read or duplicated. The second step, called the annealing phase, starts by lowering the temperature in the reagent tube to 53–65 °C depending on the respective base sequence. Here the region under investigation (i.e., the region of the DNA where the SNP of interest is located) is marked by oligonucleotides (a series of about 20 nucleotides/bases), the so-called primers. Primers are synthetically designed and produced in a way that they complementarily bind to the original DNA strand and are unique in the genome. Complementary means that an adenine binds selectively to a thymine and a guanine to a cytosine. The actual duplication process takes place in the third step, the elongation. At 72 °C a thermo-stable enzyme, the Taq polymerase, elongates the simple DNA strand starting at the position of the primer. At the end of the first PCR cycle consisting of the three phases denaturation, annealing, and elongation we have two double stranded DNA molecules. These three steps are repeated for at least 35 cycles. During the reiterations the amount of DNA copies in the test tube follows an exponential growth function: After the second cycle we have four copies and after the third cycle we have eight copies and so on. The number of DNA copies is defined by 2^n where n denotes the number of the PCR cycles. After 30 PCR cycles we have over one billion copies. Besides DNA and the Taq polymerase the investigator has to add synthetic nucleotides into the reagent tube and dependent on the protocol other chemicals like Mg^{2+} fine tune the pH-value. At the end of a PCR run our tiny signal, the DNA region where the SNP is located, has been amplified in order to make the signal strong enough to find out if a base exchange has occurred or not. The latter is the process of genotyping that follows the amplification process. It is important to know that we have a diploide chromosome set, that is, every chromosome is present twice in our organism. From each pair of chromosomes one stems from our mother and the other one from our father. Therefore, the information on any gene locus is available twice. The genotype refers to both pieces of information at a distinct gene locus, the paternal and the maternal.

As a result our genotype at a certain SNP locus (the SNP may be defined by a base exchange from A → G) can be AA, AG, or GG. The base exchange resulting in the SNP occurred somewhere during evolution by chance and was transferred from generation to generation if this spontaneous mutation turned out to be beneficial. The ancestral allele is called the wildtype and the new allele is named the mutant. Thus, in our example we have the homozygous wildtype AA, the heterozygous AG genotype and the homozygous mutant GG. Genotyping is conducted by means of gel-electrophoresis or real-time-PCR. The latter technique uses fluorescence dyes to identify both alleles.

I will not go into further detail. What I intended to explain by this brief introduction into molecular genetics is that small variants (different alleles) in the genetic code build the basis for individual differences in behavior. The basis for genetic association studies are the allele frequencies or the genotype frequencies in distinct groups differing with respect to a certain phenotype. To obtain information on alleles/genotypes fragments of the genetic code the DNA strands have to be amplified first by means of PCR to get a signal that is strong enough for further analysis. I hope that the reader can now better understand the ensuing review of empirical studies from molecular genetics trying to identify those gene variants relevant for creativity.

Association Studies from Molecular Genetics

The number of genetic association studies on creativity is very small until now. The main reason for this is that creativity is a construct that is mainly studied by psychologists and psychologists normally are not familiar with molecular genetic techniques. However, if psychologists do not want to learn these techniques by themselves, they at least have the possibility to analyze their samples in cooperation with scientists from other disciplines who run a genetic laboratory. A similar development of interdisciplinary collaborations can be observed with respect to functional imaging studies. Nowadays, many psychologists use MRI techniques to investigate the biological basis of cognitive or emotional processes. Functional imaging with EEG has a long research tradition in psychology and the adoption of MR imaging was the straightforward next step. With respect to molecular genetics, however, psychologists seem to enter a completely new field.

In 2006 the first molecular genetic study on creativity was published by Reuter and colleagues. We investigated three polymorphisms on candidate genes for cognitive functioning, the COMT VAL158MET, the DRD2 TAQ IA, and the TPH1 A779C SNPs with respect to creativity. The COMT gene had especially been successfully related to cognitive functioning before. There is mounting evidence from the literature that unequivocally relates the MET allele or the homozygous MET/MET genotype of the COMT VAL158MET polymorphism to higher performance in prefrontal executive functions like working memory and executive control as measured by the Wisconsin Card Sorting Test. Functional studies have demonstrated that the MET allele of the COMT gene is characterized by a three- to four-fold reduction in COMT enzyme activity. The COMT enzyme's primary function in the human brain is the degradation of the neurotransmitter dopamine in the

prefrontal cortex. The authors conclude that the molecular genetic findings support the assumption that high dopamine levels in the prefrontal cortex are associated with higher cognitive abilities. However, it has to be mentioned that the total dopamine activity is not only influenced by the dopamine catabolism but also by the synthesis rate of dopamine in the presynapse, the activity of the dopamine transporter, the receptor density, and the receptor affinity. DRD2 TAQ IA, the second polymorphism under investigation, has been studied with respect to intelligence but the results were heterogeneous. One study reported a higher IQ in carriers of the A1A1 genotype in a female Taiwanese sample, Berman and Noble found a significant reduction in visuospatial performance in a sample of Caucasian children and Petrill et al. found no association between IQ and the DRD2 gene in an adult Caucasian sample. The rationale for investigating the TPH A779C polymorphism, a serotonergic SNP, with respect to creativity is based on evidence that the serotonergic (5-HT) system is also involved in cognitive functioning. The mechanisms of how the 5-HT system influences cognitive functions is less understood and support from the literature is scarcer than for dopamine. For example Coccaro et al. found a significantly negative correlation between whole blood 5-HT and cognitive-intellectual abilities in a sample of autistic patients and their first-degree relatives. By means of tryptophan depletion (reducing the food intake including the amino acid tryptophan), an elegant method to investigate the involvement of 5-HT in brain functions, impairment in cognitive functioning could be demonstrated in both animal studies and studies on healthy human subjects. Further evidence stems from clinical studies showing the beneficial effects of substances increasing central 5-HT activity. All these findings underline the role of the 5-HT system in cognitive functioning, although the role of the dopaminergic system seems to be more salient. Also it cannot be excluded that some of the 5-HT effects on cognitive functioning are mediated via an indirect pathway by influencing the activity of the dopaminergic system. It is known that the 5-HT system exerts an inhibitory effect on DA release. In its function as the rate-limiting enzyme of 5-HT synthesis, the tryptophan hydroxylase 1 gene (TPH1) is a promising candidate gene for cognitive functioning. However, previous positive association studies investigating the TPH1 gene have been criticized because the TPH1 gene is primarily expressed in the periphery and not in the brain. A recent finding by Nakamura et al. reporting a specific role of the TPH1 gene for the central 5-HT synthesis in a late developmental stage underlines that the TPH1 gene could indeed have an impact on cognitive functions. Recently another TPH isoform has been identified, the TPH2 gene that is responsible in central 5-HT synthesis. Recently, a promising functional candidate SNP on TPH2, the TPH2-703 G/T, has been related to executive control functions and altered brain metabolism during a working memory task by our group. Unfortunately this SNP was not available for our 2006 study on the genetics of creativity. In this study creativity and intelligence as a control variable were measured in analogy with a previous study by our group in which we investigated the influence of testosterone and personality on creativity. Creativity was assessed by the test battery 'inventiveness' of the *Berlin Intelligence Structure Test* (BIS). The BIS defines creativity as a subcomponent of intelligence. The inventiveness

tests challenge the flexible production of ideas, the power of imagination, and the skill to consider many possible ways and solutions to solve a problem. They measure figural, verbal, and numeric creativity and have very good psychometric properties. In order to control for the influence of intelligence on the association between gene loci and creativity, fluid and crystallized intelligence were also tested and served as covariates.

The results obtained in a sample of $N=92$ Caucasian subjects showed that the DRD2-gene and the TPH1-gene were both associated with total creativity with a combined 9% of the variance while COMT was not related to creativity at all. With respect to the subcomponents of creativity, the A1+ allele (carriers of the A1/A1 and A1/A2 genotype) of DRD2 was related to higher verbal creativity as compared to the A1- allele (carriers of the A2/A2 genotype) and carriers of the A allele of TPH1 showed significantly higher scores in both figural and numeric creativity.

Recalling that verbal tasks are assumed to be processed in the left hemisphere and numeric and figural tasks in the right hemisphere, the findings suggest that the two gene loci discriminate between higher cortical functions, according to the organization of cognitive functions in the respective hemispheres. Moreover, the results indirectly support Eysenck's hypothesis on creativity suggesting higher creativity in subjects scoring high on the psychoticism dimension. Psychoticism is related to aggressiveness and there is evidence in the literature that the A allele of the TPH1 A779C which was linked to higher creativity scores in our study is also related to high aggression.

A second study from Finland investigating musical aptitude as a form of artistic creativity directly refers to the first genetic association study on creativity by Reuter et al. by adding TPH1 A779C, COMT Val158Met, and DRD2 Taq Ia, plus three additional polymorphisms, the serotonin transporter polymorphism (5-HTTLPR) and two variable microsatellites located in the promoter region of the vasopressin receptor 1a gene (AVPR1a). The authors combined a quantitative genetic and a molecular genetic approach by testing musical creativity in 19 Finnish families with at least some professional musicians and/or active music amateurs. The heritability estimates for creative functions in music were very strong ($h^2 = 0.84$; composing $h^2 = 0.40$; arranging $h^2 = 0.46$; improvising $h^2 = 0.62$). The authors reported an overall haplotype association between the microsatellite markers RS1 and RS3 of AVPR1a and musical creativity. While the effects of the gene variants of AVPR1a on all dependent variables were very strong, weak associations between the three previous candidate SNPs suggested by Reuter et al. and musical creativity could also be detected. The TPH1 A779C A allele that was related to figural and numeric creativity in the Reuter et al. study showed an association with composing. The Finnish authors argue that figural and numerical abilities are skills that are required for composing. The COMT Val158Met Val-allele was weakly associated with pitch recognition and improvising. The Taq Ia allele of DRD2 was suggestively related to Seashorers test score of time perception. The authors see a relation between the findings of Reuter et al. who reported higher verbal creativity in carriers of the A1 allele because there seems to be a common evolutionary background of music and language based on overlapping brain regions. It can be assumed that the rather weak effects of COMT, DRD2, and TPH1 may be

caused by the small study sample. However, the strong effects of AVPR1a, a gene related to prosocial behaviour, indicates that the neurobiology of music perception is likely to be related to the pathways affecting intrinsic attachment behavior.

Another molecular genetic study by Volf et al. tried to extend the role of the serotonergic system on creativity suggested earlier by also using an approach from molecular genetics. They chose the serotonin transporter polymorphism 5-HTTLPR that was also used in the Finnish study but showed no association with musical creativity. In this study on 62 Russian students the authors found higher verbal and higher figural creativity scores in carriers of the S-allele (genotypes SS and SL) as compared to homozygous LL subjects. Verbal creativity was assessed with one of the scales of the BIS that was also applied to the Reuter et al. study and figural creativity was measured by means of the figural tasks of the Torrance Tests of creative thinking. The S-allele of 5-HTTLPR has been reported to be associated with lower mRNA levels, decreased 5-HT transporter density, and 5-HT uptake as compared with carriers of the LL genotype. The findings are contrainuitive because the S-allele whose carriers exhibited higher creativity scores has been related to neuroticism and depression. It is known that creativity is associated with positive rather than negative emotionality.

In a recently published study, Kéri investigated a prominent SNP (rs6994992) on a candidate gene for psychosis, neuregulin 1, for its relevance for creativity. The starting point for his study was the suggested association between psychotic features and creativity. Neuregulin 1 has an influence on neuronal development, synaptic plasticity, glutamatergic neurotransmission, and glial functioning. In previous studies the TT genotype of rs6994992 was related to an increased risk of psychosis and lower premorbid IQ, to lower working memory capacity, to higher sensitivity to harsh criticism during interpersonal interactions (Kéri et al., 2009), to decreased activation of the frontal and temporal cortex during cognitive tasks, and to reduced white-matter density.

In a sample of 200 healthy subjects with high academic and intellectual performance Kéri found a significant allele load effect of rs6994992 on all three scales (originality, fluency, flexibility) of the *Creative Achievement Questionnaire* and on the test score in the 'Just Suppose' subtest of the *Torrance Test of Creative Thinking*. Carriers of the TT genotype had highest scores, heterozygous CT carriers intermediate, and homozygous CC carriers lowest levels of creativity. The effects hold even after correction for gender, socioeconomic status, or IQ. With his study Kéri showed that a polymorphism that increases the risk for psychosis has also a positive effect on creativity. According to the author, the link between psychosis and creativity is mediated by neuregulin 1 that reduces cognitive inhibition in the prefrontal cortex. Neuregulin has been related to this brain region and it is also known that the prefrontal cortex has a prominent role for cognitive inhibition and creativity. One limitation of the study is that the association between the neuregulin 1 SNP and creativity was found in a sample with high intellectual achievement. Further studies need to show if this findings can be extrapolated to the general population.

Finally, a recent study by Marc Runco and colleagues investigated five candidate genes for creativity and their effects on ideational fluency, originality, and flexibility. Besides the three known SNPs used in the study by Reuter et al. two repeat

polymorphisms – one on the dopamine D4 receptor gene (DRD4) and one on the dopamine transporter gene (DAT) – were also analyzed. Runco et al. applied tests of creativity that provide measures of fluency as well as measures of originality and flexibility. The authors have criticized previous studies for merely focusing on the fluency concept of creativity rather than on originality and flexibility. They argue that fluency only represents productivity but that it is not nearly as closely tied to creativity as is originality. Originality can be defined in terms of the uniqueness or unusualness of ideas. Results showed that all four dopaminergic candidate genes were associated with fluency. In contrast none of the five polymorphisms alone was significantly related to either originality or flexibility. When controlling the significant effects on fluency for intelligence, the effects became even stronger. Therefore, the study by Runco and colleagues supports previous findings that dopaminergic genes are relevant for fluency. Negative findings with respect to measures of flexibility and originality do not exclude that other gene variants are relevant for these phenotypes.

Problems and Perspectives

Genetic research on creativity is absolutely scarce. The reasons for this are manifold. First of all the construct of creativity is investigated by two different approaches, the process and the product approach which promotes inconsistencies in research findings. Second, creativity tests using the process approach are dependent on independent raters when trying to assess the component of originality. A lack of reliability in turn is related to a pronounced measurement error rendering heritability estimates low and increasing the risk of nonfindings in genetic association studies. Third, creativity is a construct stemming from psychology and psychologists do not have a long tradition in genetics especially not in molecular genetics. The first quantitative genetic studies originating from the 1970s produced small heritability estimates that may have discouraged further research in this field. However, these twin studies had mostly small sample sizes so that the question as to what extent creativity is heritable is still open. On the other side molecular genetic studies on creativity seem to become *en vogue*. After the first pilot study in 2006 three new studies were published in 2009. Of course, the proportions of variance that can be explained by some singular SNPs are very limited. Traits that are normally distributed in the population like creativity are caused by a large number of polymorphisms. Genome-wide association studies (GWAS) that are already applied in the field of psychiatric genetics may be a solution. This new technique allows investigating more than 1 000 000 SNPs at a time by placing specific hybridization probes on a microchip. At the moment the costs are very expensive but it is a question of time until this technique becomes affordable. At the moment GWAS are used in research addressing pathologies (e.g., schizophrenia), and psychological phenotypes like creativity seem to be lower in priority ranking. Despite the chances offered by GWAS there are also problems related to this technique. We are confronted with multiple testing and are at risk to commit type I errors. GWAS demand independent replication and corroboration of the candidate SNPs by ensuring high-throughput-sequencing or -hyphenotyping. Another

promising pathway is the strategy used by Ukkola et al. (2009) who combined a twin study with a molecular genetic approach. Although their sample size was small their strategy is promising in order to learn also about gene–environment interactions and gene loci that are related to them.

Recent molecular genetic studies make me confident that we will learn much more about the genetics of creativity in the next few years. Other approaches from the neurosciences that investigate brain activity or brain architecture related to creativity by means of EEG or MRI are other promising strategies worth mentioning. As already done with respect to other research topics the combination of MRI data with molecular genetics will be also very fruitful to understand the biological basis of creativity.

See also: Families and Creativity.

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Genius and Greatness

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Glossary

Anthropometric measures Instruments developed by Francis Galton that he claimed to measure what he called 'natural ability.'

'Great man' theory of history A theory proposed by Thomas Carlyle and others that maintains that history is made by a relatively small number of great creators and leaders.

Historiometric genius Genius defined according to an individual's impact on history, using historiometric measures, like the amount of space the person receives in reference books.

Multiple intelligences The theory proposed by Howard Gardner that there are seven or more distinct intelligences with divergent consequences for outstanding achievement.

Psychometric genius Genius defined according to an individual having received a very high score on a psychometric measure, most commonly an IQ test.

Serendipity When a person accidentally discovers something that he or she was not originally seeking.

10-year rule The empirical generalization that, on average, it requires about a decade of intense study and practice to acquire world-class expertise in most domains of achievement.

Introduction

Consider the following historical personalities: Napoleon Bonaparte, Abraham Lincoln, Isaac Newton, Marie Curie, Leo Tolstoy, Leonardo da Vinci, and Ludwig van Beethoven. What do they have in common that sets them apart from the rest of us? Several answers are possible, but two perhaps stand out. First, all can be considered geniuses of some kind, whether military, political, scientific, or artistic. Second, all can be said to display greatness in their chosen domain of achievement. Thus, Napoleon was a great general, Lincoln a great president, Newton a great scientist, and so forth. In these examples, genius and greatness appear to go together. Yet do they always have to correspond? Can genius exist without greatness or greatness without genius? It is the purpose of this entry to examine the conceptual connection between these two constructs. Discussion begins with their respective definitions, and then examines the convergences and divergences implied by these definitions. Although often used interchangeably, the two terms are by no means equivalent.

Genius

The concept of genius has undergone a substantial change over the course of history. The word originated in Roman times. According to Roman mythology, each man was born with a genius that represented a kind of guiding spirit or guardian angel. A man's genius is what made him distinctive – and exerted some influence over his fate. Although the parallel tutelary spirit for women was a 'juno,' this gender-differentiated usage did not survive to modern times. Interestingly, not just individuals had a genius. Particular places might have genius loci that served as protective spirits. And a Roman clan, caste, or group of families could also have a genius. Although the connection is not completely secure, the Latin word may be related to the Arabic 'jinn,' often translated into English as 'genie.'

Over time, genius became dissociated from the spiritual world. Instead, it became something highly characteristic of a given person, especially with respect to some unusual ability or inclination. Someone could have a genius for making friends, for example. In line with this usage, anyone could have a genius because genius is what defined one's individuality. But since the Renaissance, genius began to acquire a more restrictive meaning. As a result, only an elite subset of the human population could be said to have genius. In particular, a person could only be considered a genius if he or she exhibited exceptional intellectual or creative power. Uniqueness or individuality was insufficient.

At first, the emphasis seemed to have been placed on the creative powers. For this reason, perhaps, genius was initially confined to artistic domains of achievement. William Shakespeare and Michelangelo Buonarroti could thus be considered geniuses. Scientific creativity, by comparison, required no genius because science relied solely on a method that could be taught or imitated. For instance, Immanuel Kant argued, in his *Critique of Judgment*, that even a scientist as great as Newton could not be considered a genius because someone could theoretically learn to do what he did. Artistic geniuses, in contrast, invent their own rules, unconstrained by logic and fact. Nonetheless, eventually genius came to be found outside of the arts, including in the sciences. Indeed, after a while it became reasonable to speak of military genius, political genius, and the like. Sometimes the term even became overextended. Galton's 1869 *Hereditary Genius* includes athletes along with generals, scientists, philosophers, artists, and composers.

These etymological developments lead to the most critical question: How can genius be given a definition suitable for scientific research? Stated differently, is it possible to devise a definition of genius that supports precise measurement? The answer is affirmative but plural. Researchers have tended to use two rather divergent definitions of genius, namely, the historiometric and the psychometric.

Historiometric Definition

Galton was the first to define genius in terms of historical impact. A genius was someone who had acquired an extraordinary reputation for culturally valued achievements. This reputation was first established with contemporaries but was later consolidated by the posthumous appraisals of posterity. Given sufficient time, the judgment of an individual's contributions to civilization should become reasonably stable. Certain reputations will have withstood the 'test of time' whereas others will have 'fallen by the wayside.' The question was then how to assess whether or not a particular individual could claim sufficient reputation to be counted as a genius.

Galton's solution to this problem was to adopt a crude eminence measure. A person who was featured in a major biographical dictionary had a *prima facie* justification for being considered a genius. An alternative solution was proposed by Galton's contemporary Alphonse de Candolle, who introduced awards or honors as the criterion of distinction. More specifically, Candolle studied scientists who were sufficiently illustrious to earn election to a prestigious scientific society. Galton later endorsed this criterion as a reasonable alternative to his original measurement strategy.

Even so, both of these measures had a drawback: They did not admit of degree. Geniuses can differ in the magnitude of their genius. Not all persons with entries in a biographical dictionary are equally eminent. Galileo Galilei certainly surpasses Evangelista Torricelli, just as Fyodor Dostoyevsky outshines Aleksandr Kuprin. Similarly, not all recipients of a given honor or award are of equal standing as geniuses. Albert Einstein received the Nobel Prize for Physics one year after the same award was bestowed on Charles Edouard Guillaume. Whereas the former laureate revolutionized our conceptions of matter, light, space, time, and gravity, the latter laureate merely discovered some anomalies in nickel steel alloys.

The first researcher to offer a quantitative rather than qualitative measure of genius was James McKeen Cattell. In 1903, he ranked the 1000 most eminent creators and leaders of Western history based on the amount of space devoted to each luminary in standard reference books. According to his sources, the most space was devoted to Napoleon and Shakespeare, the least to Barthélemy Prosper Enfantin and François-Noël Babeuf. Later investigators refined this approach, especially Frederick Woods, who was the first to refer to such measures as historiometric.

Cattell also introduced an alternative method for the historiometric definition of genius: expert surveys. He would ask experts to evaluate the relative impact of eminent scientists. This approach has also been used frequently to assess the differential influence of achievers in a variety of domains, including classical composers and US presidents.

The above two historiometric definitions are not equivalent. Space measures tend to have much more skewed distributions than do expert evaluations. Even so, they correlate very highly, the top figures by one assessment tending to be pretty much the same as the top figures by another assessment. Just as important, historiometric judgments tend to be highly stable across historical time, even after the passage of a century or more.

Psychometric Definition

The historiometric definition of genius is clearly sociocultural rather than psychological. Reputation is irretrievably contingent on the opinions of others. Scholars have to decide how much space to assign entries in biographical dictionaries, and experts have to assess the relative impact of various contributions. Nevertheless, Galton believed that an achiever's reputation was directly related to his or her personal qualities. In particular, he attributed genius to high natural ability. The latter was a complex concept that included intelligence, energy, and motivation. Even so, it is clear that Galton viewed intellect as primary. Human beings varied greatly in natural ability, and this variation was quantitative rather than qualitative. That is, each individual could be placed on a continuous scale with the least able at the bottom and the most able at the top. In addition, Galton introduced an important innovation: the concept of the normal distribution, as described by the 'bell curve.' Although Adolphe Quételet had shown that many physical characteristics, such as weight and height, were normally distributed, it was not until Galton that psychological attributes were said to have the same distribution. He went even further by specifying that geniuses represent the upper tail of this normal distribution. That is why geniuses are so rare.

Unfortunately, at the time that Galton advanced this concept of genius, no instruments existed by which he could directly measure natural ability. So he was obliged to devise his own instruments, eventually producing a large number of 'anthropometric' measures. These assessed individuals on visual and auditory acuity, reaction times, breathing power, strength, height, and weight – attributes that do not seem to have an obvious link to natural ability. In fact, these measures were later shown not to correlate with anything that would be associated with intelligence, even less with genius. For instance, a student of Cattell found that they did not correlate with college grades. As a consequence, Galton's instruments could not provide the basis for a psychometric definition of genius.

The needed measures came from an unexpected quarter. In the early twentieth century, Alfred Binet and Théodore Simon devised an intelligence scale that assessed a child's mental age. William Stern later conceived the idea of dividing the mental age by the chronological age and then multiplying the result by 100 to yield an intelligence quotient, or IQ. Not long after, Lewis M. Terman adapted the Binet–Simon for use with English participants, implementing Stern's concept of the IQ. In the early 1920s Terman applied the resulting Stanford–Binet Intelligence Scale to a large sample of young children. Those with IQs of 140 or more were then subjected to an intensive longitudinal investigation. The study was published in a series of volumes under the title *Genetic Studies of Genius*. The criterion of IQ 140 thus became the psychometric definition of genius. This cut-off even found its way into some standard dictionaries.

Of course, such a threshold is necessarily arbitrary. It defines those individuals whose IQs are in the top 1 percent of the general population. Certainly alternative cut-offs might also be justified. Mensa, the organization for high-IQ people, requires that a member only be in the top 2% of the population, whereas membership in the Triple Nine Society demands a score in the 99.9th percentile. Even more extreme, the Mega

Society sets the IQ requirement at the 99.9999th percentile! Because standard intelligence tests do not yield scores high enough, candidates for membership must take specially designed tests.

Given the psychometric definition of genius, the person with the highest recorded IQ would be considered the world's greatest genius. Marilyn vos Savant was once listed in the *Guinness Book of World Records* as having that distinction, with a putative score of 228. Although both the claim and the score are controversial, she does illustrate an important point: psychometric genius does not always correspond to historiometric genius. Since 1986, her chief claim to fame has been the column 'Ask Marilyn' that appears each Sunday in *Parade* magazine. Here she answers questions and solves puzzles posed to her by the column's readers. She has not yet made a single contribution that would make her eligible for the distinction of being called a genius in the historiometric sense. Her situation can be contrasted with that of her husband Robert Jarvik, who attained some degree of eminence as the inventor of the Jarvik artificial heart. Stated differently, Jarvik's claim to greatness is probably higher than vos Savant's even if the latter has the higher IQ.

Greatness

The concept of greatness is strongly associated with what was once called the Great Man Theory of History. In this view, history is essentially equivalent to the biography of a few 'great men' or 'heroes.' This theory is often credited to the British historian Thomas Carlyle, who expounded the position in his 1842 book *On Heroes, Hero-Worship and the Heroic in History*. He devotes considerable attention to such historic figures as Napoleon, Muhammad, Martin Luther, Jean-Jacques Rousseau, and Shakespeare, seeing them as decisive agents of civilization. Supposedly, the world we live in would be decidedly different if these individuals had died in the crib. A more recent illustration of this theory can be found in Hart's book *The 100*, which purports to rank 'the most influential persons in history.' The top figures on his list are Muhammad, Newton, Jesus Christ, Buddha, and Confucius. A glance of the complete 100 reveals that every one of these influential figures can be assigned to one of two categories of greatness: outstanding leadership and exceptional creativity. However, it must be recognized that another guise of greatness exists that cannot be included in either of these two categories, namely, prodigious performance. Below we examine all three forms.

Outstanding Leadership

Leadership has been defined many different ways. Some of these definitions have greater scientific utility than others do. On the one hand, we might identify leadership with some mysterious property that only certain great persons possess, such as charisma, dynamism, or magnetism. These highly romantic conceptions of leadership have immediate appeal, capturing as they do some popular myths about great leaders. However, such notions do not have much precision. Accordingly, these ideas do not lend themselves to measurement, and if scientists cannot measure an attribute, they cannot really study it.

Hence, leadership researchers tend to adopt a much less romantic conception of the phenomenon. Given a group of individuals, leadership is defined according to the magnitude of influence a given group member exerts over group problem solving, decision making, or cohesiveness. Although the person who displays the most impact is often called the group leader, groups can have more than one leader, and often do. For instance, one leader might be a 'task specialist' while another would serve as the 'social-emotional specialist.' Where the former would focus on group decision making or problem solving, the latter would concentrate on maintaining group morale or cohesiveness. Naturally, the best leaders would exhibit the capacity to accomplish both ends.

Defining leadership in this way leads quite naturally to a definition of 'great leaders.' The groups over which great leaders exert their influence are much larger, and the magnitude of that influence is much greater. The groups are whole nations, even civilizations, and the influence takes the form of new religions, laws, reforms, institutions, military victories, or territorial conquests. It is no accident that some of the highest ranked luminaries in *The 100* are religious leaders: Their impact often affected millions of people not only in their own time but also for centuries after their death.

Exceptional Creativity

The creative individual is usually defined as someone who can generate ideas that are both original and adaptive. However, both criteria are quantitative rather than qualitative variables. There are degrees of originality and degrees of adaptiveness. An idea might seem original to a person even if it is not original to others. And an idea might work for a person without working for others. For this reason, it has become standard practice among researchers to distinguish between 'little-c' and 'Big-C' creativity. The former involves the low levels of originality and adaptiveness that are sufficient for everyday life. An example might be a new recipe in response to some missing spices. The latter entails high levels of both factors. The levels may be so high that the ideas are deemed original and adaptive by many others, and perhaps even by a whole discipline, society, or civilization. Big-C creativity almost invariably results in the creation of a specific product, such as a poem, play, novel, painting, sculpture, design, composition, patent, monograph, or journal article. Furthermore, it is not enough to create a concrete product; it also must have impact. For example, a poem must be frequently anthologized, a composition must be often performed and recorded, and a scientific article must be cited by many other scientists. Indeed, at the highest level of creativity the product may become labeled as a masterwork or masterpiece.

It should be evident by now that Big-C creativity bears a striking conceptual relation with leadership. Such creators are in effect leaders, and the greatest creators are the greatest leaders. The main difference is the 'group' that is the object of influence. A great film maker exerts influence over movie audiences and critics – and over fellow film makers as well. Moreover, the impact of the greatest creators, like that of the greatest leaders, withstands the test of time. Newton was listed among the most influential creators because his contributions to mathematics and physics shaped the course of history.

Even Einstein was profoundly influenced by Newtonian physics. Einstein's special and general theories of relativity only acquire importance in the context of Newton's mechanics. One cannot launch a scientific revolution without having an established paradigm against which to revolt.

Notice that Newton and Einstein exemplify another feature of truly great creators: their impact extends beyond the specific domains to which they contributed. Both have produced ideas that became part not just of the larger intellectual community but also popular culture. The story of Newton discovering gravity while sitting under an apple tree and Einstein's famous equation $E=mc^2$ are known to people who might never have had a course in physics.

Prodigious Performance

It was mentioned earlier that Galton included athletes among the 'geniuses' in his 1869 *Hereditary Genius*. Specifically, he examined both oarsmen and wrestlers! Although it seems to be stretching the concept of genius to apply it this way, no reservations are required when we speak of greatness in sports. Athletes who receive Olympic gold medals, win world championships, or hold world records can certainly earn this status. Thus, in this sense, we can say that Michael Jordan was a great basketball player or that Joe Montana was a great quarterback. Furthermore, it is obvious that the epithet 'great' can be legitimately assigned to other exemplars of prodigious performance. For example, we certainly speak of greatness in chess, and the term is no less applicable in the performing arts, including acting, dancing, singing, and instrumental performance. In general terms, if supreme performance in a given talent domain is recognized with trophies, prizes, or awards, it becomes appropriate to view the achievements as signs of greatness.

In the case of outstanding leadership and exceptional creativity we add the proviso that the person must exert sufficient influence to earn the ascription of greatness. The same requirement might be attached to prodigious performance as well. To be great, the individual must inspire others in the same talent domain. For example, many violin and piano virtuosos have been inspired by the great Jascha Heifetz and Vladimir Horowitz, respectively. In sports, certain world records set by earlier great athletes can inspire their successors to strive to attain an even more impressive greatness. With the advent of audio and video recordings, it has become possible for somewhat ephemeral forms of achievement to provide inspiration for subsequent generations.

But must we consider all forms of prodigious performance to count as instances of greatness? There are certainly cases where we might wish to withhold the appellation. Should we count serial killers? Should greatness be ascribed to individuals who manage to make it into the *Guinness Book of Records* for feats such as stringing together the longest chain of paperclips in a 24-hour period?

Convergence

It is possible to provide a convergent definition that combines the concepts of genius and greatness. The best place to begin is Kant's definition of genius, which combines some of the

features of the earlier definition of creativity with some of the aspects of Galton's historiometric definition of genius. Kant said that geniuses must generate a product that is both original and exemplary. A product is *original* if it does not depend on the *imitation* of others, and it is *exemplary* if the product is so striking that it becomes an object of imitation by others. Although Kant confined his definition to artistic creativity, the restriction can be relaxed. Contrary to what Kant argued, Newton's *Principia Mathematica* can be considered both original and exemplary. The work provided a new model for doing physics that dominated the field until the early twentieth century. Even if Newton had to learn a lot of mathematics and science to conceive his masterpiece, the resulting product was by no means imitative. The work advanced well beyond its influences. At the same time, Kant underestimated the role of 'imitation' in artistic creativity. Contrary to what he maintained, talent alone does not suffice to produce works that are both original and exemplary. Even artistic creators have to devote a considerable amount of time to mastering the necessary knowledge and skills. In fact, research has shown that it normally takes about ten years of extensive learning and practice before anyone acquires sufficient domain-specific expertise to make superb contributions to a given domain. This ten year rule even applies to child prodigies like Wolfgang Amadeus Mozart.

Indeed, we can contend that a product cannot be viewed as a work of genius unless that product represents a domain in which the ten year rule applies, at least as an approximation. This requirement then rules out many of the achievements that populate the *Guinness Book of Records*. Whoever first came up with the task of stringing paperclips together in a 24-hour period was certainly original, and the task later became exemplary, at least in the sense that the accomplishment inspired imitators who hoped to get their names in the record books. Yet it is patently true that the ten year rule does not apply. It does not take a decade to learn how to form paperclip chains. Ten minutes is more than enough practice. Hence, even the originator of the Guinness category cannot be identified as a genius.

The preceding stipulation suggests another useful requirement. It is not just a matter that chaining paper clips requires no vast domain-specific expertise. It is also the case that it requires no exceptional intelligence to acquire and manifest that expertise. Many of the unusual feats in the record books do not require any more than an average intelligence even if they require more expertise than paperclip chaining. This observation certainly holds for most of the events that earn Olympic medals. To become a champion in shot put no doubt demands tremendous skill that is contingent on considerable practice and dedication. Still, it is unlikely that shot putters must be extremely intelligent to attain mastery of the sport.

Therefore, we may add the requisite that genius can only be displayed in a domain in which expertise acquisition and manifestation presume an intellectual power far above average. This intellectual power does not have to be of the variety assessed in the typical IQ test. It could even represent a more specialized ability, as represented by one of Howard Gardner's multiple intelligences. Einstein's expertise acquisition would then have a different intellectual foundation than Pablo Picasso's or Martha Graham's. Yet the fact would remain that the

domain-specific expertise that they acquired could not be attained and demonstrated by the average person on the street. Not everyone has the intellectual wherewithal to acquire and exhibit superlative mastery of physics, painting, or choreography.

By this point, we have said that genius requires the generation of original and exemplary products within a domain that presupposes the acquisition and manifestation of an intellectually demanding expertise. Such a conception would definitely apply to every major domain of exceptional creativity, whether scientific or artistic. Moreover, if the concept of products is broadened to encompass the principal acts of generals, politicians, diplomats, legislators, judges, and the like, then the same definition works for extraordinary leadership. As a case in point, Napoleon's battlefield tactics can be judged as both original and exemplary – to such a degree that his tactics became the objects of study in military science. The definition can also be extended to certain types of prodigious performance. Undoubtedly, chess champions who devise original and exemplary tactics would be considered geniuses. The same might hold for violin virtuosos who come up with original and exemplary interpretations of masterworks in the classical repertoire. Athletes in certain sports may also qualify if (a) their skills required a high degree of intellectual power and (b) their accomplishments proved both original and exemplary. An example might be a player in a team sport whose prodigious performance permanently changed the nature of the game.

Nonetheless, this inclusive definition might seem too inclusive. After all, might not a 'criminal mastermind' count as a genius if the crimes displayed domain-specific expertise, intelligence, originality, and inspired numerous imitators? Although the answer would have to be affirmative, given the conditions, the criminal would be considered a genius of a special type, namely an 'evil genius.' More critically, we would not assert that the hypothetical individual exhibited greatness. That ascription cannot be applied because greatness presumes that the products of genius fulfil widely shared values. That is, the achievements represent contributions to society to a whole and not to some small group or individual that has what might be deemed a parasitic relationship with the larger society. Accordingly, the person credited with the accomplishment can be broadly taken as a role model for many others to follow. Stated differently, the genius who attains genuine greatness can be proclaimed as a sociocultural paragon – a person who exemplifies what is commonly taken as the best and the brightest. He or she inspires nearly universal admiration. Consequently, their portraits or images of their accomplishments more often end up on postage stamps, T-shirts, and even cartoons. The cream of the cream will have monuments built in their memory, such as the Washington, Jefferson, Lincoln, and Roosevelt memorials in Washington DC.

In the earlier discussions of genius and greatness, it was noted that these are quantitative variables rather than qualitative attributes. The same observation applies to the convergence of genius and greatness. The greatest geniuses are those who generate the largest number of original and exemplary products or acts that are widely admired as lasting contributions to civilization. For this reason, one-shot or one-idea achievers receive much less acclaim than those whose lifetime of notable achievements cannot help but provoke awe.

Pachelbel's Canon in D is certainly a very pleasant work, but it is a rather small peg to hang a reputation on in comparison to all the masterworks generated by Johann Sebastian Bach. Worse yet, Pachelbel's best cannot really compare with Bach's best, so the former is overwhelmed by both quantity and quality. Necessarily, then, Bach must be credited with more genius and greatness than Pachelbel. This same contrast is applicable to great leadership and performance as well. Union General George Meade established his reputation for his defeat of Confederate General Richard E. Lee at Gettysburg, yet Meade's lone achievement pales in comparison to the multiple Union victories under General US Grant.

Divergence

The previous section just outlined how genius and greatness might be viewed as converging on the same exemplars of exceptional creativity, outstanding leadership, or prodigious performance. This integration began with Kant's assertion that genius produces works that are original and exemplary, and from there added domain-specific expertise, high intelligence, productivity, and sociocultural value. Yet it must be recognized that this synthesis came with a price: unlike the psychometric and historiometric definitions of genius, the convergent definition of genius and greatness does not lend itself to direct measurement. Some of the components of the definition are too elusive or vague, such as sociocultural value. For that reason, we have to ask how psychometric and historiometric genius compare with greatness.

Psychometric Genius Versus Greatness

We have put forward that bona fide genius demands sufficient intelligence to enable a person to acquire and manifest domain-specific expertise. So what is the minimum level of intelligence that would suffice? Creativity research has often suggested a threshold IQ of 120. If we take this figure to apply to various intelligences rather than just that intelligence tapped by IQ tests, then it should be apparent that a genius-level psychometric IQ is not necessary. Being intellectually gifted should be sufficient. Even so, this threshold must undergo two reservations.

First, different domains of achievement seem to have distinct lower bounds to the amount of intelligence required. Among leaders, military leaders appear to require less raw intellectual power than do political leaders, and less intellect is demanded to become a poet than a philosopher.

Second, whatever the threshold level required for a particular domain of achievement, higher levels of appropriate intelligence are associated with higher levels of greatness. This positive relation was first demonstrated in Catharine Cox's classic 1926 historiometric study of 301 geniuses. After a team of independent raters assessed the individuals on IQ using developmental data, the resulting scores were shown to correlate positively with eminence. Moreover, the association has been replicated in several subsequent studies. For instance, it has been shown to hold for United States presidents, European monarchs, and eminent African American creators and leaders.

The upshot is that psychometric genius has a weak but positive connection with greatness.

Historiometric Genius Versus Greatness

One would think that historiometric genius would come much closer to greatness than does psychometric genius. Where the latter is predicated on a test score of some kind, the former is based on actual achieved eminence, as gauged by historiometric measures. In addition, it would seem that a luminary cannot attain eminence without producing something that satisfies the criteria that we have laid out for greatness. However, various other factors can undermine the degree of correspondence between historiometric genius and authentic greatness.

In the first place, individuals sometimes attain not fame but infamy. Not every person who makes it into the history texts, biographical dictionaries, or encyclopedias is placed there because they affirm certain sociocultural values. On the contrary, they are included as examples of what not to do – individuals to be eternally derided and damned. Benedict Arnold, John Wilkes Booth and Grigori Rasputin are illustrations. Significantly, one empirical study of 342 European monarchs looked at the relation between a ruler's eminence and his or her assessed morality or virtue. The relation was defined by a U-shaped curve. The most eminent were either highly moral or virtuous (the famous) or highly immoral (the infamous). In the history of England, a 'bad king' like Richard III is about as well known as a 'good king' like Henry V. A parallel pattern is seen in the United States presidency. Both good and bad presidents are better known than run-of-the-mill chief executives are, particularly when the failed administration resulted from a major scandal. Richard M. Nixon attracts more attention in the archival records than does Jimmy Carter.

Even worse, sometimes a person may attain distinction for reasons that have nothing to do with their actual achievements, good or bad. Shakespeare once wrote, "Some are born great, some achieve greatness and some have greatness thrust upon them." The first and last of these three alternatives present the biggest concern. A significant proportion of eminent personalities born prior to the twentieth century were members of royal or aristocratic families. Even if some of these 'blue bloods' eventually ended up being the agents of worthy deeds, and perhaps even works of genius, a large proportion entered the history books through an accident of birth. Even if royalty and the aristocracy are on the wane, that is no longer the only biological route to fame and fortune. One wonders what would be the celebrity status of Paris Hilton were she not the privileged heir to the Hilton hotel empire.

The third of Shakespeare's three alternatives is perhaps the most interesting. Sometimes people do score high on historiometric genius because of events or circumstances that thrust greatness upon them in adulthood rather than at birth. To illustrate, United States presidents who are assassinated in office are more likely to go down in history as great presidents – despite the fact that there is absolutely no evidence that they are better leaders. Similarly, European monarchs who suffer a violent death – by whatever means – are more eminent than those who die peacefully. Although such arbitrary influences are most conspicuous in leadership domains, they appear in

creativity as well. Sometimes it is just a matter of being at the right place at the right time. Karl Guthe Jansky, an engineer for Bell Labs, was assigned the task of investigating the source of static that disrupted transatlantic voice communications via short-wave frequencies. Having shown that that source of interference came from the center of the galaxy, he inadvertently became the founder of radio astronomy. Had his employers assigned him a different job, he would have been denied the opportunity to make the discovery, and someone else might have become the field's founder. Instances of utterly capricious serendipity are all too common, introducing an element of luck in historiometric indicators of genius.

Hence, once more, the association between historiometric genius and greatness is positive but weak.

Conclusion

Genius and greatness are both highly praiseworthy and intimately linked concepts. And both are closely connected with creativity. When we speak of creative geniuses and great creators, the distinction between the two becomes imperceptible. At that convergence, we can talk of individuals who generate works both original and exemplary in domains that presume that exceptional intelligence had been relegated to the acquisition of domain-specific expertise. Even though both constructs are also related to eminence, the relationship has some unpredictable ingredients that render it more ambiguous. Eminent creators need not be identical to creative geniuses or great creators. When we choose to incorporate psychometric IQ into the mix of concepts, the result is even more complex and ill defined. At present, it is impossible to determine whether the ambiguities can be resolved with additional empirical research. Perhaps the problem is more logical than empirical. The concepts of creativity, intelligence, eminence, genius, and greatness may need analyses that are more refined before their overlapping meanings can be precisely delineated.

See also: Awards; The Dark Side of Creativity; Eminence; Everyday Creativity; Historiometry; Multiple Intelligences; Paradigm Shifts; Teams.

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Giftedness and Creativity

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Glossary

B-cognition Maslow's conception of love for the being of the other person or object, the highest fulfillment of which is represented in certain "peak-experiences."

Divergent thinking Thinking that results in many possible ideas as opposed to convergent thinking, which emphasizes finding the one right idea.

Flow Csikszentmihalyi's description of a state in which the individual is totally immersed in an intrinsically enjoyable experience.

IQ Intelligent quotient, originally expressed as a quotient of a measure of intellectual age divided by chronological age,

but now expressed according to deviation from the average. 100 is typically set as average with numbers above 100 representing measured intelligence above average and numbers below 100 representing measured intelligence below average.

Peak experience An experience of revelations or illuminations accompanied by a feeling of euphoria.

Zen A school of Buddhism that emphasizes the attainment of wisdom through meditation in the search for enlightenment.

What is giftedness? What is creativity? And, how are they related? There are many answers to these questions. Some view them as separate constructs, others see them as overlapping, and, still others see one subsumed under the other. Also, the views vary with time, culture, and philosophical orientation. This article will examine some of the theoretical views and relationships that are proposed.

Traditional and Untraditional Views

Early definitions usually equated giftedness with intelligence as measured by standardized intelligence tests. Therefore, giftedness was not only assessed by, but also defined by, the intelligence quotient (IQ). Lewis Terman's interpretation and use of Alfred Binet's intelligence test in the United States in the 1920s enabled the study and classification of individuals according to a measure of mental ability. Further development of intelligence tests that allowed for group administration and efficient scoring enabled wider use of these tests by schools and businesses. However, concerns about equity in the 1930s and 1940s resulted in a decline in the use of IQ tests to classify students for special classes in the United States.

There is some form of gifted education in most countries, but the ways giftedness is defined and students are identified and served vary widely. A major difference is that psychometric testing has never become as prominent in other countries as it is in the United States. In fact, the Soviet Union forbade psychological tests because they were seen as supportive of the idea of innate abilities, and thus, counter to the Soviet ideals of a classless society. Though not as extreme as in the former Soviet Union, many nations struggle to balance excellence and equity, causing their educational systems to walk a fine line in providing for gifted students.

In spite of these differences, many countries still use US models for identification and service, but with a cultural flavor of their own. For example, in much of Asia, where effort is emphasized over ability, students are not labeled as gifted for their aptitude, but rather for their achievement.

Creativity is generally defined according to the parameters of novelty and value. Dean Keith Simonton called it adaptive originality. Thus, a creative product is one that has at least some element of novelty and is of value in some domain. A creative process results in such a product, and a creative person is one who regularly produces such products. Yet, this simple definition begs the questions: "novel to whom? of value according to whose criteria?" The answers are not simple. Mark Runco discussed the complexity of defining creativity when he explained that the multidimensional construct is comprised of a constellation of abilities, some of which may be developed and some that are evident in early childhood, and incorporates intentionality, motivation, choice, strategy, and evaluation of the products in addition to other processes.

E. Paul Torrance offered three different definitions of creativity, his research definition, artistic definition, and survival definition. His research definition explains creativity as:

the process of sensing difficulties, problems, gaps in information, missing elements, something askew; making guesses and formulating hypotheses about these deficiencies; evaluating and testing these guesses and hypotheses; possibly revising and retesting them; and finally communicating the results. (1988: p. 47)

This definition, so reminiscent of the scientific process, seems less applicable to artistic creativity than problem solving or scientific creativity.

According to Torrance, his artistic definition was more helpful to him in his own creative thinking. The artistic definition is composed of a sequence of metaphors with corresponding pictures, which a former student, Karl Anderson, gave him in 1964. These metaphors are:

Creativity is ... wanting to know; digging deeper; looking twice; listening for smells; listening to a cat crossing out mistakes; getting in; getting out; having a ball; cutting holes to see through; cutting corners; plugging into the sun; building sand castles; singing in your own key; shaking hands with tomorrow. (1988: p. 49-55)

Finally, Torrance's survival definition is the most basic, and according to him, the most satisfactory.

When a person has no learned or practiced solution to a problem, some degree of creativity is required. (1988: p. 57)

There are two major differences in the issues of defining giftedness and creativity. First, the definitions for creativity are less fraught with the need for legal specifications than are definitions of giftedness because creativity in itself is not a formally identified area of educational need, except where it is part of giftedness. Second, the popular belief is that an individual can be gifted in many spheres of human endeavor, although the emphasis is usually on academics. On the other hand, creativity most often conjures images of the arts, and many lay people have trouble envisioning creativity as part of higher-level mathematics or science.

In 1950, J. P. Guilford delivered a very influential speech to the American Psychological Association emphasizing the importance of creativity. In his address, Guilford decried the fact that only 186 out of 121 000 entries in Psychological Abstracts were concerned with creativity. As the then-president of the APA, his words were given great weight, and six years later, when the first national research conference on creativity was held, the number of entries had doubled. By 1965, of 4176 references found for a cumulative bibliography on creativity, 3000 were dated after 1950.

Psychologists had been looking at conceptions of intelligence that widened the view beyond that of a unitary ability that could be designated by a single number. Although not the first to conceptualize intelligence as having more than one dimension, Guilford created a complex model of intelligence, *The Structure of the Intellect*, which included many creative abilities, including divergent thinking and transformations. This model impacted the view of intelligence, and thus, giftedness.

However, the launching of Sputnik in 1957 caused great concern in the United States about the nation's competitiveness, resulting in a renewed emphasis on giftedness, particularly in science and mathematics. It was not until the first national definition of giftedness was formulated and published in a 1972 report to the United States Congress that the broadened view of giftedness was made official. It included six areas through which a child could show outstanding potential or achievement indicative of giftedness:

1. general intellectual ability,
2. creative or productive thinking,
3. specific academic aptitude,
4. leadership,
5. visual or performing arts, and
6. psychomotor.

With this definition, creativity was subsumed under the umbrella term of giftedness as one manner in which students might show their gifts.

In the educational Amendment of 1978, the last category was deleted to prevent sports programs from diverting the money allocated for the gifted. Then, in 1988, the latest version of the US federal definition was amended to emphasize that "Outstanding talents are present in children and youth from all cultural groups, across all economic strata, and in all areas of human endeavor."

Also in 1978, Joseph Renzulli published a paper that featured a definition of giftedness that would become very popular and prominent in the field of gifted education. The Three-Ring Conception of Giftedness illustrated giftedness at the intersection of above average ability, creativity, and task commitment. He explained:

Gifted and talented children are those possessing or capable of developing this composite set of traits and applying them to any potentially valuable area of human performance. (p. 261)

Thus, creativity is seen as an important component of giftedness.

In 1986, Robert Siegler and Kenneth Kotovsky differentiated the traditional view of giftedness, one in which children are identified for school programs, usually by tests, from the type of giftedness exhibited by eminent adults who contribute to their fields. They termed the first *Schoolhouse Gifted* and the second *Creative-Productive Giftedness*, to emphasize a key difference in these two conceptions – creativity. This conceptualization implied that the addition of creativity is needed to lift giftedness to eminence.

In 1993, Robert Sternberg and Todd Lubart proposed an alternative relationship between creativity and giftedness by defining creative giftedness as composed of six resources: intelligence, knowledge, styles of thinking, personality, motivation, and environment. In this conceptualization, intelligence is subsumed under the term creative giftedness. It is a separate type of giftedness, not a part of giftedness nor a type of intelligence that makes up giftedness.

Francois Gagné's view of giftedness, as delineated in his *Differentiated Model of Giftedness and Talent (DMGT)*, differentiates between giftedness as potential and talent as developed abilities. So, according to this model, one can possess gifts in intellectual, creative, socioaffective, and sensorimotor domains, but it takes a developmental process of formal and informal learning influenced by interpersonal characteristics, environmental properties, and chance to develop into talent in specific fields. Thus, creativity can be a part of giftedness that develops into talent.

These changes in views over time are listed chronologically, but they do not represent an evolutionary change in commonly held views. The greatest changes in the definitions have been the broadening of the concept of giftedness beyond IQ, and the corresponding broadening of the concept of intelligence to incorporate more abilities. Also, the greatest change in the view of creativity has been to incorporate levels of creativity, which recognize everyday creativity as well as that of the eminent, such as in the conceptualization of little *c* and big *C*, respectively. James Kaufman and Ron Beghetto have suggested two additional levels and *Cs* – mini-*c*, which is personal and inherent in the learning process, and Pro-*c*, which represents professional-level expertise that is not eminent.

Cultural Views

No matter how we conceptualize the definitions and relationship between giftedness and creativity, cultural and socioeconomic factors will continue to impact the way different groups operationalize the concepts. A good example of this cultural

relativism can be seen in the eighteenth century response of a confederacy of six tribes of indigenous North American people, called the Six Nations, to an offer from the government of Virginia to educate the Native American youth at the college in Williamsburg. The Native Americans declined, albeit with gratitude for the offer, citing past experience with their young men being educated in such colleges:

... when they came back to us, they were bad runners, ignorant of every means of living in the woods, unable to bear either cold or hunger, knew neither how to build a cabin, take a deer [sic], nor kill an enemy, spoke our language imperfectly, were therefore neither fit for hunters, warriors, nor counselors: they were totally good for nothing.

However, to show their appreciation, the Six Nations offered to take a dozen of the young men from Virginia, educate them, and "make men of them."

In more modern examples, Ernesto Bernal found that Mexican-Americans did not give much importance to grades, a large vocabulary, and good grammar as indicative of giftedness. Instead, they valued things like liveliness and being able to make it in the Anglo world. Jean Peterson found that Latino, African American, Native American, immigrant Asian, and low-income Anglo groups viewed giftedness differently from each other and differently from mainstream teachers. Although each group differed in its focus, she found some common themes in the language of these groups when describing gifted people. They tended to put more emphasis on helping in the family and community, including leadership, building and art skills, and nonbook knowledge. Two of the groups valued not displaying what one knows, with the Native American group refusing to identify anyone as gifted. Likewise, in Asia, the proverb, "The nail that sticks up will be hammered down," reflects a view that one should try to blend in with the crowd.

In the Scandinavian countries, where the ideal of egalitarianism is especially strong, there has also been reluctance to identify any students as gifted. Yet, in much of Europe, and in countries that have modeled their education system from European systems, there has been a tradition of testing and separating students in the upper grades according to academic ability. For example, the gymnasium is the term given to selective secondary schools in German-speaking countries, as well as in the Nordic, the Benelux (Netherlands, Belgium, Luxemburg), and the Baltic countries. Likewise, the British and French, and their former colonies and commonwealths, have traditionally had systems that have attempted to separate students to prepare for the university or a trade. The tension between promoting excellence and equity has impacted schools systems all over the world.

So, too, views of creativity differ. For example, there is a difference in the way that people in western cultures view creativity as compared to the way people in eastern cultures do. In the West, creativity is usually defined as the ability to produce work that is novel, original or unexpected, appropriate, useful, or adaptive concerning task constraints. In contrast, in the East there is a focus on personal expression or understanding of an inner sense of ultimate reality. This includes a focus on meditation as a method to achieve these goals.

Yet, the experiences of creating in the East and West are undoubtedly very similar. The work of Abraham Maslow in describing B-Cognition in Peak Experiences and Mihalyi

Csikszentmihalyi in describing Flow are very reminiscent of the Zen Buddhist state when turning inward in the search for higher consciousness.

Philosophical Orientations

In a series of experiments designed to measure people's implicit conceptions of the constructs of intelligence, creativity, and wisdom, Robert Sternberg found that both professors of art, business, philosophy, and physics, as well as laypersons had systematic implicit theories of each of these psychological constructs. They had a more difficult time separating intelligence and wisdom from each other, but their conceptions of these two constructs correlated well with measures of intelligence and social intelligence/competence respectively. No measure of creativity was used.

Professors' and laypersons' implicit conceptions of creativity were highly overlapping, including an emphasis on freedom of spirit and unconventionality, aesthetic taste and imagination, inquisitiveness, and intuitiveness. Yet, they differed according to the specialized fields of the professors in expected ways. For example, art professors emphasized originality and imagination, while the physicists emphasized aspects of problem solving. This may also have been partially a function of the design in which the questions of the experts were field related: "Thus, physicists, for example, were not asked their conceptions of intelligence or creativity as they apply to philosophers, or vice versa." Another important caveat is that the respondents were all from New Haven, thus not representative of the multicultural views as discussed above. It is likely, given the research on culturally mitigated views of giftedness, that a more diverse group of participants would have used a wider variety of conceptions of these constructs.

Implications

The definitions of giftedness and creativity might not be important to individuals other than researchers who work in these areas if it were not for the practical implications. Whether creativity is considered a part of giftedness determines who is identified for gifted programs and what kinds of curriculum modifications are made for a student. In addition, the relative importance that a society places on giftedness or creativity determines central values that impact, among other things, allocation of resources, hiring, business conduct, immigration policies, evaluation of quality, and self regard.

Traditionally, giftedness as defined by intelligence has been valued more than creativity. There is evidence that teachers value gifted students more than creative students, and a look at entrance exams to colleges or the professions shows that they test academic aptitude, not creativity. However, there has been a change in recent years with more emphasis on creativity as a valued ability. This may be, as Keith Sawyer claims, because the last several decades have seen the most developed countries move away from an industrial economy and toward a knowledge economy. Recent economic reports have indicated the value of creativity for the well-being of a nation, and especially the economy. It remains to be seen whether the current worldwide economic crisis will be the catalyst for creativity that

Sputnik was for giftedness. If so, we may see an increased explosion of definitions of creativity aimed at operationalizing the construct for identification and development, and the hierarchical relationship between giftedness and creativity may be reversed.

See also: Definitions of Creativity; Divergent Thinking; Teaching Creativity; Zen.

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- <http://www.gifted.uconn.edu/NRCGT.html> – National Research Council on the Gifted and Talented.

Group Creativity

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Glossary

Brainstorming A technique for increasing idea generation that emphasizes quantity of ideas and deferred judgment.

Competition Working for individual goals or to surpass the performance of others in a group.

Cooperation Working together collaboratively toward a common goal.

Cross-functional teams Work teams that involve individuals with different job skills or expertise.

Divergent thinking style A way of thinking that emphasizes the generation of unusual or atypical responses to problems.

Electronic brainstorming Generating ideas as a group on a local computer network.

Intrinsic motivation A strong interest in an activity for its own sake rather than for external rewards such as praise or money.

Leadership style An approach to leadership that is typical of certain individuals, such as directive or participative.

Prevention focus A self-regulatory tendency in some individuals to focus on security and safety, resulting in a focus on responsibilities and avoidance of risk.

Promotion focus The tendency of some individuals to have a self-regulation system that focuses on approaching opportunities and accomplishments.

Teamwork The organization of work in terms of groups that collaborate in performing work tasks.

Transformational leadership style A type of leadership enacted by one who has charisma, is inspiring, encourages innovation, and is sensitive to the needs of individuals.

Creativity

Creativity is generally considered to involve the generation of novel but useful ideas that gain widespread acceptance. The development of novel ideas requires a certain degree of knowledge and experience, a willingness to take risks or take unique perspectives, and a style of bringing together diverse or previously unconnected domains. From the various ideas that are generated, the most useful ones must be selected and then promoted to gain social acceptance. Creativity involves some important processes such as preparation, incubation, illumination, and verification.

Most research and theory on these creativity processes focuses on individual creativity, the 'lone genius.' The classic perspective is that creativity requires certain individual characteristics and our culture tends to focus on individual geniuses. Yet creativity is essentially a social phenomenon and almost all creativity involves group processes. Geniuses such as Einstein and Freud were greatly influenced by the scholarship and mentorship of others. The development of novel ideas requires some basic knowledge in a variety of areas. This knowledge is often attained in group contexts through the role of teachers, mentors, and colleagues. These individuals may directly provide information or direct or motivate the knowledge acquisition process. Individuals may also learn to model the work and creative styles of key individuals in their group or social context. Colleagues and peers are used to obtain feedback on novel ideas or discoveries. Creative geniuses often encounter considerable resistance to their ideas but eventually their novel ideas may gain much acceptance and acclaim. Creative processes

need to successfully go through the phases of generation, incubation, evaluation, and promotion to gain widespread acceptance for novel ideas. Only a small percentage do so successfully.

Group Processes

Group interaction provides a basis for the exchange of information among group members. This information can be in the form of knowledge, skills, or new perspectives. Effective groups should have individuals with a diversity of knowledge and skills and be motivated for a full exchange of ideas. However, a number of factors inhibit groups from attaining this ideal. In their discussions, group members tend to focus on information and ideas they have in common rather than ideas that are unique to a particular individual. They also tend to evaluate ideas as they are presented and this may inhibit group members from presenting novel or unusual ideas that may receive critical reactions. In particular, group members may be hesitant to share ideas or perspectives that are contrary to the shared beliefs, values, or norms of the group. Groups tend to react negatively to those who deviate from their norms or values and often enforce conformity to norms. If group members share responsibility for a group product, some members may loaf or reduce their efforts and let others do most of the work. Unless group members are already strongly motivated to work on a particular task or project, the group context may lead to reduced motivation. If these various negative group factors are counteracted, groups have much potential to facilitate creativity.

Group Idea Generation

Creativity requires that individuals take new or unusual approaches to problems. This is sometimes called a divergent style in which there is an emphasis on unique or atypical responses. This may require a somewhat random association of different domains, sets of knowledge, or ideas. Group interaction should be ideal for such a process. One can bring together people with diverse knowledge and skills and allow them to combine these in unique ways. Certainly such a group has a greater potential for developing unique conceptual combinations than a similar group of individuals working in isolation. However, experimental studies have demonstrated that groups generate fewer ideas and fewer high quality of ideas than do similar numbers of individuals performing in isolation.

One problem with groups is the tendency toward conformity. Groups often have a strong tendency to seek consensus or agreement. Individuals who deviate from a group consensus or norm often receive negative reactions from group members. They may be criticized and rejected if they do not conform their ideas to those consistent with the group consensus. This type of reaction can be observed in creative and scientific domains as well as in areas of values and opinions. However, if conformity is the dominant force, how can innovation ever occur? Fortunately, highly motivated individuals who persist in promoting their novel ideas or perspectives may eventually gain group acceptance. Research on the influence of minority opinions in groups indicates that persistent minorities can have an impact on the beliefs of those holding the majority perspective. Furthermore, new generations that are not as committed to older paradigms are more likely to appreciate or accept these novel perspectives. Exposure to minority perspectives can even increase divergent thinking. Thus a critical factor in creative innovation is the persistent efforts by the creator to promote his or her ideas.

Another way to increase novel perspectives in the group is to encourage some degree of turnover in membership. New members will not have been involved in prior interactions with the group and thus will not have acquired some of the group biases or conclusions. The additional input from new members may stimulate additional ideas or reevaluations. However, groups may not appreciate new ideas when they have already developed some degree of consensus. Yet, new members may be useful in overcoming the tendency of the group to develop a consensus before they have fully examined all of the relevant issues (sometimes called groupthink).

Heterogeneity

A major benefit of group interaction is that it allows individuals with different educational backgrounds and expertise to exchange information and ideas. With the increasing complexity of different disciplines and areas of expertise, it is difficult for an individual to develop significant expertise in more than one area. As a result, creative advances that require the combination of information from different domains of expertise will require some form of group interaction or exchange process. Cross-functional teams in business and industry involve individuals with different job skills or expertise. Scientific research also often requires this type of diversity. Intellectually diverse

groups should be more likely to develop unique or creative ideas because they have the ability to combine many different sets of knowledge. However, such an outcome is not inevitable. Unstructured groups tend to focus on areas of expertise or knowledge that they have in common. Group members may have difficulty understanding ideas from an area where they do not have a grasp of some of the basic concepts or language. Group members often express some discomfort in groups that are diverse in cultural characteristics or backgrounds such as race, ethnicity, or language.

Individuals from different backgrounds may also have different value systems. As a result, conflicts or disagreements in diverse groups are likely. Although both emotional and intellectual conflicts can inhibit group productivity, under the right conditions cognitive conflicts can increase creativity. If conflicts stimulate individuals to reevaluate their assumptions or perspectives, group members may experience some intellectual growth. This is evident from studies where the majority viewpoint is challenged by a minority perspective. The group member presenting the conflicting perspective tends to produce negative reactions from other group members. However, if the group deviant persists in making a strong case for his or her point of view, the other group members may think more deeply about the issue and experience some degree of cognitive change. Exposure to minority perspectives in groups may even stimulate group members to take a more creative or divergent approach on other tasks or projects.

The research literature thus far has not found overwhelming support for the creative potential of diverse or heterogeneous groups, whether the diversity is based on cultural, personality, expertise, or other differences. It is presumed that groups need to overcome some of the inhibitory factors and learn how to take advantage of their diverse perspectives. It appears that positive feelings about diversity, a positive group climate, some experience as a group, and effective group sharing techniques are required to enable groups to fully tap their diversity potential.

One possible reason for the mixed results for diversity in enhancing creativity might be the role that mood plays. Both positive and negative moods have been shown to have an impact on creativity, but their effects depend on a complex mix of factors. Positive moods appear to be related to increased flexibility or divergent thinking, especially if individuals have a focus on accomplishment (promotion focus) and they involve some level of activation or arousal (such as happiness). In contrast negative mood states may increase task persistence if there is some level of activation (e.g., anger) and there is some prevention focus (a concern for safety and tendency to avoidance). These individuals may not take the 'risks' involved in divergent thinking but may be highly motivated to persist on the task and possibly come up with novel insights in that way. From this vantage point, when diverse groups are associated with activating positive feelings and a promotion focus, these factors may lead to greater creativity due to increased flexibility in the thinking process. However, when diverse groups produce some strong negative feelings and a prevention focus, these factors may lead individuals to greater creativity through increased persistence. So it will depend on what type of creative performance one is measuring to determine more precisely the potential benefits of diversity on creativity.

Group Brainstorming

Even though groups have much creative potential, they often do not attain it. In a desire to get along and please others, group members may avoid disagreements or self-censor any thoughts or ideas they feel might receive negative reactions. Groups are often formed on the basis of similarity of values, interests, or purpose. Individuals whose words or deeds conflict with the general group consensus are likely to elicit negative reactions from other group members, who will try to move the deviant member back into the group mainstream. However, conflict, disagreement, and exposure to disconfirmation of one's ideas are the seed of creativity in groups. Therefore, it is important to structure groups so that there is much tolerance of disagreement or deviant perspectives. This is the philosophy behind the brainstorming procedures developed by Alex Osborn. He noted that premature judgment of ideas shared in groups is a major inhibitor of creativity. He developed a set of rules and procedures to facilitate the exchange of ideas in groups. Groups are instructed to defer judgment of ideas in intensive idea-generation sessions. They are to express all ideas that come to mind, not to criticize ideas presented, to generate as many ideas as possible, and to build on the ideas of others. Thus there is an emphasis on the full and nonjudgmental exchange of ideas or information in a group. Only after such an exchange process will the group members or outsiders begin the task of evaluating the value or utility of the ideas generated. The brainstorming rules do seem to increase idea generation in groups, but groups often still generate fewer ideas than a comparable group of solitary brainstormers.

Why do these groups underperform? It may be hard for group members to overcome a natural tendency to self-censor unusual or unique ideas, even in groups where there may be no overt negative evaluations. Even though no negative feedback may occur, individuals still do not want to make negative impressions. Individuals in groups may also tend to reduce their efforts or loaf if there is no individual accountability for the group's performance. This is most likely if other group members appear willing to take up the slack. The group interaction process also may inhibit one's ability to generate novel ideas. When others are talking, one cannot present ideas and it may be difficult to think of new ones. Groups may also get off on tangents or elaborations that limit the time available to generate new ideas.

These various problems can be counteracted in various ways. When groups use a writing or computer-based exchange process, their performance improves significantly. Various forms of electronic brainstorming are now available to facilitate the idea-exchange process. In electronic brainstorming individuals type ideas on computers and these ideas are shared with others who are typing their ideas at the same time. At the end of the brainstorming session, the ideas are often summarized and evaluated by means of computer voting. Conventional face-to-face groups can also significantly improve their performance if they receive some training in the efficient sharing of ideas. Groups composed of members who are positively disposed to social interaction (e.g., low social anxiety or high sociability) tend to be more productive in the generation of ideas in groups.

The major benefits of group interaction for creativity may come after the interaction process is completed. When individuals have some time to reflect or let the ideas incubate, additional creative insights may occur. Thus the most beneficial pattern may be one in which group interaction and solitary reflection are interspersed. This is, of course, typical of the ways many scientific and work teams function. There are also benefits of group brainstorming experiences beyond the ideas that are generated. Participants enjoy the experience and may use it to practice or develop their intellectual skills. Group brainstorming may also be viewed positively as means of impressing others and developing appropriate organizational norms such as openness to the ideas of others.

Models of the Group Creative Process

There have been several comprehensive models of the group creative process. These models have primarily focused on the cognitive processes involved in searching one's memory for relevant information, the effects of ideas shared by others on this process, and the motivational and social factors that influence these processes. These models can account both for the negative effects of group interaction and the conditions under which one can obtain benefits of group interaction. When one member of the group is exposed to ideas from others, this may stimulate additional associations and allow individuals to build on these shared ideas. Shared ideas may also remind participants of other relevant domains or categories of knowledge and may stimulate a search of these domains. However, if individuals do not pay careful attention and process the shared ideas they will not benefit. Moreover, if the ideas shared by others limit their ability to share ideas because of time competition or because they are irrelevant to the task or distracting, the sharing process may inhibit group creativity. Benefits of shared ideas are most likely when group members have an opportunity to process ideas or rehearse and reflect upon them. This should enhance the potential associative impact. It is also important that group members are highly motivated to attend to and process the shared ideas. This motivation can come from internal factors such as a strong interest in the topic, the interaction process or external factors such as incentives for performance or valued goals. Shared ideas can also serve as a motivational factor because high levels of shared ideas by one member may motivate a high level of performance by other group members. Group members who share similar personal and performance relevant characteristics may be more likely to be a source of influence. However, group members may also pay attention to those who are very different in personal characteristics since such individuals may have unique expertise or perspectives on the issue or problem at hand.

Leadership

An important factor in group effectiveness is leadership. Most groups have either an appointed or an informal leader. A major function of the leader is to motivate each group member to contribute effectively to the group. The style of the leader has a strong impact on group functioning. Some leaders tend to be

very directive or production oriented. Their major concern is that the job gets done or the goal is achieved. Other leaders are more nondirective or person oriented. They are concerned with the personal well-being of the group members as well as goal achievement. The nondirective/person oriented style is consistent with a teamwork culture of participative management. Recent trends in teamwork have emphasized the importance of teams being autonomous or self-directed. This involves having team members with much freedom in the choice and conduct of their tasks. There is some evidence that these types of teams are most productive. Team autonomy should also be related to team creativity. Team members are more likely to be intrinsically motivated when they have a lot of choice in the conduct of their work. Intrinsic motivation exists when individuals have a strong interest in an activity for its own sake rather than as a means for external rewards such as praise or financial gain. Intrinsic motivation appears to be an important factor in the generation of creative products. A highly directive or authoritarian leadership style may inhibit or reduce such intrinsic motivation.

Participative or nondirective leadership is not inevitably better than directive leadership in enhancing group creativity. People can be motivated to work hard for both intrinsic and extrinsic reasons. Many artists and scientists reap significant financial rewards and worldly acclaim and continue to make creative contributions. Extrinsic rewards that reflect positively on one's competence may, in fact, increase the sense of efficacy that is required to take on the unusual challenges or risks that lead to significant creative accomplishments. Thus directive leaders who set high standards or goals and provide significant rewards for creative successes may significantly enhance the creative efforts of group members. Teams that experience a strong sense of challenge as well as intellectual stimulation tend to be most creative.

What then are the critical features of leader or supervisory behavior? Many of the important components are part of a transformational style of leadership, which motivates individuals to perform beyond expectations. Transformational leaders have charisma in the sense of being strong role models in terms of ability, standards, persistence, values, and willingness to take risks. They inspire by motivating followers to a shared vision, high goals, and a sense of optimism. They encourage innovation and creativity and refrain from public criticism. They are sensitive to the unique characteristics and needs of each group member and provide the appropriate level of directive or nondirective support.

Which of these styles is best for creative groups or teams? A plausible answer for this question is that different styles of leadership are needed in different phases of the group processes. A more directive or transactional style may be most helpful in leading to the production of a high quantity of ideas in a limited period of time. However, the inspirational and intellectual stimulating aspects of transformational style may be most helpful in making decisions concerning which ideas should be implemented. Thus it is clear that creativity in groups requires some degree of task and interaction structure. The leader needs to insure that the appropriate level of structure is in place, such as appropriately alternating individual and group interaction. The type of leadership or management that is likely to inhibit creativity would be characterized by

high levels of control, emphasis on external evaluation and criticism, lack of clear direction or vision, and lack of support for innovation.

Cooperation and Competition

When people work together in groups there are tendencies for competitive or cooperative relationships to develop. Some group members or groups may emphasize the need for cooperating or working with one another to achieve their common goals. Cooperation may be the only way to function effectively when the unique skills of all group members are required for success. This would be the case for many complex scientific and technological enterprises. However, cooperation is also emphasized as a generally positive orientation by those who espouse the benefits of teamwork and collaborative learning. Participants in research and development teams cite a cooperative and collaborative corporate climate as being conducive for creativity. A cooperative atmosphere should enhance the willingness to take risks, to share ideas and information with others, and to compensate for the inadequacies of some group members. However, a system that ignores individual differences in the quality of contributions is not likely to motivate group members to optimum levels of performance.

Any system of reward that is sensitive to differences in contributions to the group may induce some sense of competition among group members. In competition the goal achievement of one group member may reduce the chance of goal attainment of other group members. In competitive situations, one group member's gain is another's loss, as when only one can win a prize or get a big raise. Competition can be healthy in motivating group members to perform at a high level, but it can also lead to conflicts and a reduced willingness to work cooperatively. This problem does not occur when competition is between groups, teams, or organizations. Fierce competition among top scientific teams to be the first with a certain discovery is quite common and provides strong additional motivation for creative efforts. Effective group leadership is required to develop the appropriate balance of cooperation and competition in groups. This is likely to vary with the phase of the innovation processes. In the discovery or generation phase, cooperation may be critical for a full exchange of information and views. Once a range of ideas has been proposed, there could be some healthy competition in the development and promotion of different alternatives.

Team Innovation

Today is the era of teamwork. Most organizations have structured their work so that individuals work together as a team on a particular project. Team members are often trained in multiple skills so that they can perform a range of tasks. It is presumed that teamwork will lead to higher job satisfaction and productivity. Teamwork is also common in scientific enterprises because the complexity of most scientific problems requires individuals with a variety of skills. So much of the creative work that occurs in the business and research enterprises occurs in a group context. Researchers have only recently begun to study creative processes in these types of groups.

Studies of scientific research laboratories have shown that group interactions are important in facilitating important discoveries. These interactions often occur during regular laboratory meetings in which research findings are discussed. Creative laboratory groups are led by researchers who are willing to take risks and set challenging but realistic goals. They often may work simultaneously on a set of high- and low-risk problems to ensure that they will have some degree of success. They pay particular attention to unexpected or inconsistent results and use analogies to understand the implications of these and other findings. These analogies focus on the similarity between the ongoing research and prior research or research and concepts in other domains. Conceptual or creative change often involves the use of these types of analogies by highly expert researchers. Other important factors in the creative success of research laboratories are a diversity of expertise among the group members, a willingness to challenge one another's interpretations, and the posing of questions that stimulate group members to think about an issue in different ways.

Research on team innovation in organizations has led to a similar perspective. Innovation or development of new ideas in teams requires a supportive organizational context. Some important features of this context are explicit support by the organization of innovation, a positive interpersonal atmosphere, and an intellectually stimulating and challenging environment. It is important for the team to be committed to a clear set of goals or objectives. There is some research evidence that groups or teams striving for a specific, difficult group goal outperform those that did not have specific, difficult goals. Teams also need diversity and differences of opinion but they need to handle emotional and intellectual conflicts effectively. In addition, teams in which there is a high level of participation or communication, an open and frank exchange of conflicting ideas or opinions, and support for innovative ideas are most likely to develop innovations. Moreover, clarity of team goals and commitment to their accomplishment is associated with high levels of team innovation. Finally, high reflexive teams who have a hierarchical ordering of plans as well as both long and short range planning are more creative than low reflexive teams who do not have such plans. It is important for the organization to support these innovative efforts and to provide training for effective teamwork.

Phases of Group Creativity

Creative processes tend to go through a series of stages. A preparation stage involves the acquisition of knowledge, information, or ideas. It may take some time to digest these and to come up with some novel perspectives. This period of incubation often involves being focused on other activities. Most creative people are engaged in a variety of activities that allow for multiple incubation opportunities and potential combination of ideas from different domains. The incubation period may be followed by an experience of insight or discovery. After new ideas have been generated they have to go through a promotion or elaboration process. The creator needs to persuade colleagues and other consumers of ideas or products of the value or utility of the new ideas. This may involve considerable feedback from peers and experts in relevant domains as

ideas are sharpened or elaborated. The social judgment process can be influenced by a variety of factors. Groups may not be particularly objective in this process. The prior reputation of the innovator, the apparent novelty of the ideas, and the consistency of the ideas with prior conceptual systems will likely influence this judgment process. Groups may be wrong in their judgments if they simply focus on developing a consensus. However, if there is a full exchange of perspectives, group interaction may increase the likelihood of making correct decisions. Groups can be helpful in catching logical or conceptual mistakes, especially if these can be clearly demonstrated.

One phase of the group creative process is the selection of the best ideas from among the pool of available ideas for further evaluation and possible implementation. It appears that groups are not particularly good at picking the most novel ideas, focusing instead on the more feasible ones. Although it makes sense to focus on feasibility, it is important for groups and their leaders to make sure that the most novel or creative ideas get full consideration. Although they may not be feasible at present, they might be in the future. There are a number of guidelines that appear to enhance the effectiveness of the group decision processes. Groups should have sufficient time to evaluate all of the alternatives adequately. They should also have multiple meetings that may allow for the occurrence of unconscious processes, which may lead to better decisions in the case of type of complex issues that groups often face. Outside evaluators or experts should be consulted to make sure that group has considered all of the relevant issues.

See also: Analogies; Business/Management; Collaboration; Conformity; Creativity in Science; Divergent Thinking; Incubation; Insight; Leadership; Rewards and Creativity; Teams.

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Joseph Haydn 1732–1809

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In our search for exemplars of creativity, we often turn to men and women of international renown. This is especially the case in the arts where names from the past and more recent times like Rembrandt, Michelangelo, Picasso, Shakespeare, Brecht, Warhol, Mozart, and Beethoven texture our landscape. These people, above others, have through their art, significantly shaped the ways in which we view the world and have added much to our notions of what it means to be creative. Not often mentioned in this list is the name Franz Joseph Haydn (1732–1809); and yet it was Haydn who reshaped the musical world so profoundly that he prepared the way for the genius of Mozart and the audacity of Beethoven.

It was Haydn, who not only enabled the flowering of the Viennese classical style, but who also set the stage for the expansive romanticism that shook the very foundations of society. It is in the life and work of Haydn that this interconnection of art, social development and politics found an expression, all accomplished by a congenial man who was able to mix easily with commoners and the aristocracy. That a medal was struck in his honor and a statue erected to celebrate his life, tributes usually reserved for monarchs and noblemen, demonstrates the great esteem he was held in his lifetime. It was not, however, his demeanor alone that saw him gain this recognition, though he was demonstrably diplomatic in his dealings with his musical peers and patrons; his obvious ability to stretch boundaries and to use his creative genius to continually challenge and recast the musical forms of his time that makes him an exemplary creator. It is not without significance, therefore, that his moniker 'Papa Haydn' still has currency today.

Haydn left very little correspondence and wrote no treatises that could offer insights into his creativity. Furthermore three early biographers – Griesinger, Dies and Carpani – relied on anecdotes, and in Dies' case, interviews with an aging Haydn, whose memory was fading, to create a picture of this man who dominated musical Europe in the late eighteenth century. All three biographies were published after Haydn's death and lack first-hand accounts of his thought processes as they developed over time. We do, though, have an extensive repertoire of extant compositions which, under any measure, represent a large and productive creative career. His works include two oratorios, 14 masses, 15 operas, more than 69 string quartets, and 104 symphonies. This record of Haydn's life preserved in his compositions demonstrate a man continually inspired by a creative energy that remained with him even in his declining years.

By way of brief biographical summary, Haydn was born in Rohrau, Austria, and at the age of six, and on recognition that he had musical talents, was sent by his parents to live with a relative Johann Matthias Frankh who lived and worked in Hainburg as a schoolmaster and choir director. Here Haydn learned the violin and harpsichord and sang treble in the church choir. At this young age his talent for singing was noted by the director of music at St Stephens Cathedral in Vienna, where he moved as an eight year old in 1740. Nine years later when his voice had fully broken and he was unable to sing the treble parts, he was dismissed. For several years he worked as a musician, busker and accompanist to the Italian composer Nicola Porpora, from whom he learned musical composition. Following a number of years of financial and employment insecurity working freelance in the court of Vienna and in various aristocratic houses, Haydn eventually in 1761 gained the position of Vice-Kapellmeister to the one of the wealthiest and politically powerful families in the Austrian Empire, the Esterházy family. In 1766 and following the death of his predecessor, Haydn became Kapellmeister. Haydn worked with the Esterházy family for 30 years first under the patronage of Prince Paul Anton Esterházy and then his successor in 1762 Prince Nikolaus.

Following this long tenure and after Prince Nikolaus' death in 1790, Haydn traveled twice to London in 1791–1792 and 1794–1795 under the auspices of J. P. Salomon. He finally settled in Vienna where he lived out his final days dying on 31 May 1809.

Once his compositional talents became fully known, Haydn lived and worked within the security of the patronage system that the Court of Eszterháza offered. Only later in his life was he able to live comfortably off the income he derived from manuscript subscriptions as the music publishing business began to thrive. The apparent ease of his financial circumstances lacks the potent narrative of an artist who kicked against the pricks of institutionalism and aristocratic control to ultimately triumph. Instead, Haydn's creative genius was enacted through his subordinate social position marked by the 'Esterhazy uniform' worn by court servants, and by the fact that much of his work was achieved in physical isolation in Esterháza.

The palace that Prince Nikolaus Esterházy constructed in 1766 to rival the Palace of Versailles was built on swampland. Although it soon became the Prince's preferred residence, especially during the summer months, for Haydn it was a barren

'wasteland' far from the bustle and musical life of Vienna. And yet it was in this isolation that Haydn's creativity found expression. Here he developed instrumental music from the old Baroque Suite – a collection of short mainly dance pieces – to what we now know as the Classical string quartet and symphony.

Under Haydn, the string quartet and symphony developed into a standard four-movement work which can be summarized as a first *allegro* movement with perhaps an introduction, a second slow movement, a third *minuet and trio* movement retained from the Baroque Suite, and a final movement which completes the set with a dramatic flourish.

However, it was not just the sheer enormity of his output nor his role in establishing the formal arrangements that developed into the Classical style that warrant focusing on Haydn. Rather it was his ability to work productively within his social context and the audacious nature of his musical innovations that make him a fascinating study of creativity. Thus with the freedom of hindsight and in recognition of the global celebrations of the bicentenary of his death, it comes as no surprise that Haydn is called "the most dangerous man in musical history" by *Kansas City Performing Arts Examiner* journalist Erick Klackner. In his 2009 article he writes that:

The most ruthless among us will stab a person in the back. The most cold and calculated among us will stab a person in the front. But it takes the most creative among us to stab a person in the front without them even knowing it. This is Joseph Haydn (n.p.).

Klackner observes that Haydn was such an unremarkable a person that today he has been overshadowed by composers with surnames beginning with 'B' (including Beethoven, Bach and perhaps even the Beatles!). And yet Klackner goes on to quote Sir Simon Rattle who announced at the BBC Proms in 2008 "probably to the surprise of many" that "there is no greater composer than Joseph Haydn" (ibid.).

What, then, are the hallmarks of his greatness and how did he express his creativity? To make these assessments I will examine his creative work from five perspectives: politics, diplomacy, motivation, musical structure, and spirituality. I will conclude with some comments that links Haydn with the contemporary quest for understanding the development of artistic creativity.

Creativity and Politics

Notwithstanding the isolation of Esterházy, Haydn did not write in a social or political vacuum. Haydn created his works during a period of scientific and political change and revolution. The industrial revolution and the changes to the civic landscape that came in its wake, along with the advances in scientific inquiry that accompanied the Enlightenment formed the backdrop of Haydn's world. Several events helped shape his musical development and creativity.

First, as a young man Haydn would have been aware of the disastrous effects for the Lisbon earthquake that occurred at 9:55 on the morning of 1 November 1755, devastating much of the city. Geologists looking back believe it to be about magnitude 9.0 on the Richter scale and the death toll was

60 000–100 000 people, making it probably the most destructive earthquake in recorded human history. The tragedy occurred on All Saints Day, an important festival and holiday in the Christian Church's calendar giving rise to questions of God's immanence and ability to protect the innocent. The necessary theodic revisions resulting from the chaos brought into question ecclesiastical authority and a consequent loss of faith of the populace in their pastors. Ultimately the effects of these revisions informed the Austrian Enlightenment and its influence on religious music which will be addressed later in this article.

The earthquake also rocked the scientific community resulting in reconsiderations of Enlightenment certainty. The need to cope with indeterminate character of such natural disasters raised questions about the ability of scientific inquiry to solve humanity's problems. Similarly scientific revisions came in the form of global exploration and in particular Lieutenant James Cook's journey on the *Endeavour* to Tahiti to observe the 1769 transit of Venus. Cook's mission in itself is unremarkable in that he was to observe the transit as one of 76 places around the earth and from these calculations extrapolate the scale of the solar system. What is remarkable, however, were the secret orders from the British Admiralty that Cook was to open once he reached Tahiti. He was ordered to travel south into uncharted waters and locate the supposed 'Great Southern Land,' a continent to balance the landmass of the Northern Hemisphere. Instead of finding another America, Cook discovered and mapped a series of small islands including New Zealand, and continental Australia. The certainties that the scientific community had claimed concerning the nature of the globe were shattered with Cook's travels.

The theological and scientific certainties that began to be undermined in the eighteenth century also spread to the political arena. Across the Atlantic, the American War of Independence 1775–1783 and in Europe the French Revolution in 1789 destabilized traditional political arrangements resulting in the rise of democratic governments in the Western Hemisphere.

This shift in power and responsibility from leaders born to their position, to democratically elected officials delegated authority by their constituents is prefigured in the Romantic turn in the arts. For Haydn this found expression in what we now term his *Sturm und Drang* (storm and stress) works composed 1767–1773, compositions that gave rise to emotional expressions that burst through the strictures of Enlightenment rationality.

For the older Haydn in London, his knowledge of changes in the political and social landscape, along with his freedom to work through compositional problems as they arose, gave him an ease with the English aristocracy. For example, as Griesinger reported:

The King and the Queen wished to keep him in England. "You shall have a place in Windsor in the summers," said the Queen, "and then," she added with an arch look toward the King, "we shall sometimes make music tete a tete." "Oh!" replied the King, "I am not worked up over Haydn, he is a good honest German gentleman." "To keep that reputation" answered Haydn, "is my greatest pride" (p. 34).

Thus, underpinning Haydn's creativity was a diplomatic ability that enabled him to work with people of varying ability and

status. His early years of working as a freelance musician in Vienna's aristocratic houses taught him valuable lessons that he was able to draw on at the Court of Eszterháza and in London.

Creativity and Diplomacy

Rather than stifling his creative drive, his many years working to please his patron and to accommodate the Esterházy's musical tastes, provided Haydn with lessons in the art of diplomacy. Haydn's first patron, Prince Paul Anton Esterházy, was a well known music lover but died after Haydn had served him for just 1 year. Paul Anton was succeeded by his brother Nikolaus in 1762 and he was equally fond of music. Thus Haydn regularly accompanied the Prince on his favorite instrument the baryton, a now extinct part of the viol family of fretted, bowed instruments played in a similar manner to the modern-day cello. It was during these extended periods of almost daily music-making with the Prince that Haydn learned how to cater for the Prince's musical preferences while experimenting with harmony and form.

Haydn's role of Kappelmeister made him responsible not only for composing new music, but also ensuring that the instruments were in constant working order. Here, then, was a man equally comfortable in the company of the aristocracy and his musical peers as well as developing his musical vocabulary through experimentation and plying his craft as instrumental repairer. In this manner he worked for 30 years gradually building his reputation across Europe.

But this reputation could have been ruined in 1772 if Haydn had not developed the necessary diplomatic skills to address a deep concern among his musicians. During the autumn of that year the Prince delayed his return to Vienna. The servants, including the musicians, being obliged to pander to their master's whims, remained at Eszterháza absent from their loved ones. They were growing restless, wanting to return home. Haydn too was suffering by being so long away from home but his status as just another contracted servant did not grant him direct access to the Prince to plead on behalf of himself and his musicians. The only tool he had at his disposal was his pen.

Haydn set about writing a symphony that would startle the Prince and encourage him to bring his long summer's holiday to a close. On that evening in 1772 Haydn produced a symphony that was radical by any measure. Now known as Symphony No 45 'Farewell' Haydn had set this symphony in the distinctive and unusual key of F sharp minor, and although to us in the twenty-first century this is not particularly striking, back then on that balmy autumn evening this would have shocked the audience. The beginning theme is an unmelodic descending triad in the violins underneath pulsating cellos and basses. The score requires the violinists to play with a harsh, short, almost hammered style that is all but impossible to perform sweetly; and by the third measure, the audience had been assaulted with clashing chords and confronted with the most unusual tonalities.

Haydn had a reputation as a musical ironist, often using unconventional harmonies and unexpected surprises to startle his listeners. On this night, though, Haydn was in the process of rearranging not only the ways his symphonies were structured

but also the natural order of this little aristocratic community. With the audience now fully awake and alert to the not-so-subtle twists and turns of this new work, the symphony continued through its four standard movements. By the final movement the feathers he had ruffled at the start of the work were now beginning to settle. This last movement began in Haydn's usual style with a spritely *allegro*. It seemed that the aristocrats' universe had returned to normalcy. But Haydn had another surprise in store. About half way into the movement, the activity suddenly stopped and the orchestra started playing a mournful *adagio*. As the music continued, one-by-one the musicians blew out the candle lighting their music and quietly shuffled off stage eventually leaving Haydn and his concertmaster Alois Luisgi Tomasini softly finishing the symphony as a duet.

For Haydn, his 45th symphony was both a creative and diplomatic triumph. Not only was he able to quell the growing anger of his musicians, he was also able to direct his employer to take remedial action while at the same time preserving the Prince's dignity. The elegant industrial action where the musicians artistically withdraw their labor by quitting the stage, signaled a new style of leadership where creativity and organizational activity merge together under the notion of 'principled infidelity' (see Hoyle and Wallace, 2008). Hence, here is Haydn the prudent leader using all his wisdom and creativity to secure a positive outcome for both his staff and employer, all the while helping change the social order *and* the aesthetic direction of Western music.

Further evidences of Haydn's diplomatic skills are evident after Prince Nikolaus died in September 1790. Immediately on hearing of the Prince's death, the impresario J. P. Salomon met with Haydn and persuaded him to visit London, at that time Europe's cultural capital. Although initially reluctant because of his poor English language ability, Haydn agreed, and during his two visits there in 1791–1792 and 1794–1795 he composed 12 symphonies, an opera and a number of works for chamber ensembles. However, although Haydn was feted by the English aristocracy and music-loving populace alike, his presence was not without controversy.

It was Haydn's *savoir-faire* that made him a great success in London. He was required to use the orchestra of the musical entrepreneur Giovanni Gallini, a group with whom he had no history or working relationship. Yet despite this presenting an opportunity for disaster, Haydn worked with the musicians in such a way that they became willing to meet his requirements. For, as Griesinger reports:

Through long practice he had learned in general how musicians must be handled and thus succeeded by much modesty, by appropriate praise and careful indulgence of artistic pride so to win over Callini's orchestra that his compositions were always well performed (p. 36).

However problems arose in 1792 when he discovered that a rival group, the Professional Concert, had invited one of Haydn's former pupils, Ignace Pleyel, to compose music for their annual subscription series. The Professional Concert's commercial viability was threatened by Haydn's work with Salomon. Arthur Searle writes that Haydn was wary of the potential for destructive acrimony to break out sought for appeasement. In a letter he wrote:

So now a bloody harmonious war will commence between master and pupil. The newspapers are full of it, but it seems to me that there will soon be an armistice because my reputation is firmly established here (in Searle, p. 231).

Notwithstanding that it appeared as though Pleyel was unwittingly set up by the Professional Concert to act as a foil for Haydn's popularity, Haydn sensed the potential for catastrophe. This only served to spur his creative endeavors and he deliberately set about to upstage Pleyel by further experimenting with the orchestral sound. Griesinger writes:

I asked him once in jest whether it was true that he had composed the Andante with the Drum Stroke [Symphony No. 94] to waken the English who fell asleep at his concert. "No," came the answer, "but I was interested in surprising the public with something new, and in making a brilliant debut, so that my student Pleyel, who was at that time engaged by an orchestra in London (in 1792) and whose concerts had opened a week before mine, should not outdo me" (p. 33).

The English were impressed by Haydn's versatility and, again as Griesinger reports:

Clippings from English newspapers of the year 1792, which Haydn had kept in his diary, are full of the highest praise for the originality, versatility, and productiveness of his talent (p. 28).

This penchant for dealing with warring factions and for seeking peaceful solutions arose again in 1795. With all his practical wisdom and years of experience in dealing with contrary people, Haydn offered a solution to an impasse among several musical luminaries.

On 21, January 1795, I dined at Dr Parsons', where a quarrel arose as to which of the three doctors, Parsons, Dupuis, or Arnold, should direct in the orchestra the Handel anthem at the marriage of the Prince of Wales. Dr Parsons is Kapellmeister of the Royal Chapel, the other two are Court Organists. But in England it is the organist who is chief director in all churches, and the singers are under him. Each of the three wished to conduct. As I was pressed to give my opinion, I said, "Let the junior organist play the organ, the other direct his choir, and Dr Parsons the *Instrumental Performers*; and because the singer always takes precedence over the instrumentalist, let him stand with his choir on the right, the other on the left" (p. 29).

Although Haydn's advice was rejected, nonetheless he had learned the important art of diplomacy and this was crucial to his success as a composer. Besides diplomacy, though, Haydn's biographers offer some insights into his personal drive and inner motivation.

Creativity and Motivation

Contemporary scholar Teresa Amabile ruminates on the motivations that underpin creative endeavors. Although much of her research has been conducted among research and development scientists, the essence of her ideas applies to Haydn. Amabile argues that creativity occurs under conditions when the creator is intrinsically motivated and who has a deep love for their work. This is certainly true of Haydn even to his final years. J. C. Hadden records that Haydn wrote in 1802 of his pride of knowing that his music continued to give people pleasure.

Often when contending with the obstacles of every sort opposed to my work, often when my powers both of body and mind failed, and I felt it a hard matter to persevere in the course I had entered on, a secret feeling within me whispered, "There are but few contented and happy men here below; everywhere grief and care prevail, perhaps your labors may one day be the source from which the weary and worn or the man burdened with affairs may derive a few moments' rest and refreshment." What a powerful motive to press onwards! And this is why I now look back with heartfelt, cheerful satisfaction on the work to which I have devoted such a long succession of years with such persevering efforts and exertions (p. 103).

For Haydn, composition was not an exercise in self-aggrandizement where he sought to garner both his reputation and financial reward. He was not just driven by the desire for extrinsic recognition but, rather, a desire to offer his talents for the betterment of mankind. This desire perhaps even intensified as he aged, with his mind fully engaged in compositional ideas until his death. Biographer Griesinger noted that "ideas oftentimes came to him whereby his art might still be carried much further, but his physical powers no longer permitted him to put them into execution" (p. 8). Haydn's life is testament to the creative spirit that impels people beyond accepting the *status quo* and urges them to continually experiment, even though physical powers may wane.

So far in this article I have placed Haydn within his political, scientific, and social context and have explored his penchant for diplomacy and his inner motivation to perform a social good. But what of his musical contribution and in what ways does his work offer insights into the creative process? Perhaps his primary contribution in this regard is the development he made in musical structures.

Creativity and Musical Structure

As mentioned, Haydn played a primary role in the development of the string quartet and symphonic forms that grew out of Viennese classicism. It was in this environment that he worked alongside other composers, notably his friend Wolfgang Amadeus Mozart, who as Griesinger reports, warned him against traveling to England because of his advanced age, to which Haydn retorted, "but I am still vigorous and in good health" (p. 23). Furthermore, it was to Haydn in Vienna that the young Ludwig van Beethoven came for lessons in composition. In recognition of Haydn's influence, Beethoven dedicated his first set of piano sonatas to his teacher (Opus 2 nos 1–3, 1795) along with his first String Trio (Opus 3, 1794) and first String Quintet (Opus 4, 1795).

Within this environment and using both chamber and symphonic ensembles, Haydn participated in creating what is now termed 'sonata form' or sometimes 'first movement form.' Sonata form takes on oxymoronic and paradoxical binary-ternary shape. It has two major sections, namely the beginning Exposition, where generally two themes are stated, and a concluding Recapitulation where these themes are restated, thereby giving it a binary shape. What sets sonata form apart from other binary forms, however, is a middle section between the Exposition and Recapitulation known as the Development (hence its ternary element). Although this middle section is marked by thematic (melodic) development, of more

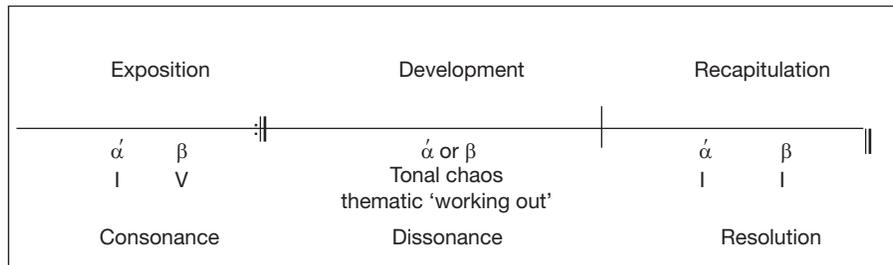


Figure 1 A synthesised plan of sonata form.

importance are the harmonic twists and turns it contains. Tonal dissonance is pushed to a point where any sense of *home* is lost to the listener. Hence this middle space of tonal and thematic ‘working out’ creates numerous possibilities for the composer to exploit. For instance, the Development opens the possibility for harmonic chaos which then challenges the composer with a problem of timing. How far can listeners be pushed before they are alienated from the purpose of the movement outlined in the Exposition? When should listeners be offered an escape route from feelings of collapse and disorientation by the Recapitulation and the safe return of the main themes and reestablishment of the home (tonic) key?

Figure 1, a synthesised plan of sonata form, shows the progression between the three sections. The melodic themes are indicated with the α and β nomenclatures. Below these are numbers in Roman numerals I and V and, following musicological convention, these numbers represent harmonic relationships of the tonic and dominant and give meaning to the structure. (There are other harmonic possibilities such as the second theme in IV the subdominant or even vi the relative minor, but in order to present a stylized image, the dominant V is chosen.) There are no such numbers in the Development section because this is marked by the collapse of tonality.

It was this musical structure of sonata form that provided Haydn with the vehicle to play with his audiences, to toy with them through wit and irony, and to surprise them with sudden changes in dramatic intensity. Thus sonata form as it morphed and evolved under Haydn’s tenure provided him with the license to experiment both with instrumentation and tonality. Although his sometimes radical compositions startled his audiences, he rarely estranged them.

Even as early as 1761 as Vice Kappelmeister, Haydn was carrying out daring musical experiments. For example, in Symphony No. 6 in D ‘Le matin,’ instead of having the bassoon and double bass playing in unison, thereby reinforcing the bass line, he gives the bassoon an independent line, an innovation that was revolutionary for the time. Similarly, Haydn experiments in this symphony with sudden and dramatic changes from *forte* to *piano*, a technique that became a signature effect for his later works.

These experiments marked an even deeper development that Haydn explored, that of harmony. The generation prior to Haydn culminated in the works of Handel and J. S. Bach. Under these latter composers, musical compositions were set within stable keys. Thus a contrapuntal work of Bach may traverse through a number of different tonalities, but always the tonic home key is present, even in its absence. Thus the tensions caused as a result of these tonal excursions are kept

manageable by the certain return to the tonic. However, under Haydn this sense of tonal predictability changed and key centers were set against each other within a movement thereby increasing the dramatic intensity of the music. Thus in Haydn’s work there is a constant pull between different tonal centers each competing with the other.

The freedom to explore musical antipathy, most notably in his *Sturm und Drang* works referred to above, is expressed in works that are at once both witty and humorous as well as tempestuous and dramatic. These works mark a reinvention of himself as an impassioned composer. Many of the works of this period are characterized by the use of the minor key (e.g., String Quartet Op 20 No 5 in F minor and Symphony No 50 in C minor), and the often use of playful false endings and deferments designed to keep the listener fully attentive.

Following this period of angst and development Haydn continued to draw on his creative talents to refine the symphonic and string quartet forms. Ultimately it was Haydn’s spirituality which reveals a paradoxical mix of outward cheerfulness and an inner restlessness that characterizes his music. Hence, it is to the inner spiritual life of Joseph Haydn that we turn and examine the music that reveals this deeper purpose.

Creativity and Spirituality

Haydn’s final years perhaps mark him as the consummate creator. Rather than living of the spoils of his fame, on his return to Vienna Haydn set about creating and solving further musical problems. During these years from his return from London until his death, he wrote six masses and two oratorios, works which form an important part of the canon of Western music.

In his last six masses (Numbers 9–14) Haydn merges the four-movement form of the symphony with the parts of the Mass Ordinary: the *Kyrie*, *Gloria*, *Credo*, *Sanctus*, and *Agnus Dei*. These two forms are contradictory. Where the symphony contains its primary intellectual content in the first movement and ends in the fourth movement with an explosive flourish, the Mass Ordinary works in reverse, with the congregation gradually moving emotionally beyond the opening *Kyrie* and the *Gloria* and *Credo* narratives to the much more contemplative and sober *Sanctus* and *Agnus Dei*. For Haydn this posed numerous compositional problems especially how to end the mass in a celebratory mode while at the same time leading the congregation into quiet reflection. However, working within the strictures of the two forms saw Haydn at his most creative,

for his solution was to superimpose three repetitions of the symphonic form over the five movements of the Mass Ordinary.

Perhaps it was Haydn's sincere yet simple spirituality that provided him with the tools to solve these compositional problems. Rosen writes that Haydn's religious faith was "simple, direct, and popular in character" (p. 368), and yet he appears to have grappled with the liturgical form in profound ways. Rosen acknowledges that the later masses are "full of admirable details and contain writing of great power" he also argues that "they remain, however, uncomfortable compromises" (ibid., p. 369). It is Haydn's ability to embrace complexity and to creatively work with the structural challenges and limitations within the mass that demonstrate a deeper spirituality that Rosen misses.

Therefore it appears as though Haydn was a deeply religious man and his turn to composing masses in the final years of his life is testament to his lifelong commitment to Catholicism and his quest for an authentic spirituality. Griesinger writes that "Haydn was very religiously inclined, and was loyally devoted to the faith in which he was raised" and notes that "All his larger scores begin with the words *In nomine Domini* and end with *Laus Deo* or *Soli Deo gloria* (In the name of the Lord, Praise to God, To God alone the glory)." He also claims Haydn "was very strongly convinced in his heart that all human destiny is under God's guiding hand, that God rewards the good and the evil, that all talents come from above" (pp. 53–54).

In Austria under the reign of Emperor Joseph II (1780–1790) Catholicism became simplified and liberal. Joseph introduced a number of reforms that saw religious practices transform from their former highly ritualized and even superstitious tenor to more simplified forms in the vernacular. These developments provided the context for Haydn to write the final two oratorios *The Creation* (1798) and *The Seasons* (1801). In particular *The Creation* demonstrates the essence of Haydn's creativity. The libretto was originally in English and tells the story of the creation of the Earth from the biblical *Genesis* narrative. Although the work ends with a hint of the Fall, it shows Adam and Eve in a state of spiritual bliss. Contrasting this oratorio with Bach's Passions (*St Matthew* and *St John*) which shows humanity imprisoned in the consequences of Adam's sin, Haydn's libretto derives more from ancient Greek optimism and respect for the body. In *The Creation*, Adam is a virtuous character rather than man whose self-will was the cause of human suffering.

This optimistic view of humanity and the creative essence that Haydn believed is derived from the Divine is expressed most profoundly in the opening section of *The Creation*. The chaotic opening is a slow *Largo* in C minor which moves to its conventional relative major E flat with shifts to the flat side of E flat minor, in bars 16–19 and 32–35, and again to D flat major, in 21–25. The melodic motifs of the opening are mere punctuating dynamic fragments rather than melodic phrases.

All these fragmentary elements ultimately lead to the entrance of the chorus singing "And the spirit of God moved upon the waters" with the tonality descending to the home key of C minor moving then to the explosion of 'Light' in bar 78 in C major offer a clue to Haydn's spirituality. The movement is both profoundly simple and yet complex. A paradoxical mix of

a shortened conventional sonata form mixed with tonalities that prefigure that of the romantics and even anticipates the miniaturist Anton Webern (1883–1945).

Musically Haydn follows a principle established in the symphonic form of putting most of the intellectual content in the first movement. The opening of *The Creation* is no exception. The sudden harmonic shift from C minor to C major depicting the creation of light is not only programmatically determined, but also contains the essence of a theology of presence, an agenda explored more recently by phenomenologist Merleau-Ponty, who writes of an 'empirical pregnancy' (p. 207) that begins an artist's work. Although not the silence of the painter's line, for Haydn the bursting forth of light is the moment of empirical pregnancy. It is this sweeping brush stroke of light that enables the becoming of being as the 'spirit of God' continues to hover and move. Thus it is Haydn's theological optimism that is not only the hallmark of his last works but is characteristic of his entire oeuvre.

Haydn the Consummate Creator

There are, therefore, many sides to Joseph Haydn. His abiding reputation is of a man of wit, a trickster with a magician's sleight of hand who leads listeners toward an expected close, all the while plotting for ways of robbing them of the satisfaction of final resolution. And yet to dismiss him as the joker in the pack is to miss the essence of his creative genius. Beneath his evident jocularity lies a darker, more angst-ridden struggle.

Nicolas Rothwell reflects on the Op 50 Prussian Quartets which Haydn wrote in his mature years in 1787. He notes that they are "contained, unyielding pieces – works that strain against the cage of form and elegance, and only at rare instants break through to resolution, and allow their themes a semblance of fluency and flow" (p. 44). And this is the mystery that is Joseph Haydn; for he was no revolutionary in the sense that he swept away all that had gone before. Rather, with the patience of a master he gradually reformed existing structures and crafted new directions that were realized by Mozart and Beethoven and later into the Romantics.

The kind of creativity that is expressed in Haydn's compositions is deeply connected with his predecessors and yet breaks through into something new. It is this that is the essence of Haydn's creative process. He did not work in a vacuum but rather used the materials available to him at the time and stretched them into previously unknown directions. Indeed the political, scientific, social, and theological environment within which he worked provided him with a context for his creative expression, enabling him to shape the direction of Western music towards the romantic revolution.

Rather than offering a simple template, Haydn continually wrestled with structural dimensions never settling into what today's business-speak could call strategic 'best practice.' On the contrary, it is the ways in which Haydn continually contested the forms within which he worked that makes him a fascinating study. He continually builds up and tears down in order to avoid finality and closure; and all done with the congenial demeanor of a man who is both comfortable and discontented; settled yet ever-reaching for transformed structures and new tonal vistas.

See also: Art and Aesthetics; Music.

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Handwriting and Creativity

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Glossary

Creative aspirations The interest in, and the desire for, the realization of a creation. Graphologically, creative aspirations are reflected in the height and elaboration of the upper zone of letters such as t, f, h, k, and l, and in many capitalized letters. It is the expressiveness of writing, or the totality of graphic movements, that is sufficient to differentiate one writer from another.

Creative organization The deliberate and systematic production of ideas and methods that result in creation. Graphologically, the creatively organized person can be expected to show good organization, simplification of form, and originality of graphic expression. Good organization is reflected in the overall use of space and movement in time (ease of forward movement). Simplification is the use of economic shortcuts, finding economy of time and motion, and seeking what is essential. Originality refers to spontaneity and creativity in the handling of space, form, and movement.

Creativity in writing The ability to produce new forms, to restructure stereotyped situations, to innovate, to redefine, and to improvise. Required is the aspiration to imagine and conceptualize creations, together with the organizational skills for turning such ideas into objective creations.

Graphology The study or description of handwriting in relation to changes from the ordinary which occur in some physical disorders, such as hyperactivity, learning disabilities, and alexithymia; the art or science of inferring a person's personality, character structure, and possibly, aptitudes, from the peculiarities of his or her handwriting.

Intentionality Creativity requires that a person is able to care about a state of future affairs (the realization of a creation), to organize a program to realize this state, and to persevere in this endeavor in spite of distractions, obstacles, and obstructions. On the other hand, the intention to solve a problem can lead to the deliberate and systematic production of ideas that result in creations.

Spoken words are the symbols of mental experience, and written words are the symbols of spoken words.

Aristotle

Graphology, Personality, and Culture

Eleventh century Chinese scholar Kuo Jo Hsu claimed that by using handwriting, he could distinguish "the noble man from the common man from a moral point of view." Efforts to develop graphology as a rational science were underway in eighteenth century Europe and North America, and for well over a century there has been a consistent, yet limited, interest in the relationship between handwriting and personality. Notably in France and Israel, graphology is widely used in personnel selection. This practice has been justly criticized as unfair to potential employees, for its results fail to approach the levels of validity attained by other widely available and less expensive screening devices. Graphology is not a viable method of assessing an individual's potential, and lacks ability to predict on-the-job performance. More generally, the claims of practitioners of graphology that their 'science' is sufficiently developed to have practical reliability and validity has scant support (Edwards and Armitage, 1992).

With respect to the evaluation of personality, graphology has not shown itself to be effective in well-controlled tests. Guides to graphology that describe relevant factors to examine (e.g., slants, zone, pressure, size) and the traits (e.g., character,

personality, moral) they are claimed to 'reveal' lack consistency and await standardization. Attempts by Furnham et al. (2003) to predict psychometrically valid personality measures from reliably measured handwriting factors collected under non-self-conscious conditions have also failed to establish robust relationships between graphology and personality. The claims made for graphology are either not supported, or at best only occasionally and weakly supported. Yet, the possibility of future success cannot be ruled out. Graphology should not be dismissed as mere quackery and pseudo-science, or dismissed along with astrology, parapsychology, palmistry, the Tarot, and other such occult knowledge practices, even though the roots of graphology can be found in sympathetic magical practices.

The invention of writing, as a technique of representing speech by a durable trace, was historically a dramatic leap forward for humanity. Sequential numbering, which requires a system of number signs, is inconceivable without writing, and such a number system is prerequisite for a system of economic exchange. This in turn is a requirement for the development of urbanized societies with developed economies, in which time and value are subject to calculation. Thus, while graphology has a long way to go to establish itself as a way to measure salient aspects of one's personality and character structure, writing has played a crucial role in the development of civilization.

On the individual level, writing is essential to the development of cognitive abilities. The learning of handwriting has the power to initiate reflection and to encourage the higher cognitive processes of analysis and abstraction. Wherever there are students, legible writing is required, attractive script is appreciated,

and both can affect evaluations by teachers and institutional gatekeepers. As text comes to be written directly onto computer keyboards, and as the 'man of letters' comes to be replaced by the 'blogger,' skilled handwriting has waned in importance. Because each person's handwriting is unique, however, graphology can and will long continue to be used in legal systems to detect forgery and ascertain authorship of written text. Handwriting is of interest to cognitive and affective neuroscience, because certain pathologies of brain development and neurochemical processes of brainwork can result in pathologies in speaking, reading, and writing. While humans of all cultures, as far as we know, have the potential for reading and writing, those cultures which remain largely illiterate fall short of developing in their members the most special of left hemisphere functions, which include rational analysis, and which presuppose the measurement of time and money. Literacy, together with numerical cognition, confers ability to question the epistemological and theological doctrines of one's culture and civilization, thereby attaining the potential for developing a rational, enlightened, and scientific understanding of the world. While neuroscientist Joseph Bogen (cited in de Kerckhove and Lumsden, 1988: 442) groused about our own culture being a scholasticized, post-Gutenberg-induced-industrialized computer happy exaggeration of the Graeco-Roman penchant for 'propositionizing,' we must take literacy, reading, and writing seriously as one component of what might be needed in order to avoid a possible broader 'clash of civilizations' promoted by fundamentalists of all kinds. With writing, and handwriting, comes the promise of freedom to think logically and clearly, hopefully in a way that is not limited by the lack of affect and symbolization, which Bogen called 'appositionalizing.' By being taught to decode alphabetic texts, which are both linear and sequential, the brain is encouraged to adopt strategies of sequential analysis for a wide range of other cognitive operations as well. This insight was first expressed in Plato's *Phaedrus*, in his suggestion that the art of writing bears a strong resemblance to the four rules of investigation – examination, division (into kinds or variables), order, and enumeration. This insight was articulated by Descartes, 2000 years later, in his *Discourse on Method*. We find this perennial idea further explored, and grounded in contemporary neurocognitive theory, in Martin Taylor's (1983) model of the bilateral cooperative model of reading.

Creativity: Aspirations and Organization

Creativity requires productive thinking. There is a 'dialectical' aspect to creativity in that it often involves interaction of logical-analytic/propositional and gestalt-synthetic/appositional modes of thought, which are ordinarily lateralized to the left and right sides of the brains of right-handed adults without substantial brain damage. Thinking that integrates these two opposite yet complementary modes of thought is perhaps necessary for creativity, but alone is insufficient because of linkages between creativity and intentionality. On the one hand, creative ideas can be stimulated by the integration of analytic and synthetic thought. But creativity means more than an idea and an aspiration; also required is that something actually be created, a creation.

Graphology, the Study of Handwriting

Proponents of graphology (see Brannan, 2004) maintain that writing can be used to identify a creative personality insofar as writing communicates not only the semantic content of words but also expresses features of the personality structure of the writer. Handwriting is a process of psychomotor gesturing, this gesturing externalizing and thereby giving creative expression to ideas and the contents of inner speech. Qualitative-holistic and quantitative methods of graphological analysis have been developed with the intention of enabling graphologists to make inferences about 'sectors' or 'constellations' of personality structure on the basis of detailed features of handwriting, on the levels of words and letters. One well-known quantitative graphological technique, the Psychogram, was developed by K. Roman and given formalization and elaboration by D. Anthony. The most usual objective of graphology in general, and the Psychogram in particular, is to represent an integrated view of an individual's personality. The forty separate graphic indicators of the Psychogram (organization, rhythm, speed, rightward trend, pressure, etc.) are partitioned, on a conceptual, *a priori*, basis, into eight sectors, including 'intellect, aspirations, and creativity'. Roman wisely cautions that no single component or feature of handwriting can be interpreted without reference to others, even though for purposes of analysis they can be set apart and considered separately, viewing each one by itself. A single feature is significant only in relation to the group to which it belongs. This advice is widely ignored by graphologists. For example, Brannan (2004: 38) does not hesitate to claim that "a relatively heavy *t*-bar is evidence of strong will-power. . . . This trait implies the strength of purpose of the writer" (an inference made about Babe Didrickson [lived 1914–1956], a noted female athlete). Anthony operationally defines the intellect-aspirations-creativity sector of the Psychogram by six quite general features of handwriting samples:

1. good organizational structure;
2. innovative simplification of form;
3. upper zone elaboration ('desire to form, build, or arrange,' e.g., of the letters b, d, f, h, k, l, and t, and capitalized letters);
4. upper zone height;
5. originality, and
6. expressiveness (indicated, most generally, by an overall consistency in effort and direction).

Creativity, Thought, and the Brain

Gestalt-synthetic, holistic thought (in the adult, right-handed person) is usually associated with the functioning of the right cerebral hemisphere (RH) of the human brain, and logical-analytic thought with the left hemisphere (LH). Intentionality, along with planning, monitoring, editing, commanding, and controlling, is associated with the executive-level functioning of the frontal lobes of the brain. The frontal lobes evolved out of, and remain closely linked to, the limbic structures which provide emotional response to images and models, and which, in combination with memory and information about the body and environment, enable the frontal lobes to direct

meaningful, goal-directed actions in the interests of the self. The goal-directed behavioral programs of the frontal lobes extend to intentions and plans. These programs are complex results of social development and are formed with the participation of language, which enables abstraction, categorization, and generalization, and which is much involved in the control and regulation of behaviour.

Dysgraphia and the Split Brain

Dysgraphia – handwriting disability, can come about, as we have seen, as a result of living in a largely preliterate culture. It can also come about as a developmental disorder due to genetic accident, injury, or illness. Dysgraphia seldom occurs in isolation, as it is often concomitant with related disorders such as alexithymia, dyslexia, dyscalculia, parkinsonism, hepatic encephalopathy, aphasia, attention-deficit disorder, and various emotional pathologies. Still-developing dysgraphic students are apt to also have physical disabilities, sensory impairments, mental impairments, or emotional disorders. Dysgraphia stands in the way of academic success. Students with dysgraphia in the United States are eligible for special educational services, and are apt to be placed in categorical classroom programs designed for children with specific learning disabilities.

We can understand creativity through the study of neurological patients with a pathological lack of integration of analytic and synthetic thought. Such a group of patients are the ‘split-brain’ (cerebral commissurotomy, corpus callosotomy) patients who have had the two hemispheres of their brains surgically divided through sectioning of the corpus callosum, a structure containing some 200 million nerve fibers that directly connect the two hemispheres. This radical surgery was carried out as a treatment of last resort for severe, drug-refractory epileptic seizures. Following this operation, patients are limited in their ability to integrate the workings of the two sides of

the brain. The two hemispheres can be of two minds. One of these patients would put his arm around his wife with one hand, while pushing her away with his other hand and arm, a case of true ambivalence.

In a remarkably simple but nonetheless crucial experimental study of eight patients undergoing split-brain surgery, J. Bogen discovered limitations in both their writing and their drawing abilities. Following the operation, the right side of the body is controlled by the LH and vice versa. Therefore, performances carried out by the right hand result from LH activity, and performances carried out by the left hand are related to the activities of the RH. These patients, who were all right-handed, experienced a reduced capacity to write (dysgraphia) with their left hands but not with their right hands. They also experienced a reduced capacity to copy figures (dyscopia) with the right hand, but not with the left. The dysgraphia-dyscopia phenomena are illustrated in **Figure 1** by responses of one of the split-brain patients. To measure dysgraphia, a written model of the word, ‘Sunday’ was presented. The patient was able to copy this word with his right hand (and LH) but could manage only a crude ‘S A’ with his left hand (and RH). His severe dyscopia is illustrated by his effort to copy a cross and a solid cube. He copied the figures quite well with his left hand, but with his right hand showed no configurational ability. It would appear that he started at the top (line segment 1) and then proceeded clockwise. He drew the first seven lines correctly; but at the end of line 7 (the ‘bottom’ line), he made a wrong turn, leftward, instead of up upward and to the right. It is as if the left side of the cross fell off its axis between lines 7 and 8. It appears as if he grasps the figure as a sequence of lines that turn either to the left or right, but made one wrong turn. This could have been an effort at linear direction finding, but it most certainly was not an exercise in gestalt completion. For the cube, it is as if he had merely used his left-hemisphere recognition of a number of connected lines, and then made a visual gesture of stacking some of them up. He showed no configurational ability to recognize the cube as a whole or gestalt.

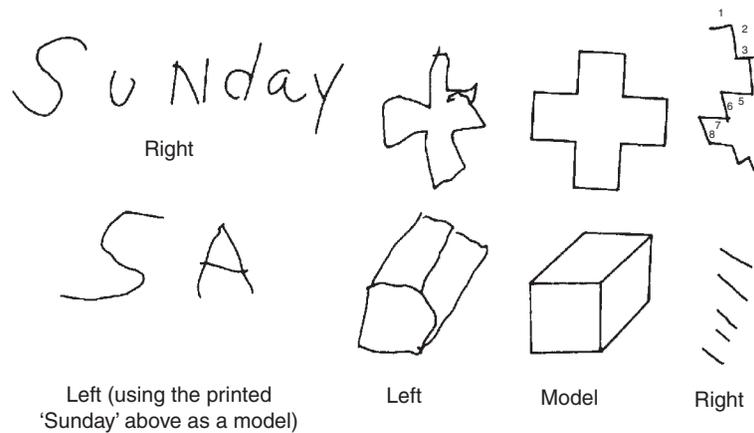


Figure 1 At the left side of the figure, dysgraphia in the left hand (and right hemisphere) illustrated by the inability of a commissurotomy patient to write the word “Sunday” with his left hand (and right hemisphere). At the right, dyscopia in the right hand (and left hemisphere) illustrated by a patient who, while able to copy models of a cross and a cube with his left hand (and right hemisphere), failed to do so with his right hand (and left hemisphere). Reproduced from J Bogen (1969) The other side of the brain I: Dysgraphia and dyscopia following cerebral commissurotomy. *Bulletin of the Los Angeles Neurological Societies*, vol. 34, Figure 5b, p. 83.

Alexithymia, Creativity, and the Split Brain

Klaus Hoppe and J. Bogen found *alexithymia* – a cognitive-affective disturbance involving a lack of words for feelings, in twelve commissurotomy patients. Alexithymia literally means ‘no words for feelings.’ A better term would have been the existing Greek work, *a-thymo-alexia*, which means ‘no feelings for words.’ By analogy, the problem of the color-blind person is not a lack of words for colors, but rather a lack of colors for words. The alexithymic person has difficulty describing his or her feelings to other persons. There is a difficulty in verbally identifying feelings but also in distinguishing feeling from bodily sensations. There is a lack of symbolizations, termed ‘asymbollexia’ by Hoppe in 1985, and an impoverishment of fantasy life, resulting in a utilitarian, operational mode of thinking. The opposite of alexithymia, called ‘symbollexia’ by

Hoppe, is apt to be taken for granted in the everyday world but must be considered a form of creativity in its own right. According to interhemispheric transfer deficit theory, alexithymia results from a physical or functional disconnection of the two hemispheres, such that the cognitive representations of negative affects (of the RH) cannot be articulated in words (by the LH). J. J. Bogen and G. Bogen (1969: 201) have argued that an interaction between the modes of thought of the two sides of the brain is necessary for creative thinking. They suggest that “to demonstrate that division of the corpus callosum leads to a loss of creativity, we need some measure of creativity.”

Handwriting provided such a measure in a further alexithymia study carried out by TenHouten et al. in 1985, which included eight of the twelve split-brained patients of the Hoppe-Bogen study and eight precision-matched control subjects. All 16 subjects were shown a 3-minute videotaped film

Commissurotomy	Normal
AA 1. Baby all for his self in a bed hasn't even his self.	Caa Two toys monkeys hugging The baby disappears An older child swinging
NW Baby was not surprised. By a object around her wheel. Some words	Cnw Then she ran picked her and a car I think, ran
DM 4. HEY get off its get the ball They the car hit the boy	Cdm Dupon de l'anniversaire pour el tiempo ya viene al desarrollo en otros actividades
NG 4. all the things left in the car at it a end song plays	Cng A chime indicated a beautiful world for the baby to find her tomorrow
RY its a baby playing in the 1. with his toys.	Cry 2. The bird above first came around and there was no help in the crib, but there were other things top in the crib.
CM 4. She ball rolled into the street the boy ran to get it, there was a car coming. the last thing you	Ccm 3. Show when a child can be having fun and also being happy, without knowing it's wrong surrounding him.
RM YOU DON'T SHOW IT RIGHT IT'S ALL MIXED UP	Crm The baby likes his toys and is secure the baby leaves the crib and his bed
LB 4. Next he played with a blue ball, which rolled into the street, he pursued the ball as a car was coming.	Cib 1. In the first part of each section there was happening?

Figure 2 Selected handwriting specimens of eight commissurotomy patients (left column) and eight precision-matched normal control subjects (right column). Reproduced from TenHouten WD (1994) Creativity, intentionality, and alexithymia: A graphological analysis of split-brained patients and normal controls. In: Runco MD, Hoppe KD, and Shaw M (eds.) *Creativity and Affect*, p. 336. Norwood, NJ: Ablex.

four times. The film's two scenes depicted, with music and visual images but no words, the deaths of a baby and of a boy. After the second showing of this film, all subjects were instructed to write four sentences expressing what they felt about the film. Small samples of the handwriting of the subjects are shown in Figure 2. The commissurotomy patients, in comparison to controls, were described by Psychogram variables as having less form and arrangement in the elaboration of their writing's upper zone and they wrote in a less expressive way. They were relatively constricted in their expression of self, as their graphic gestures lacked individual distinctiveness. Their script lacked rhythm and coordination of movements, organization, and trizonal dynamics. In addition to its arrhythmic quality, their handwriting lacked an effective articulation of the letters with connecting strokes, which according to Anthony, indicates a lack of 'creativity of the graphic expression.' Patients were infirm in their writing stroke (ductus) and showed an arrhythmic alternation of pressure and release. Here they can be said to lack control of sensuous expression. Their writing lacked consistency in the slant of the letters. There is inadequate control over alignment and direction of lines and spaces between lines. And finally, there was a general irregularity in these patients' script. The handwriting samples were scored on the Psychogram by a professional graphologist, Marc Seifer, who was told only the age and sex of the writers (standard procedure in graphology). The six variables classified as indicators of creativity were inter-correlated, with the result that all correlations but those between Organization and Upper Zone Height were positive. A factor analysis of this correlation matrix resulted in a two-factor solution, meaning that there are two latent, abstract concepts which might explain the correlations.

Aspirations and Organization Measurement

The two upper zone variables – Upper Zone Elaboration and Upper Zone Height – joined Expressiveness in the first factor. Anthony defines 'aspiration' as a desire for the realization of values – of "ideals, ambitious intellectuality, power, honour, excellence . . ." (1977: 3). He argues, "Graphologically, it is commonly reflected by the upper zone elaboration . . . and upper zone height (. . . interest and aspirations above the daily routine, the intellectual guiding principle)" (1977: 3). Anthony defines Expressiveness as "those graphic movements which are 'sufficiently distinctive to differentiate one individual from another.' These can include a flair for dynamic design and spontaneous movements on the positive side, or by a stultifying rigidity and static immobility on the negative" (1977: 3). This three-variable factor was named Creative Aspiration. The second factor attracted the other three intellect-aspirations-creativity sector variables: Organization, Simplification, and Originality.

Organization refers to the writer's overall use of space and movement in time (ease of forward motion). Here, the emphasis is on form and design; figure and ground; and unity, coherence, and coordination. If 'creativity' is defined, as in Anthony, as "the ability to produce new forms, to restructure stereotyped situations, to invent or innovate, to redefine, to improvise" (1977: 3), then good organization can be interpreted as a rather global measure of creativity. Anthony states that, "high scores for simplification and originality . . . are indicative of creativity"

(1977: 3). Simplification of form means economic shortcuts in writing, seeking economy of time and motion, and seeking what is essential. Originality has the commonsense meaning of the term, here referring to "spontaneity . . . and creativity in the handling of space, form, and movement." The three variables forming this factor were together named Creative Organization. The person of high creative aspiration is apt to be known for his or her original ideas; the person of high creative organization not only has creative ideas, but possesses the methodological and organizational skills to turn such ideas into objective creations.

Intentionality Measures

The commissurotomy patients, as hypothesized above, showed significantly lower scores for Creative Aspiration and for Creative Organization than did their precision-matched normal controls. They were lower than controls for overall measures of other sectors as well – for Goal Direction, Libidinal Energy, Expression of Feelings, Control, and Script Quality (Form Level and Functional Productivity). A 'second-order' factor analysis, using six sector-level variables, led to the discovery of a possible lack of intentionality in these patients. In both alexithymia and in some psychosomatic disorders there is an impoverished level of relations to objects and goals, and a lack of dynamic energy in relation to these objects. This lack of intentionality degrades one's ability to sustain focus. The data, while only exploratory and based on samples ordinarily considered inadequate for multivariate statistical analysis, suggest that a person predisposed to act with intentionality can be expected to show, in his or her handwriting, the following features:

1. an ability to integrate intentions with actions in a fluent and rhythmic manner;
2. good alignment control, indicated by parallel lines that are unwavering and straight – here reflected in a sense of direction and orderliness – and an effective use of time, all suggesting a functional integrity toward the fulfilment of objectives;
3. writing that shows a naturalness and spontaneity in voluntary control of size, pressure, form, and arrangement;
4. writing that is firm, with rhythmic alternation of tension and release in pressure and stroke (an elastic and flexible stroke shows meaningful functioning, the making of an effective 'impression' on the world); and
5. contractions and release that are balanced and rhythmic in movement, distribution, and form, all of which indicate an ability to perform productively.

Note in this description the importance of rhythm (the strongest single variable for commissurotomy-control group differences). The commissurotomy patients' handwriting had, as global features, lack of coordination and rhythm, intentionality, and goal-directedness. Graphological variables contributing to Intentionality included, in addition to three creativity variables (Upper Zone Elaboration, Upper Zone Height, and Expressiveness): Rhythm, Trizonal Dynamics (psychical energy, goal-oriented behavior), Firmness of Ductus (the control of meaningful functioning, or making an 'impression' on the environment), Connectedness (ability to connect experiences

purposefully), Fluctuation (which integrates intentions with actions in a fluent and rhythmic manner), Slant Consistency, Alignment Control (indicating functional integrity toward the fulfilment of objectives), and Regularity (movement and arrangement volitionally controlled by the writer, an ability to concentrate, and firmness and resolution). On the sector level, data analysis indicated that intentionality is primarily a joint function of two sectors, goal direction and emotional release. An overall measure of intentionality was positively correlated both with Creative Aspiration and with Creative Organization. These results have implications for the study of creativity and of pathological lack of creativity. On the basis of other than graphological analysis, in the same study it was found that following the splitting apart of the left and right hemispheres of the brain, patients had a degraded experience of symbols.

These split-brained patients, in comparison to precision-matched normal control subjects, used few affect-laden words (a face valid index of alexithymia). Their relatively frequent auxiliary verbs suggested a passive and indirect personal style; and they used relatively few adjectives, suggesting speech that is flat, dull, uninvolved, and lacking in color and expression. Further, they were found relatively less apt to fantasize or imagine symbols (of the filmic stimulus). There was an overall lack of creativity in the content of their spoken and written verbal productions. These patients have been described as dull, flat, colorless, inexpressive, passive, indirect, lacking fantasy, unimaginative, unresponsive to symbols, and describing circumstances of events rather than feelings about these events. The evidence suggests, albeit indirectly, a lack of creativity in the content of their spoken and written verbal productions. They symbolized in a discursive way, using mainly secondary-process thought as opposed to a presentational structure consistent with primary-process thought. Hoppe (1985) noticed concreteness in their symbolizations, with an emphasis on stereotypic denotations. The strongest overall result of the handwriting analysis was that, for all of the eight pairs of subjects, patients showed less emotional release than did controls, which replicates the earlier finding of alexithymia following cerebral commissurotomy.

The hypotheses advanced on the basis of graphological variables, distinguishing the handwriting of patients and controls, were consistently supported by other data. The split-brain patients showed a strong dysgraphia in their left hands. They also showed a strong dyscopia in their right hands. Their linear-thinking left hemispheres were not informed by their right hemispheres' affective, expressive, and spatial creative mode of thought. This interhemispheric transfer deficit resulted in what can be termed an *expression dysgraphia* in the right hand, a phenomenon that had not been detected earlier. The split-brained patients did to some extent, however, express and symbolize emotions, primarily in a subconscious, negative way, through their handwriting. The alexithymia of these patients is a matter of degree, and their LHs are hardly devoid of affective expression, especially for positive emotions. Research with split-brained patients shows that their RHs are able to signal their LHs, possibly by means of brainstem connections. In two of these patients researchers found an 'affective aura' rapidly communicated from RH to LH (see TenHouten, 1994; TenHouten et al., 1988). There was in this project a continuity of results based on graphology and

on several other content-analytic measures. The criterion variables, it should be noted, were interpreted not as personality or character attributes, but rather as cognitive structures.

Smith's Study of Handwriting and Creativity

In one other study of relationships between handwriting and creativity in 71 fifth-graders, Willa Smith devised a measure of creativity in 1998, the Graphological Creativity Quotient (GCQ), based on the graphological traits spontaneity, openness, flexibility, intuition, autonomy, self-acceptance, complexity, and perseverance. Not surprisingly, an index based on these eclectic criteria did not predict across several measures of creativity, but a weak positive correlation of 0.30 ($p=0.01$) was found between the GCQ and the Torrance Test of Creative Thinking (TTCT), and between Complexity and TTCT ($p=0.05$), when the other creativity variables were controlled. Generally, the results were weak and nonsignificant.

Handwriting Sensitive to Brain Damage

Cerebral commissurotomy is a radical surgery, but handwriting can be distorted even by minor brain damage, often without the writer being aware of the change in his or her script. It can be hypothesized that insofar as a head injury is potentially life-threatening, it is one's signature that is the aspect of handwriting that is most apt to be affected. As an example, following a left-occipital injury sustained in an automobile accident, my own signature underwent three changes. First, there emerged a greatly simplified, and sometimes eliminated, first *r* of Warren. The dropped *r* was always the leftmost one, as if *rr* symbolized the left and right cerebral hemispheres: this was corrected only with a protracted, conscious effort to do so. Second, a dent emerged at the height in the upper loop of the *t* in Houten. Graphologists uniformly regard the upper zone of script with higher cognitive functioning, so that this upper-zone dented *t* would be interpreted as symbolizing a pathology of higher, cerebral functions. This script feature lasted less than a year. And third, the *en* of Houten was essentially dropped, as were other letters and numbers at the ends of words or number strings. This was likely a manifestation of a mild form of unilateral neglect of the right visual field, not uncommon following left sided occipital lobe damage. It is important that we follow Beyerstein's (1992: 397–398) sage advice, that, just because the brain is responsible for our psychological makeup as well as our writing, it does not follow that "script formation necessarily reveals deep secrets about our personal habits, talents, and predilections." Relationships between minute details of writing and social, psychological, and neurophysiological phenomena would appear to exist, but this is no guarantee that graphology can become an effective evaluative or predictive tool. Certainly, there is no *a priori* basis to assume that writing deserves any special status as a window on personality or character.

From Graphology to Graphonomics

Handwriting analysis will always have a small following on the part of interested persons who are apt to also be practitioners

of nonscientific knowledge practices such as astrology, the Tarot, and the *I Ching*. Persons can indeed experience some insight into the self as a result of having their handwriting 'read' by an adept practitioner of graphology. As one of these authors, Santoy (1994: 230) proudly concluded, "Any novice who has studied this book carefully is now capable of analyzing the handwriting of his friends or acquaintances." To assert that a written *t* with a "short, tapered horizontal stroke" reveals a person with "Caustic humor; sarcasm; destructive tendencies" is not science, but it does possess a kind of synthetic rationality. It is rooted not in science but in sympathetic magic. The problem with this 'key to personality' level of graphology is that, whatever clues are detected about an individual's handwriting script, there is no way to validate that the clues measure what it is claimed they measure, and the same clues can be interpreted in wildly different ways. There is no doubt that graphologists have overestimated the quality and value of graphology. As the same time, there is no doubt that many graphologists are highly insightful, and are able to make use of detailed features of handwritten script to construct a highly useful overview of a person's personality and character structure.

Handwriting is a phenomenon of the world, and as such is subject to scientific investigation. Advances in the study of handwriting, focused both on pathology and productivity of mind, can lead to advances in the scientific study of handwriting, from which cognitive and affective mental structures can be studied in normal and pathological populations and across cultures and writing systems. Handwriting is primarily communicative, and therefore involves social relationships with other societal members. Graphology can be understood only through multi-level analysis, of the mental, the social, and the biological. In fact, such an interdisciplinary enterprise has been underway for two decades, not under the name of graphology but rather as 'graphonomics.' This term, graphonomics, was chosen by an association of psychologists, bioengineers, physiologists, computer scientists, cognitive scientists, and engineers. The International Graphonomics Society was founded in 1985. No graphologists were invited to join this Society, and their conference proceedings cite no graphologists. Moreover, there was no mention of the possibility that handwriting might be correlated with personality. In commenting on this development, Beyerstein (1992: 415n2) observed that, in perusing published works by graphologists, he found that none of the authors "seem conversant with the published research of this

highly relevant scientific organization." The scientific analysis of handwriting, graphonomics, is too important to be left to graphologists.

See also: Personal Creativity.

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Relevant Websites

- www.graphology.ws/graphology-world.htm – Graphologists and graphology.
- www.graphonomics.org – International Graphonomics Society.

Katharine Hepburn 1907–2003

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Introduction

Scrolled across the mantel of the fireplace in Katharine Hepburn's childhood home appeared the words, "Listen to the Song of Life." In her autobiography written in her mid-80s, Hepburn recalled the fireside, with her father to the left and mother to the right. This screen memory of the fireside at the Hepburns's will guide our exploration of the long, creative acting career on stage, screen, radio, and television of Katharine Hepburn.



Photograph of Katharine Hepburn supplied with permission from The Connecticut Historical Society, Hartford, Connecticut, USA.

Background

America at the turn of the twentieth century was an exciting time for Katharine Hepburn to be born. The frontier in America had ended in 1890 with railroads and communication lines stretched across the United States. New industries were

springing up, such as the Corning Glassware Works, which her great uncle founded. Suffragettes were working to make it possible for women to vote. The times supported independence and an attitude of hope.

The parents and grandparents of Katharine encouraged their children to aim high in their lives. Excellence was their expectation. Katharine's maternal grandmother, who died when Katharine's mother was a young girl, impressed upon her daughters the importance of higher education to reach their full potential. Katharine's mother earned her baccalaureate degree at Bryn Mawr and later completed a master's degree in art. Katharine's father, the son of an Episcopalian minister, was a physician who specialized in urology and venereal diseases. The Hepburns were role models of achievement for their children.

Katharine's Early Life

To understand how Katharine Hepburn became a highly creative twentieth-century woman, a sketch of her life is essential. By the time Katharine, the second of six children, was born in Hartford, Connecticut, on 12, May 1907, her parents had already established themselves in Hartford as free-thinkers. They challenged the status quo and set progressive goals for the betterment of their community and society at large. Katharine's mother became a powerful leader in the women's suffrage movement and had allied herself with the prominent British suffragette Emmeline Pankhurst, who visited the Hepburn home when Katharine was quite young. When Katharine was 10 years old, her mother became affiliated with the strong suffrage movement led by Alice Paul, who successfully pushed for an amendment to the US Constitution in 1920. This amendment legalized voting privileges for American women. When Katharine was an adolescent, her mother became close to Margaret Sanger, an eminent advocate for birth control. Her mother also worked in the Hartford community to close brothels and to help prostitutes.

Katharine's physician father helped women in his community and elsewhere who, faced with sordid circumstances, contracted venereal diseases that sometimes resulted in death. He became a leading light to improve societal conditions especially for women. In fact, both parents created sparks in the Hartford community and beyond. Ahead of his time, Dr Hepburn strongly advocated physical exercise to promote good health and he modeled this view in his everyday life. After work each day, he joined his own and neighbor children in physical activities.

From an early age Katharine became adept at tumbling, at mastering the trapeze, and even at wrestling. She became a better runner than most boys. She also became a star in swimming and diving and won awards for her success. During her grade school years, Katharine cropped her hair and wore pants (which became a kind of trademark for her throughout her

life). She called herself 'Jimmy' and enjoyed being known as a tomboy. This androgynous side of Katharine reemerged many times during her life. Androgyny is a hallmark of creative individuals. Katharine stayed away from activities, such as needlecraft, which were common among girls in that time and place.

Katharine was fortunate and grateful to have parents who honed habits, attitudes, and values that supported her eventual goal. Her parents modeled and encouraged persistence, hard work, and resilience, key attributes in creative success. Her father challenged his children to be competitive and encouraged his children to pick themselves up after failure, learn from their mistakes, and continue to soldier on. Both parents instilled a sense of freedom in their children. Katharine especially appreciated her parents' high regard for fostering individuality and a sense of freedom.

Katharine's Atypical Adolescent Years

During adolescence Katharine engaged in activities that paved the way for her career in-the-making including organizing and acting in plays. One summer, for example, she and her good friend, Ali Barbour, put together a performance of 'Beauty and The Beast' that mobilized siblings and neighborhood children. The girls charged admission to benefit Navajo Indians of the American Southwest.

Katherine was 14 when she experienced tragedy. She was visiting their mother's friend in Greenwich Village when one morning Katharine found her beloved older brother, Tom, dead of strangulation. The death was initially ruled a suicide, but that cause remained open to speculation.

Tom's tragic death had a huge impact on Katharine's life. During the aftermath of Tom's death, she became even closer to her parents. Katharine dropped out of the school she had attended and avoided contact with people who might raise questions about Tom's death. Instead, she engaged a tutor who prepared her for entrance to Bryn Mawr College at 17.

The Bryn Mawr Years

Bryn Mawr College, a prestigious liberal arts college committed to educating women had stringent standards, and was highly regarded. Katharine's early days at Bryn Mawr College were difficult. Later in life she remarked that she was unaccustomed to "being with a gang of young girls." She described it as "an agony." A well-remembered incident in the college dining hall early in her freshman year became for Katharine "almost the end of me." She overheard a sophisticated New York student refer to her as a "self-conscious beauty." That comment led Katharine to avoid dining room contacts with other students.

Fortunately, Katharine met and joined a group of compatible students. They called themselves 'The Tenement.' With them she felt secure. One of Katharine's new-found friends, Alice Palache, who helped Katharine with her studies, continued to be close to her until Palache's death in her eighties.

During her sophomore year Katharine suffered a 10-day lapse in her studies because of an appendix attack. Afterwards,

the dean wrote a letter to Katharine's father that suggested his daughter consider transferring to a different college where she might do better in her studies. Katharine's supportive father then wrote a letter to the dean, stating that if he had a sick patient in the hospital and did not know what to do for her, he would not send her home. The dean then agreed to keep Katharine as a student.

Katharine managed to get her grades high enough to act in three college plays including the lead role Pandora in a comedy by John Lyly, a forerunner of Shakespeare, called 'The Woman in the Moon.' The play was a huge hit as Katharine assumed the moods of planets, such as war-like Mars and loving Venus. Acting in this successful play confirmed Kate's determination to become an actress.

Katharine broke the news to her parents she wanted to become a professional actress. Her father thought her choice was just one step above being a streetwalker and told her financial support would be cut back if she followed that career. Katharine's mother believed her own progressive, unorthodox work was a far cry from Katharine's choice.

Katharine's parents taught her to be independent so she stood firm, determined to follow her calling. Katharine's father then provided her with a small amount of money. He told her that if things did not work out, she could always return. Perhaps because Katharine's mother strongly believed in freedom of choice, she finally went along with her daughter's decision.

Kate's Earliest Work in Acting

As a beginner in a highly competitive field, Katharine realized that she would have to stand out from others. Her tall angular appearance, her wearing pants, and an oversize man's sweater that she tied behind her with a safety pin, were not new in her demeanor. She had stood out even as a child by wearing pants and boys' attire. Now, as a young woman determined to make her mark, she realized that getting noticed called for a further step and in 1932 and 1933 she deliberately adopted a novel and appropriate tactic; she often appeared in public carrying a live white gibbon that had become her pal.

Talent, however necessary, was of itself insufficient to fulfill Katharine's dream of becoming the greatest actress in the world. She possessed valuable personal attributes, including determination, persistence, resilience, a strong work ethic, and practical common sense. She was also fortunate to have ample personal support from significant people, such as her family and devoted friends.

Katharine Hepburn launched her career known as 'Kate,' the name she kept from that time forward. Her work began on stage in 1928. After playing in 'Summer Stock,' she successfully debuted in Baltimore in 'The Czarina' and later had a small part in 'The Cradle Snatchers.' Kenneth MacKenna, the lead actor in 'The Czarina,' took an interest in helping the young actress. Because MacKenna feared that Kate's high-pitched nasal voice might prove hurtful, he gave her a letter of introduction to Frances Robinson-Duff, an extraordinary coach, who had tutored actresses such as Sarah Bernhardt.

MacKenna recognized that Kate's talent made her stand out, so he recommended her to Edwin Knopf for a small part in the Broadway production of 'The Big Pond.' Instead of getting a small part, Kate got her first big break and was cast for the lead role. However, after one performance of the pre-Broadway tryout at Great Neck, Long Island, New York, Kate was fired. Her coach, Frances Robinson-Duff, gave Kate the bad news that her performance had been too self-contained, she had rushed her lines, and her voice was too high. She also appeared stiff and failed to demonstrate feeling in a believable way. In spite of these failures, however, Robinson-Duff believed that this unusual newcomer had the makings of a remarkable actress. Even at their first meeting, Kate reminded Robinson-Duff of Eleonora Duse, a world-renowned Italian actress, who had recently died. Robinson-Duff and other professionals who understood the requirements for excellence in acting, realized early that this young actress, so different from the common run, would succeed.

Lowes and Highs of Kate's Career During the 1930s

This negative experience didn't stop Kate's ambition. From the beginning to the end of Katharine Hepburn's career, she showed powerful intrinsic motivation. She loved acting, and she did it for its own sake, and for enjoyment. Throughout her career, she worked hard to do her very best and nothing short of steady striving for improvement would satisfy her.

Kate's prodigious productivity in her first ten years of acting is amazing. Before she was 30, she had played roles in approximately 20 stage plays. In just six years, from 1932 to 1938, she starred in 15 films, which included comedies and dramas. She also opened to the imagination of her audience a variety of ways of being and living, especially with regard to women.

A Bill of Divorcement, the first film in which Kate starred, set her on the way to becoming a first-rate film actress. Kate benefited from working with George Cukor, the film's director, and with acting legend, John Barrymore. Both men thought that Kate showed remarkable talent, and both supported her on this maiden voyage. Barrymore saw something in Kate that reminded him of his mother, Georgiana Drew, who he thought was the best actress who ever lived. In late life Kate remarked on her good fortune to have had the privilege to work with Barrymore and Cukor during a vulnerable time in her career.

This early period is punctuated with sporadic criticism and major awards. On stage in New York in 1933 Kate's first performance in *The Lake* resulted in scathing criticism. Dorothy Parker, satirist, screen-writer, and short story writer, said of Kate at that time, "She ran the gamut of emotion from A to B." A few days later *The Lake* closed.

In 1934, Kate won the Academy Award for Best Actress in the film, *Morning Glory*, and just two years later she was nominated for a second Academy Award for her performance in *Alice Adams*. Some of Kate's other films including *Little Women* and *Stage Door* received Academy Award nominations. However, many of her movies in the mid-30 were flops including *Spitfire*, *The Little Minister*, *Sylvia Scarlett* and *Mary of Scotland*. Shortly after she performed in the bomb *Quality Street* a writer in a movie magazine dubbed Kate "box office poison." Perhaps the

major low point in Kate's career followed the filming of *Bringing Up Baby* in which Baby was a live leopard. That film, which opened in 1938, lost money for RKO and Kate's contract was not picked up.

Kate's Relationships: The Intermingling of Early Private and Public Life

In her senior year in college, two young men showed considerable interest in Kate. One of these, Bob McKnight, a student at Yale, proposed but she put him off. A second young man, Ludlow Ogden Smith, was waiting in the wings. 'Luddy' was highly educated and showed broad interests and Kate esteemed him as a good friend and a very nice man. 'Luddy' strongly believed that Kate would become a superb actress, and he was willing to do anything that he could to support her career goals. Kate and 'Luddy' were married in a private ceremony in December 1928.

A few weeks into Kate's first and only marriage, the young couple separated. Kate concluded that her aspirations to become a first-rate actress did not fit with being married. 'Luddy,' who came from an aristocratic, wealthy family, continued to do all he could to be supportive to Kate as her acting career unfolded. They were formally divorced in 1934 but especially during her last years Kate treasured 'Luddy' more and more for his selfless generosity and friendship.

In the meantime, Kate and another student of Frances Robinson-Duff became good friends. The young woman, Laura Harding, an heiress of American Express, moved in with Kate and they shared many conversations that supported Kate's career. They were constant companions and confidantes who moved to Hollywood as Kate's career in films got started and because Laura also knew the acting field well, she was able to provide help and understanding.

During the 1930s Kate also became close to some men, one of which was Kate's first film director, George Cukor. They became dear friends and mutually-valued professional associates. They both recognized the importance of establishing good relationships with everyone who played a role in the film's production, including the stage crew and both favored films that would touch the audience. From 1932 onward, Kate considered George her best friend in Hollywood.

Kate also met men during the 1930s in whom she became interested romantically. One of these was John Ford, a film director and a married man. Chief among Kate's would-be suitors, however, was Leland Hayward, a gifted literary agent who met Kate soon after she arrived in Hollywood. Kate found Leland easygoing and lighthearted and felt that they were well-suited to each other, enjoying his presence in her life. Moreover, Leland liked Laura Harding, Kate's housemate, and he also became a friend of Kate's mother. Leland wanted to marry Kate, but she turned him down. This lovely relationship, in Kate's eyes, lasted nearly four years. However, eventually Leland Hayward moved to the East Coast to help a client, Edna Ferber, who was opening a play called *Stage Door*. Margaret Sullavan played the leading role in the play, which became a hit. The next thing Kate heard from Leland was that he married Sullavan. Kate was thunderstruck by the news, but being resilient, she moved on.

Another major suitor, Howard Hughes, came into Kate's life in 1936 during the filming of *Sylvia Scarlett*. This famous aviator and business mogul landed his amphibian plane along Trancas Beach, the site where 'Sylvia Scarlett' was being filmed. Hughes, a friend of her costar Cary Grant, had wanted to meet Kate for some time. Hughes had been in the audience on a regular basis when Kate went on tour with the play, *Jane Eyre*. Kate soon became involved romantically with the daring aviator who then taught her to fly. Time spent with Hughes also introduced Kate to painting which she enjoyed for many years. Although Kate's romantic relationship with Howard Hughes was over by the early 1940s, their occasional future contacts were cordial.

Kate's Mastering Difficulties at Home and Reinventing Her Image

While visiting her family in 1938 and doing her best to resurrect her career, a hurricane severely damaged the Hepburns's seaside home. Kate was able to salvage some of the best furnishings of the home, but the rest was gone forever. To make matters worse, Kate's brother Dick, who tried unsuccessfully to become a playwright, also caused her trouble. After his first play failed miserably, he wrote another which satirized his family, including Kate and because she believed that Dick's new play could be hurtful to her career and to her family, she and her father did their best to suppress it.

Kate's penchant for taking stands, her questions about accepted societal assumptions, and her 'gumption,' that is, her insistence on being her own person, annoyed some critics. Some scholars think that meeting occasional obstacles, in the case of people who have many positive resources, such as Katharine Hepburn, enhances the development of creativity.

Resurrecting her damaged career, an aim that manifested well Kate's strength of character, was helped when playwright Philip Barry came to the Hepburns's seaside home to confer with her about a script he was writing and a role she would soon play. From the beginning of Kate's career, when she was an understudy for Hope Williams in the stage play *Holiday*, Barry had recognized enormous talent in the young actress. Over the years, as Kate worked with him on occasion, Barry became inspired to write a play with her in mind. Barry's script for *The Philadelphia Story* resulted in a Broadway hit in 1939. Kate recognized making a movie of the play could rebuild her film career. So she managed to buy the rights with the help of Howard Hughes.

Kate's Rise to Fame in the 1940s and 1950s

In 1940, the filmed version of *The Philadelphia Story* electrified audiences as it revealed a new Kate, a person able to express her soft and sentimental side. The reinvented Kate was fully in touch with what was going on in American society at that time. A practical woman who studied all aspects of acting, Kate realized how important it was to get the audience on her side as she moved forward in her career. She was now on her way to becoming a much-loved star.

Just two years later, MGM's film, *Woman of the Year*, brought into Kate's life a celebrated actor and a significant person,

Spencer Tracy. This first film with Tracy was a major hit and won a third Academy Award nomination for Kate. Hepburn and Tracy played a couple who held high-powered jobs and together they discovered a way to reconcile love and work.

Hepburn and Tracy acted together in nine films. They became closely associated with each other both professionally and personally for 26 years despite the fact that Tracy was married. From the record it is evident that Tracy meant the world to Kate. However, the classic New England gentlewoman kept silent publicly regarding her profound love for Tracy until after the death of his widow, Louise, in 1983.

One significant expansion of Kate's repertoire took place in the late 1940s after she was invited to play the character Rosalind in Shakespeare's *As You Like It*. Taking on a major role in a Shakespearean play exhilarated but frightened her. She accepted the challenge, enlisting the help of a British actress, Constance Collier, to serve as her Shakespearean tutor. As Collier worked intensively with Kate, she schooled her in the rhythm and cadence of Shakespeare. Kate's first major performance in a Shakespearean play opened successfully on Broadway in January 1950, followed by a tour. Kate later played a variety of Shakespearean characters on tours in the United States, England, and Australia, and she became known as an acclaimed Shakespearean actress at the American Shakespeare Festival Theatre in Stratford, Connecticut.

By 1950 Kate realized that any failure to work to improve would result in moving backwards. Her professionalism called for steady efforts to improve all aspects of her acting. She believed that L. B. Mayer, her strong supporter at Metro-Goldwyn-Mayer where she acted in ten films during the 1940s, would grant her free rein to do anything she desired on the set. Mayer's belief in her ability bolstered her confidence.

Kate spoke her mind strongly throughout her acting career. She expressed ideas about the arrangement of the set, supported the stage crew and members of the cast, and studied the background and characters of the plays in which she performed. She did not bear fools gladly, but she was ready to help anyone on the set who needed it. Kate's aim to become the best actress in the world never ceased. Her focus in midlife shifted, however, from the fame she desired in her early years to attainment of artistry in acting.

In midlife she faced extraordinary challenges and roles that moved her forward. In 1951 she took on a risky leading role, along with her costar, Humphrey Bogart, in *The African Queen*, which was filmed in the Belgian Congo under the direction of John Huston.

There she experienced some harrowing adventures. For instance, at one place near Murchison Falls, anyone who braved going ashore had to walk through a carpet of crocodiles. She confronted dangerous snakes. Kate also became very ill during filming, caused by polluted bottled water! Nevertheless, Kate was "... moved by the beauty of the country - by its vigor." (Hepburn, 1987: 120) She was also doing what she loved, acting, and she cherished what she described as that remarkable experience. For his performance in *The African Queen*, Bogart won an Oscar while Kate won another nomination as Best Actress. Later during the 1950s Kate received three additional Academy Award nominations for *Summertime*, *The Rainmaker* and *Suddenly Last Summer*.

Kate's Fruitful Golden Years

From ages 55 to 75 Kate accomplished much of her finest work. One of her most celebrated and moving triumphs was for her characterization of Mary Tyrone, the mother of Eugene O'Neill, in his *Long Day's Journey Into Night* in 1962. At the Cannes Film Festival that year, Kate was named Best Actress for playing that extremely touching role. She was also nominated by the Academy as Best Actress. In that emotionally draining film, Kate felt she reached her career high.

Kate was deeply affected by Spencer Tracy's death in 1967, but she continued to work hard. In that year, she received an Academy Award as Best Actress for her last appearance with Tracy in *Guess Who's Coming to Dinner*. She received another Academy Award for *The Lion in Winter* (1968) in which she starred with Peter O'Toole. Next she played the role of Coco Chanel, French fashion designer and perfumer, in the musical *Coco*, which she described as her most challenging and difficult part up to then. Her performance got rave reviews when it opened on Broadway in 1969.

In the same year that Kate performed in *Coco*, she played the lead role in *The Madwoman of Chaillot*. In 1971 she played Hecuba in *'Trojan Women,'* based on the tragedy by Euripides. Later, in 1975, she worked with Laurence Olivier in the televised film version of *Love Among the Ruins*. She received her final Academy Award as Best Actress in 1981 for her performance in *'On Golden Pond.'*

In her eighties, Kate wrote two books, one about her experiences in working on *'The African Queen'* (1987). The other was her autobiography, *Me: Stories of My Life* (1991). Then, in the evening of Kate's life, she acted occasionally in televised plays and made a brief appearance in a film.

The Dying of Some Lights and the Rising of Others in Kate's Latter Years

Some important lights in Kate's life went out during her last years. One was her beloved friend and film director, George Cukor. Her friend dating back to her college days at Bryn Mawr, Alice Palache, and her longtime friend, Laura Harding also died. During these years Kate spent quality time with her former husband and faithful friend, Ludlow Ogden Smith before he, too, died. Next the death of Phyllis Wilbourn, her 'right hand' in late years and a friend for over 40 years, filled Kate with sadness. Finally, Kate experienced the death of her brother Dick.

Fortunately, as many lights went out in Kate's life in old age, significant new lights turned on. One of the presences that entered her life was journalist and friend, Cynthia McFadden, who reminded Kate of herself when she was Cynthia's age. Another was friend and biographer, A. Scott Berg, who spent time with Kate during her last 20 years. These new presences in Kate's life consoled her as she faced the deaths of many people whom she loved. Together with Kate's living family members, McFadden and Berg supported Kate and kept her spirits up as much as possible as she experienced health problems and loneliness.

Kate's Responsiveness to a Flower and to a Question About Life's Purpose

Kate was never more down-to-earth, yet lifted up and inspired, than when she worked in her garden at Fenwick. She loved what she saw and felt and smelled – being close to her flowers and nurturing their growth brought her joy. During her first walk with Scott Berg in Kate's garden at Fenwick, she surprised him by asking "Have you ever looked at Queen Anne's lace, . . . I mean really looked at it, up close, and studied it? . . . Aren't they just thrilling?" (Berg, 2003: 364). Kate went on, "Now how can anybody look at this and not believe there is some higher power, some divine force at work in the universe greater than Man, some god that created it, that created all this, that created us?" (Berg, 2003: 364–365). Kate's sensitivity and responsiveness to a humble flower, that some treat harshly as a weed, revealed two poles to Kate's pondering: The concrete and the transcendent. Her keen response even to a flower evokes a question: Could this quality of spirituality have influenced the luminous quality and artistry in her acting?

Many years later, during his last long conversation with Kate, Berg asked her what she thought life was all about and what our purpose as humans really is. Without hesitation, she answered that our purpose is to work hard, to love someone, to have some fun, and, if we are lucky, to be loved back (Berg, 2003: 366).

Kate's Latest Distinctions

Kate was certainly loved. She received many honors during her final years of life and thereafter.

Hepburn was enshrined like no other female movie star. While her contemporaries faded into obscurity, Kate made the 'Dictionary of Cultural Literacy'. In 1996 she was named one of the one hundred most influential women of *all time*, up there with Eleanor Roosevelt, Marie Curie, Joan of Arc, and (I do not jest) the Virgin Mary. In a Reuters poll in 1999, Hepburn was named the 'greatest' film actress of the twentieth century, paired, fittingly, with the other all-American, John Wayne. (Mann, 2006, xx)

Kate's name, unlike most of her peers, is listed in the biographical section of Webster's collegiate dictionary. The US Postal Service also honored her memory in 2010 by issuing a commemorative postage stamp that bears her image.

Katharine Hepburn and Creativity

Katharine Hepburn's creative gift, her originality and imagination, which manifested itself in her being able to enter the stories and lives of her characters and to make them live for herself and her audience, has long been recognized. For instance, Katharine was able from the script and from her study of the character's situation, to read the mindset of Mary Tyrone, a character based on Eugene O'Neill's mother, and depict a life very different from her own. In the film based on O'Neill's play, *Long Day's Journey Into Night*, Katharine was able to feel and communicate Mary Tyrone's life and story, in a way that stirred the audience, the critics, and herself. She, along with the critics, believed that this

characterization was one of the finest in her career. Like creative musical conductors who through their interpretation of great music are able to stir the audience deeply, Hepburn was able to achieve the same goal in her acting. Again and again she was able to evoke emotions as wide-ranging as deep sorrow and jubilation in herself and her audience. She enabled her audience to empathetically cry or rejoice.

Research literature on creativity also reveals a host of attributes often found in eminent creative people that marked the life of Katharine Hepburn. These include preparedness, resilience, fierce independence, calculated risk-taking, persistence after failure, high productivity, trauma in early life, family support, extraordinary talent, and a network of influential friends and colleagues.

What may well be the major source of Katharine's creativity, that is, her imagination, "a way of knowing things that can be known in no other way" (Berry, 2010: 186), appears to lie at the heart of her greatness. Accessing Katharine's dynamic imagination was something that the science of Hepburn's time could not do. Imagination is *sui generis*, in a class all its own. Katharine's constantly changing consciousness, the handmaiden and very ground of her imagination, is somehow reminiscent of a bird in flight. When it alights momentarily, it can be witnessed only briefly, before it resumes its mysterious flight. Some see imagination "in one of its aspects" (Berry, 2010: 187) as:

... the power by which we sympathize. By its means we may see what it was to be Odysseus or Penelope, or David or Ruth, or what it is to be one's neighbor or one's enemy. By it, we may 'see ourselves as others see us'. It is also the power by which we see the place, the predicament, or the story we are in.

These wise words enable us to see what we could not otherwise see in Katharine's characterizations, that is her ability to communicate the life, the emotions, the predicament of another person. Her ability to sympathize with her character and her character's plight appear to lie at the heart of her creativity in acting (Berry, p. 187).

The Legacy of Katharine Hepburn

Katharine Houghton Hepburn died on 29 June 2003, at the age of 96. She left a legacy that testifies to her highly creative life. It includes her correspondence, transcript of interviews, films,

and records of radio, stage, and television performances. Kate's books and those of others who knew her well, such as A. Scott Berg's, can be easily found in libraries. Her name and works belong to the cultural story of the twentieth century.

Kate, an American original who strove to show through her acting that she understood people, their emotions, and the temper of the times, remains mysterious, unfathomable, and complex. In the end one is left with Kate's screen memory of her family at the fireside, with father to the left and mother to the right, with the words, "Listen to the Song of Life," scrolled across the mantel of the fireplace. This image depicts the motto of Katharine Hepburn, an actress who immersed herself fully in the creative process all her life.

See also: Families and Creativity; Talent and Creativity.

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Heuristics: Strategies in Creative Problem Solving

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Glossary

Concept selection Choosing relevant or critical concepts to focus on.

Conceptual combination Combination or reorganization of unique and abstract features of concepts relevant to the problem.

Creative thought The production of solutions to novel, complex, and ill-defined problems.

Heuristics The strategies people apply in executing cognitive processes.

Idea evaluation Evaluating and refining ideas relevant to problem solving.

Idea generation Developing and contextualizing ideas that may be valuable in problem solving.

Implementation planning The extensive use of forecasting and development of backup plans.

Information gathering Seeking information that is relevant to solving the problem.

Problem definition Establishing a clear perspective of what the exact problem is.

Solution monitoring Monitoring progress of solution implementation and changes resulting from implementation.

Introduction

In real-world settings, settings where performance matters, creative thinking involves the production of solutions to novel, complex, and ill-defined problems. Creative solutions to these problems are typically characterized by originality, quality, and elegance. These, apparently, straightforward statements, however, broach a question, a fundamental question, to those of us interested in understanding creative performance. What capacities must a person possess that will allow them to produce viable solutions to the kinds of problems that call for creative thought?

In fact, a variety of human capacities appear to represent potentially important influences on peoples' creative problem solving. Creative problems are demanding. As a result, motivation influences peoples' performance in solving the kinds of problems that call for creative thought. Similarly, the complex nature of creative problems suggests that openness, a personality attribute, will prove of value in accounting for creative performance. People, moreover, must search for, and appreciate, the value of creative solutions. Thus values also have been found to influence peoples' creative problem solving.

Although a variety of attributes, personality, motivation, and values to mention a few, influence peoples' creative problem solving, of particular importance is how people think about, and think through, creative problems. Thus students of creative thinking have stressed the importance of knowledge or expertise, the processing activities applied to this knowledge, such as conceptual combination and idea evaluation, and the heuristics, or strategies, people apply in executing these processes. In the present effort, we will examine the role of strategies, or heuristics, in shaping peoples' performance as they work on problems calling for creative thought.

Underlying this goal, however, is a broader concern. More centrally, the strategies people apply in working through problems calling for creative thought exert sizable effects on

subsequent performance. As a result, strategies often provide a basis for this development of effective instructional interventions. Strategies, moreover, often provide a basis for the assessment of creative potential. Thus the identification and analysis of strategies applied in solving creative problems provides a basis for a number of interventions intended to improve creative thinking and enhance our understanding of creative thought.

Knowledge, Processes, and Strategies

It is commonly believed that people cannot produce problem solutions, including creative problem solutions, without knowledge. Knowledge is usually thought to be domain specific – for example knowledge of physics versus knowledge of knitwear design. The acquisition of knowledge within a domain is frequently held to result in the acquisition of expertise. Multiple studies have shown that this acquisition of expertise influences peoples' ability to produce creative problem solutions within a given performance domain.

What should be recognized here, however, is that the acquisition of expertise within a performance domain evidences certain key characteristics. First, experts, as opposed to novices, have more information available. Second, this knowledge is better organized with knowledge organization being based on underlying concepts. Third, relationships among concepts are well defined and articulated resulting in the acquisition of viable mental models. Fourth, well organized mental models facilitate recall of knowledge and recognition of discrepancies, or anomalies, in observations, or events, within this domain.

Although these attributes of expertise all contribute to creative problem solving, if people only had existing knowledge to work with it would be impossible to produce original problem solutions. Recognition of this point has led many scholars to propose models of the processing activities by which people

work with expertise, extensive domain specific knowledge, to produce creative problem solutions. The most widely accepted model of the processes involved in creative thought is a model proposed by Mumford and colleagues.

Mumford and colleagues held that eight critical processing activities are involved in incidents of creative thought:

1. problem definition,
2. information gathering,
3. concept selection,
4. conceptual combination,
5. idea generation,
6. idea evaluation,
7. implementation planning, and
8. solution monitoring.

Within this model execution of an earlier process, for example problem definition, is held to provide an input into the operation of subsequent processes, for example information gathering and idea evaluation. These processes, moreover, are held to operate in a dynamic and recursive fashion over time, with people cycling back to reexecute earlier processes if an optimal solution is not reached at a given stage in a cycle of problem solving activities. Although these processes are held to be involved in most incidents of creative problem solving different processes take on special importance in certain domains. Thus the biological sciences stress information gathering where the social sciences stress conceptual combination.

Over the years, a variety of evidence has been accrued for the validity of this model as a description of the processes underlying creative thinking. For example studies have produced evidence indicating that the processes specified in this model, for example problem definition, conceptual combination, and idea evaluation influences the production of creative problem solutions. Effective execution of these processes has also been found to be related to real-world incidents of creative achievement such as a leader's ability to address critical incidents. Other studies have shown that effective execution of each of these processes makes a unique contribution to predicting performance on creative problem solving tasks. Still other studies have shown that the relationships observed among these processes are, in fact, consistent with this model. Finally, effective execution of these processes has been found to mediate the impact of abilities, such as intelligence and divergent thinking, on creative problem solving. Thus it appears this model provides a valid description of the key processes involved in creative thought.

What should be recognized here, however, is that each of the processes specified in this model represents a complex phenomenon in its own right. One implication of this statement is that any given processing operation may be executed in different ways. For example, in information gathering one might search broadly or one might search in depth. Similarly, in problem definition one might define a problem based on goals sought or, alternatively, the procedures to be applied in problem solving. The particular cognitive operations applied in process execution are what are referred to by the terms heuristics or strategies.

Of course, not all heuristics, or strategies, are likely to prove equally beneficial for effective execution of any given process. Thus a key question confronting students of creativity is what

strategies do, or do not, contribute to effective process execution in creative problem solving efforts. Answers to this question are of interest not only for theoretical reasons but also for practical reasons with regard to the assessment and development of creative talent and the creation of work environments likely to promote creative thought. Accordingly, in the following section we will examine the available evidence bearing on the strategies contributing to effective and ineffective execution of these creative thinking processes.

Process Specific Strategies

One study of process specific strategies examined the strategies contributing to performance during problem definition. The researchers presented 124 undergraduates with four ill-defined problems. Participants were asked to select 4 of 16 alternative definitions of this problem. These alternative problem definitions were varied to reflect definitions stressing key diagnostics, goals, problem solving procedures, and restrictions of varying quality and originality. Subsequently, participants were asked to provide solutions to two advertising and two management problems known to call for creative thought. Solutions to these problems were scored for quality and originality.

When scores on the measures of creative problem solving were correlated with and regressed on the measures of problem definition strategies, it was found that problem definition strategies were effective predictors of the quality and originality of obtained solutions producing multiple correlations in the 0.30 range. More centrally, it was found that people who defined problems in terms of high quality procedures and high quality restrictions tended to produce more creative problem solutions. Use of more original material in problem definition was not related to creative problem solving. Thus use of strategies that result in clear definition of a problem with regard to approach (e.g., procedures, restrictions) but not specific outcomes or concerns (e.g., goals, information) appears to contribute to creative thought. In other words, strategies that result in specification of a viable approach to problems appear to contribute to problem definition.

In a study of the strategies contributing to creativity in information gathering researchers asked 137 undergraduates to produce solutions to the four advertising and management problems which were scored for quality and originality. To measure information gathering strategies participants were presented with a series of four novel, ill-defined problems through web-based administration. They were then presented with a series of cards presenting different types of information bearing on the problem: cards reflecting:

1. key facts,
2. diverse information,
3. information bearing on goals,
4. information bearing on restrictions,
5. information bearing on core concepts,
6. inconsistent information, and
7. irrelevant information.

Time spent reading these cards was used to measure the depth of processing of each information type.

It was found, again, that depth of processing different types of information was strongly related to the quality and

originality of solutions obtained on the creative problem solving tasks producing multiple correlations in the 0.40 range. More centrally, it was found that people who spent more time encoding information bearing on key facts and inconsistent, or anomalous, information produced both higher quality and more original solutions on the creative problem solving tasks. Thus people who employ a focused, albeit open, search strategy, looking for critical information and anomalies during information gathering, are more likely to produce creative problem solutions.

A related study examined the strategies that contribute to creativity in concept selection. Again, the quality and originality of solutions to advertising and management problems provided the basis for assessing creativity. To assess concept selection strategies people were presented with five social innovation problems that might be understood using a number of different concepts. People were then presented with eight key concepts, reflecting general principles, specific actions, long-term actions, and evaluation of actions, where they were asked to select the two concepts they believed to be most useful in problem solving. Again, these strategy measures were found to be effective predictors of creative problem solving producing multiple correlations in the 0.30 range. More centrally, it was found that people who preferred to work with concepts bearing on long-term actions, but not concepts reflecting general principles or specific actions, produced more creative problem solutions. Thus, in concept selection, broad abstract concepts or concepts dictating a specific course of action are of limited value. Rather, creative problem solutions arise from people who prefer to employ concepts guiding long-term actions.

A study of conceptual combination provided evidence indicating that analogical thinking strategies might promote creative problem solving. More specifically, the investigators argued that identification of key features of each relevant concept, mapping the similarities and differences in these features across concepts, and elaboration of the implications of emergent features might account for the success of peoples' conceptual combination efforts. In fact, the findings obtained in this study and others support these propositions with regard to creative problem solving with the notable proviso that people may use metaphors (e.g., birds fly and flight represent freedom) when they are asked to map shared features of highly diverse concepts.

In a more recent study of conceptual combination strategies researchers asked 284 undergraduates to draw aliens. Instructions were given to think of aliens in abstract features or concrete attributes of earth animals. It was found that more original drawings of aliens were obtained when people employed abstract features in thinking about aliens. Thus, in conceptual combination, a search for abstract features linking concepts coupled with elaboration of emergent features of new concepts arising from conceptual combination contributes to creative thought.

Although new concepts provide the basis for generating the new ideas that have been the hallmark of creativity, these new concepts must be used to generate ideas. One set of studies examined the strategies contributing to idea generation. Broadly speaking, their findings indicate that a strategy where the practical implications of emergent features are explored contributes to idea generation. Thus, in a series of studies

they provided participants with abstract forms. They asked participants to imagine using this form and found that more creative ideas are produced when people envision alternative uses of the form. Moreover, creative idea generation improved when people were asked to think about problems associated with use of this object. Thus in idea generation a strategy of contextualizing emergent features to craft potential products and a strategy of identifying restrictions on the application of these products appears beneficial.

Although these strategies contribute to idea generation, multiple ideas will be generated, and, in a real-world context, these ideas must be evaluated. Thus idea evaluation is an important aspect of creative thought. Researchers have argued that idea evaluation is not simply a passive appraisal process but, instead, involves actively working with ideas. To test this proposition, one study asked 148 undergraduates to assume the role of a marketing manager developing an advertising campaign for a new product – the 3D holographic television. The advertising campaigns developed for this new product were appraised for quality, originality, and feasibility. In developing these campaigns people were presented with initial ideas of varying quality and originality. They were instructed to appraise these ideas with respect to innovative or operational efficiency standards and suggest revisions to these ideas with respect to innovative and operating efficiency standards.

It was found that when people were presented with original ideas, use of efficiency evaluations resulted in the production of the most creative advertising campaigns. When, however, people were presented with high quality ideas, use of innovative standards resulted in the production of the most creative advertising campaigns. Thus the most effective strategy in idea evaluation is a compensatory approach where people appraise and revise ideas to remediate deficiencies. Use of this compensatory strategy, moreover, implies that people must recognize unique weaknesses of ideas, and, in fact, other studies have shown that a search for idea deficiencies contributes to creative thought. This idea evaluation apparently requires a search for deficiencies in ideas and express attempts to compensate for these deficiencies.

Presumably, active idea evaluation will result in an idea one can work with to bring a new product, a new picture or a new drug, into the world. However, development of a new product is an inherently complex undertaking. Studies examining planning processes suggest that three critical strategies are involved in planning, including planning creative work. First, the person must mentally simulate the actions required as they unfold over time. Second, they must forecast the effects of various events on effective execution of this model. Third, they must develop back-up plans for opportunistic exploitation of emergent opportunities and to compensate for problems likely to arise in the work.

Some support for the relevance of these strategies has been provided. In one study, researchers asked 174 undergraduates to prepare a plan for operating a new experimental school where they had assumed the role of principal. These plans were evaluated for quality and originality. Prior to preparing these plans, participants were given training in the application of relevant implementation planning strategies (e.g., forecasting). It was found not only that these training interventions to improve strategy application resulted in the production of

more creative plans but that instruction in application of these strategies proved especially beneficial for people evidencing creative ability – high divergent thinking scores. This mental simulation, forecasting, and development of both positive and negative back-up plans appear to represent critical strategies for implementation planning.

Plans and actions, of course, have consequences. Thus monitoring has also been considered a critical process in creative problem solving. Effective monitoring, however, appears to be based at least in part on planning with monitoring markers being formulated with respect to both plans and back-up plans. Thus creative people appear to employ a wider range of plan based markers in monitoring, considering both markers of plan success and back-up plan markers. In addition to searching for a wider array of markers, creative people in monitoring, also appear to focus on crisis events – events that disrupt progress toward long-term goals. Thus broad monitoring and extensive monitoring of crisis events appear to represent two strategies commonly contributing to effective performance among people working on creative tasks.

Cross-Process Strategies

Although many strategies are tied to execution of a particular creative thinking process, some strategies may prove beneficial for execution of multiple processes. For example, one study examined the effects of three cross-process strategies that might contribute to creative thought: brainstorming (generating multiple ideas), hierarchical thinking (finding things in common), and changing perspectives (considering alternative viewpoints). Undergraduates, 92 in all, were given training in the application of one of these strategies, and asked to generate solutions to a creative problem. It was found that the hierarchical strategy, by allowing access to shared features, resulted in the production of the largest number of new ideas. Thus some evidence is available for the value of at least some cross-process strategies. Broadly speaking, five cross-process strategies have received attention in recent years:

1. variability,
2. forecasting,
3. exploration,
4. causal analysis, and
5. meta-cognitive control.

The assumption underlying variability as a strategy is that producing more material, and a wide range of material, will prove beneficial in creative thinking by providing people with more material to work with in execution of creative processes. Although the value of having more material to work with is limited by cognitive processing demands, there is reason to suspect that variability may contribute to creative thinking. For example, in one recent study researchers provided 60 undergraduates with hints as they worked on a computer task. Some hints were intended to encourage variability but others were not. They found that hints that indicated varying specific aspects of the task induced the highest variability in contrast to no hints and a general hint to vary. Other work has shown that increased variability results in improved performance on creative tasks such as painting. However, increased variability

may also require the imposition of standards for selecting the material to be retained in cognitive processing.

The assumption underlying the impact of extensive forecasting on process execution is related to the potential impact of variability. In forecasting people predict the consequences, or implications, of various actions on events. As the forecasting of downstream implications of process execution increase more material is taken into account and critical emergent issues are identified resulting in improved process execution. Thus the extensiveness of forecasting is held to contribute to creative thinking.

In a recent study, researchers asked 149 undergraduates to develop advertising campaigns for a new product – a high energy root beer. These advertising campaigns were the creative product of interest and they were appraised for quality and originality. Prior to preparing these campaigns, study participants were asked to forecast during evaluation of ideas and during implementation planning. Attributes of those forecasts were assessed. One factor which emerged from these attributes was the extensiveness of forecasting. It was found that the extensiveness of forecasting during idea generation, and the extensiveness of forecasting during implementation planning, contributed to the production of higher quality and more original advertising campaigns. Because there is reason to suspect that other processes might also benefit from extensive forecasting, for example extensive forecasting might contribute to the identification of anomalies during information encoding, there is reason to suspect that extensive forecasting might represent a viable cross-process strategy.

One outcome of extensive forecasting is that it permits exploration of a variety of alternatives during process execution. Given the findings of previous studies there is reason to suspect that more extensive exploration of the products produced in execution of all of the cognitive processes underlying creative thinking would prove to be of value. Commonly, the use of an explorative strategy is subsumed under one of two creative thinking styles: (1) exploration versus assimilation; or (2) innovation versus adaptation.

In one study of exploration and assimilation, researchers asked 87 undergraduates to solve two creative problems – the two-string and hatrack problems. Behavioral statements were used to assess peoples' preferences for applying an explorer or an assimilator style in problem solving. For example, people were asked to indicate whether "I prefer to stick to a set of principles when I solve problems" (assimilator) or "I prefer to develop new principles when I solve problems" (explorer). They found that explorers typically produced better solutions to novel problems, although assimilators produced better solutions when working on less novel problems. Thus there is reason to suspect that more extensive exploration will generally contribute to execution of a number of the processes held to underlie creative thought.

One particular value of exploration is that it allows identification of critical causal variables shaping the construction of creative problem solutions. In fact, studies of historically noteworthy cases of social innovation found that intensive analysis of key causes was typically associated with creative efforts. The identification of key causes, moreover, may influence the effective execution of a number of processes such as concept selection, idea generation, and implementation planning.

One recent study examined the effects of causal analysis strategies on solving creative problems. The researchers asked 180 undergraduates to solve six social innovation problems known to call for creative thought. Problem solutions were scored for quality and originality. Prior to starting work on these problems, participants were given training in strategies that would result in better causal analysis. For example, think about causes that have big effects or think about causes that effect multiple outcomes. It was found that training in causal analysis strategies resulted in the production of more creative problem solutions – particularly when the problems presented were more novel. Thus there is reason to suspect that intensive analysis of causes might prove to be a general cross-process strategy contributing to creative thought.

A final set of cross-process strategies that might contribute to creative thought may be found in the area of meta-cognition. Meta-cognitive strategies are employed to organize and structure thinking processes. In a recent study, researchers asked 36 elementary school students to solve a treasure hunt on a deserted island creative thinking problem. After completing their work on this problem, participants were interviewed with respect to meta-cognitive strategies employed during problem solving. It was found that participants who applied a meta-cognitive strategy of mindful learning typically produced more creative problem solutions. Although these findings suggest that a mindful learning strategy may contribute to creative problem solving, and execution of multiple processes held to be involved in creative thought, further research is needed to identify other meta-cognitive strategies that might contribute to creative thought.

Moderators

Taken as a whole, it seems clear prior research has provided a stronger understanding of the strategies, or heuristics, contributing to creative thought. Not only have the strategies contributing to effective execution of critical processes such as conceptual combination, idea generation, and problem definition, been identified, but so too have the strategies, or heuristics, that contribute to effective execution of multiple processes. In this regard, however, it is important to bear in mind another point emerging from recent research. More specifically, a number of variables exist that act to moderate the impact of any given strategy on creative problem solving. Broadly speaking, these moderators fall under two general rubrics: (1) characteristics of the person solving the problem; and (2) characteristics of the problem.

Person Characteristics

People bring to creative problems knowledge and expertise. As noted earlier, strategies are executed with respect to a particular knowledge base. As a result, it can be expected that knowledge and expertise would represent potentially powerful moderators of strategy application. This issue has been examined in a recent study.

In this study, 190 undergraduates were asked to devise a plan for directing a new experimental school with these plans being scored for quality, originality, and elegance.

A conceptual combination task was presented prior to generation of these plans through a consultant's report and a series of strategy execution exercises. In one condition the consultant's report presented concepts, schematic knowledge, and asked participants to apply feature search and mapping processes. In the other condition, cases, experiential knowledge, were presented and participants were asked to apply strength analyses and forecasting strategies. It was found that application of both sets of strategies could result in the production of creative problem solutions. However, when working with schematic knowledge, having more concepts was beneficial. When working with case-based knowledge, having fewer cases was beneficial. Thus knowledge type appears to moderate the effectiveness of applying different strategies.

Not only does the type of knowledge being applied moderate strategy application, with experience people acquire procedural knowledge, knowledge about strategy application, as well as declarative knowledge. Because expertise contributes to the acquisition of procedural knowledge, it can also be expected that expertise would serve to moderate the impact of various strategies on creative problem solving. In fact, prior studies have provided evidence in a comparison of expert and novice designers that strategy shifts are also observed as a function of expertise.

In addition to knowledge, another set of characteristics people bring to creative problems are base abilities such as divergent thinking and intelligence. Given the evidence indicating that abilities influence process execution, it also seems reasonable to expect that abilities will also influence strategy application. In keeping with this observation, a recent study found that abilities, specifically divergent thinking and intelligence, moderated the acquisition, and application, of strategies involved in implementation planning. Similarly, other studies have provided evidence indicating that people lacking requisite abilities often apply suboptimal strategies when working on problems calling for creative thought.

As suggested by our foregoing observations, it appears that application of many of the strategies involved in creative problem solving is, in fact, demanding. The demands made by strategy application, in turn, imply that attributes of the person, for example need for cognition, openness, and the value placed on novelty, which leads people to invest cognitive resources in strategy execution, might contribute to creative problem solving. In a recent study along these lines, researchers examined the effectiveness of peoples' application of forecasting strategies. The researchers manipulated motivation by inducing feelings of high versus low self-efficacy and high versus low implementation intentions. They found that self-efficacy and implementation interventions contributed to the production of more effective forecasts. Thus motivation may influence strategy execution.

Problem Characteristics

Not only can the characteristics of people moderate strategies being applied, and the effectiveness of strategy execution, it also appears that the nature of the problem at hand may prove of some importance in this regard. One potentially important variable in this regard is the domain from which the creative

problem is drawn. Problems drawn from different domains not only emphasize different processes, they may also call for the application of different strategies in process execution. A case in point may be found in contrasting the idea evaluation strategies employed by scientists and leaders. One study on this topic found that scientists in idea evaluation seek early confirmation of ideas. In other words, they look for support. In contrast, leaders, in idea evaluation, seek to appraise ideas based on critical feedback. Thus leaders seek early rejection of nonviable ideas. These examples illustrate our broader point. The domain in which a problem emerges will condition the relevance of various strategies applied in creative problem solving.

Within a domain, the problems presented to people calling for creative thought vary with respect to their complexity and difficulty. These differences in problem complexity and difficulty, in turn, lead to greater demands in the execution of certain processes. As the demands made by process execution increase or decrease, different strategies may be required. This point is illustrated in a series of studies on the strategies involved in execution of the conceptual combination process. In the initial study it was found that feature search and mapping strategies contributed to successful combination and reorganization efforts. However, these strategies were only effective on relatively simple conceptual combination tasks where the concepts involved (e.g., birds, balls) shared certain features. On more complex conceptual combination tasks where shared features were less evident (e.g., birds, furniture) application of these strategies was less effective. Rather, on more demanding conceptual combination problems a search for metaphors was required to execute the conceptual combination process.

A final aspect of the problem that appears to influence the strategies applied pertains to the person's relationship to the problem. People in problem solving interact with the problem. However, these exchanges with the problem may occur in a number of different ways. For example, the problem might be affectively engaging or affectively neutral, it might be challenging or routine, or it might be immediate as opposed to distant. A recent study examined the influence of immediacy and distance of problems by asking people in causal analysis to think about implications of events for friends and families (immediate) versus institutions (distant). The researchers found that causal analysis strategies had stronger effects on creative problem solving when a distant as opposed to an immediate framework was applied during strategy execution.

Conclusions

Our foregoing observations with regard to heuristics, or the strategies people apply in executing the processes involved in creative thought, have a number of noteworthy implications. Perhaps the most important implication arising from these studies involves our basic conception of creative problem solving. Traditionally, creative problem solving has been understood in terms of convergent and divergent thinking. The strategies being applied in executing the processes underlying creative thought, however, suggest this distinction may not hold. For example, idea evaluation and information gather

are considered convergent processes. However, identification of anomalies in information encoding and compensation in idea evaluation suggest that noteworthy 'divergent thinking' may be required. Similarly, problem definition has been viewed as a divergent processing activity. However, the fact that a search for quality procedures and restrictions is critical to execution of this process suggests it may have a distinctly 'convergent' aspect.

Not only do strategy studies have some noteworthy theoretical implications, they have some noteworthy implications for our basic conception of creative thought. Not only are multiple processes involved in creative problem solving, each of these processes calls for application of a number of strategies. Moreover, the strategies that are applied may be process specific or process general. To complicate matters further, the strategies applied in problem solving may vary as a function of both characteristics of the person and characteristics of the problem. This exceptional level of complexity has two important implications. First, there may not be a simple, straightforward, 'recipe' for creative thinking. Second, substantial resources will be required to identify the many varied strategies people can apply in creative problem solving depending on their personal capabilities and the nature of the problem at hand.

Work along these lines, although demanding, may have great value. From a practical perspective, strategies have been shown to be strongly related to creative problem solving performance. The strength of these relationships suggests that strategies might provide a viable framework for both the assessment of creative potential and the design of educational interventions intended to enhance creative potential. From a substantive perspective, the identification of the strategies, or heuristics, contributing to process execution has resulted in a richer, more complete, understanding of creative thinking. We hope the present effort will serve as a stimulus for further work intended to unravel how heuristics shape creative thinking.

See also: Metacognition; Problem Solving.

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Historical Conceptions of Creativity

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Glossary

Associationism The proposition that the mind consists entirely of ideas (words, images, formulae, etc.), each of which is associated with other ideas. Thinking, therefore, is simply a process of moving from one idea to another by way of a chain of associations.

Bicameral mind The concept that the mind is composed of two chambers, one in which desirable innovations are inspired by the gods, and a second chamber in which more mundane thoughts are produced by the person.

Biopsychosocial theory The belief that all human acts are borne of a complex interaction of biological, psychological, and social forces.

Cerebral localization The principle that each of the various human abilities are located in the lobes, which are sections of the brain.

Fundamentalism A movement or point of view characterized by rigid adherence to fundamental or basic principles.

Gestalt German for 'mental patterns or forms.' Gestalts have complex relationships, and are more than merely 'associated' with each other. As mental patterns, they form ideas that are greater than the sum of the parts.

Humanism The belief that humans have the ability to solve problems through their own mental efforts, without having to rely on inspiration from the gods or from God.

Muse A spiritual intermediary for the gods. A person who felt a creative impulse would invoke the appropriate muse for assistance.

Original genius As opposed to mere talent, refers to the ability to create fundamentally new and highly valuable ideas and products.

Paganism The religious belief that many gods play roles in human behavior.

Introduction

What is creativity and how does it work? One group of historians believes that it is a cyclical phenomenon. As Von Fange explains this view:

A close study of dead civilizations indicates that they usually started on their road to glory because of fortuitous circumstances exploited by a strong, inspiring leader. The nation then carried on for a period under its own momentum. Finally, creeping vanity led the people to become enamored of their undisputed superiority; they became so impressed with their past achievements that they lost interest in working for further change. Soon their sons, coddled in the use of all the great things their fathers and grandfathers had pioneered, became as helpless as newborn babes when faced with the harsh reality of an aggressive and changing world (1959: 29).

Although there is some truth in this, there is considerable evidence that in fact, there have been three distinct historical periods in which human understanding of the concept of creativity has differed substantially. From earliest times until the Renaissance, it was widely believed that all desirable innovations were inspired by the gods or by God. Then, sometime during the Renaissance, this view began to give way to the idea that creativity is a matter of genetic inheritance. In the beginning of this century, the debate turned to an argument over the relative contributions of nature versus nurture. In recent decades, there has been growing acceptance of *biopsychosocial theory*, that is, the belief that all creative acts result from a complex interaction of biological, psychological and social forces. How these changes in the popular conception of creativity emerged, however, is far from simple and not without controversy.

Prior to the nineteenth century, very little was written about the nature of creative thinking. Although there had been

extensive theorizing about other human capacities, conjecture about the origins of creative productivity had been impeded by the belief that it is too obscure, too multifaceted, too ethereal to allow for intellectual analysis of its process. The first effective scholarly inquiry was undertaken only a little over a century ago. Research on the creative process was deterred not so much by ignorance as by the conviction that the nature of innovative thinking was already understood: it was thought that it comes as a gift from above.

The Bicameral Mind

The earliest explanation, one that is largely inferred from the writings of Homer and the authors of the Bible, was that the mind is composed of two quite separate chambers (this concept is unrelated to the current knowledge that the brain is composed of two hemispheres). The first scholarly treatise to document this view was written by psychologist Julian Jaynes. He coined the term *bicameral mind* as a label for this phenomenon. Throughout early human history, Jaynes posits, people uniformly believed the chamber of the mind in which new thoughts occur was controlled by the gods. Thus they thought that all creative ideas come from the gods, usually through the mediation of a *muse*, a sort of intermediary for the gods. A person who felt a creative impulse would invoke the appropriate muse for assistance: Calliope for epic and heroic poetry; Clio for history; Erato for love poetry; Euterpe for music and lyric poetry; Melpomene for tragedy; Polyhymnia for songs or hymns to the gods; Terpsichore for dance; Thalia for comedy; and Urania for astronomy. A major function of the mind, then, was as a receptacle for supernatural innovations. It was

believed that the gods projected their ideas from Mount Olympus by inspiring (literally, 'breathing into') this first chamber.

The purpose of the second chamber of the mind was to express inspiration through the more ordinary mechanisms of speech and writing. It was considered to be the public representative of the first chamber. The second chamber also was used to express such mundane thoughts as 'I am hungry.'

The bicameral process is exemplified in the tales of Homer, in which the characters are able to accomplish great acts, but only as directed by the gods. In their most important achievements, Homer's heroes did as they were inspired to do, carrying out the strategies given them. This was no passive act, however. They could choose not to follow the inspiration given them and some did. Thus when they effectively followed the instructions of a god in battle, they were credited with great bravery, but not with the idea for the act. When they wrote a beautiful poem or play, they were admired for having produced it, but mainly because they had been chosen for the honor.

Many early thinkers, Plato and Aristotle among them, believed that the 'creativity' chamber also housed madness when the spirit of the Muse was present. Hans Eysenck cites Plutarch's description of Archimedes, the great geometrician:

... how, continually bewitched by some familiar siren dwelling within him, he forgot his food and neglected the care of his body, and how, when he was dragged by force, as often happened, to the place for bathing and anointing, he would draw geometrical figures in the oil with which his body was anointed, being overcome by great pleasure and in truth inspired of the Muse.

This 'madness' was not the same as insanity, however. As Eysenck points out, "... in Latin there is no linguistic distinction between *madness* and *inspiration*. *Mania* and *furor* are terms that cover many different non-rational states like anger, passion, inspiration, and insanity."

Perhaps the first to challenge the concept of the bicameral mind was the philosopher Aristotle in the fourth century BCE. Although he agreed with his predecessors that inspiration involved madness, he suspected that great insights begin as the result of a person's own thoughts, through a process which has become known as *associationism*. This view proposes that the mind consists entirely of ideas (words, images, formulae, etc.), each of which is associated with other ideas. Thinking, therefore, is simply a process of moving from one idea to another by way of a chain of associations. Aristotle suggested that mental associations are formed between events and objects that occur in the same place, the same time, that are similar, or that are opposites.

For example, the associationist view might speculate that the prehistoric builder who thought of moving huge blocks of temple stones by repeatedly placing wooden rollers in front of the stones got the idea from remembering playing with toy blocks and sticks as a child. The situations may be different, but the method of transportation is similar. Another example would be an imaginative chef's ability to create a delicious new dish by combining ingredients called for in a previously used recipe, but in a different way. At any rate, Aristotle did not spend much time pursuing this insight, and belief in the bicameral mind lived on for several more centuries.

Jaynes states that by the end of the medieval period, speech, writing, and other mental operations grew more complex.

As a result, it was recognized that thought could actually originate within a person's mind, and the notion of the bicameral mind eventually broke down. In its place came self-awareness and thus insight into the human potential to create. After many divergencies, this insight provided the opportunity for the development of scientific discovery.

For this monumental achievement to occur, however, other innovations were required. So many of these innovations come to us from the Greeks in the three centuries before the ascendancy of the Roman Empire, and so few from the medieval Europeans. Both cultures accepted the concept of the bicameral mind, so why was there so great a disparity in the creative output of the two periods? It appears that although they shared the conscious concept of creativity (the 'gift from above' view), the *unconscious concept* held by the two cultures was quite different. In this difference lies the answer to the question, "Why were the accomplishments of these two cultures so disparate?"

Paganism Versus Fundamentalist Religion: The Greeks

During the so-called 'Golden Age' (500–200 BCE), the Greeks invented most of our Western literary and political forms, developed many innovations in the arts, and shaped the disciplines of history, medicine, mathematics, and philosophy. Only portions of their written output still exists, perhaps about a fifth. Not a single one of their public buildings and only a few of their statues remain standing. And yet it is their oratories, plays and histories that are still found worth reading in the world's colleges and universities, and their buildings and sculpture that are emulated more than any other. Historian Daniel Boorstin compares them to other civilizations:

Inquiry for its own sake, merely to know more, philosophy on the Greek model, had no place in [a world view such as the Confucian, Incan, Buddhist, or Christian] tradition. Greek philosophers, beginning with Thales, were men of speculative temperament. What was the world made of? What are the elements and processes by which the world is transformed? Greek philosophy and science were born together, of the passion to know.

To what may we attribute this flourishing of passionate imagination? An insightful hypothesis has been put forth by historian Moses Hadas. He suggests that the Greeks were prolifically creative because they were free of many of the cognitive restraints that afflicted other major civilizations. It is true that they were economically secure and had ample assistance in their daily lives from their slave system but, Hadas argues, their main asset was the absence in their lives of the religious beliefs that fettered most other societies. They believed their ideas were inspired by the gods, but by gods who existed in proliferation and who cared little about the lives of humans. Although they were concerned about displeasing their gods, the Greeks saw no reason to think that self-expression would distress them. After all, the more beautiful or original their creative product, the more likely was it to have been given them by their pleasure-loving gods.

In making this case, Hadas compares classical Greece and its pagan beliefs to medieval Europe and its fundamentalist Christian orientation. He argues that it was not so much the

restrictive teachings of early Christianity or the 'otherworldliness' of the religion that caused inhibition of creative thought throughout the medieval period (the end of the fourth through the twelfth centuries), but its claim to exclusive validity. In its struggle to gain acceptance and then dominance, early Christianity was harsh in its rejection of deviant ideas, which were considered heretical. Beginning with the execution of Arias and continuing through the use of several forms of inquisition, the Church dealt harshly with the progenitors of such thinking.

The polytheistic Greek religion, on the other hand, allowed the individual to exercise choice among various classes of deities. The scope of individual autonomy was infinite, and the Greeks were of the belief that the actions of the gods were unpredictable – they could never assume to know what the gods thought or felt.

Hadas buttressed his case for a sharp distinction between the attitudes of Greek *paganism* and the Christian religion by pointing out what Greek paganism did *not* have:

- churches
- family allegiance to one point of view (members of Greek families were free to choose any god to worship, or none at all)
- strong prejudices against older or newer beliefs
- dogma
- sacred books revealed by a spiritual being, detailing that dogma
- priests
- claims to infallibility
- epic religious stories (e.g., the Garden of Eden, the escape from Egypt)
- a clear concept of sin
- true villains (because many religious views were simultaneously acceptable, persons whose views were diametrically opposed still could respect each other. There were no heretic).

Perhaps the clearest view of the Greek ideal can be seen in their emulation of heroes, as compared to Christian attitudes toward saints. A Greek hero was "any deceased person worthy of a cult, that is, of receiving offerings of flowers or wine on his special anniversary." The offerings are not meant to appease him or her, but to serve the people. For example, Hadas points out, "... we eat cherry pies and chocolate hatchets [on George Washington's birthday] to serve ourselves, not our first president." The main distinction, he argues is that "A man approaches sainthood to the degree that he *suppresses* the impulses of ordinary humanity and assimilates himself to a pattern outside humanity. A man becomes a hero to the degree that he emphasizes his human attributes." Hence Greek pagans were encouraged to perceive excellence as a more readily attainable goal than were medieval Christians.

The single 'sacred source' the Greeks did have was the poetry of Homer. This was the one source of information that all Greek children learned, and its code was therefore accepted with as little question as we accept the facts of the multiplication table. There, it appears, is the explanation for the relentless Greek drive for excellence in all aspects of their lives, and for the quality of their production in the arts and crafts. A person composed music or wrote poetry not merely for self-expression or profit, but as an entry in the national contest for the

approbation of society. The main objective was honor. Even the potters who fashioned the cheapest household bowls took pains to sign their work. When the vases were artfully crafted, both potter and painter signed the bottom. All Greeks knew who designed the Parthenon, but the builders of the great Christian cathedrals remain anonymous. Cathedral architects chose not to put their names on their work because the work was for the greater honor and glory of God, so it would be prideful and disrespectful to display authorship.

From Homer through the Epicureans, we can see that significant and persistent value placed on the self-sufficient individual. To quote Hadas:

The Homeric warrior [knew that] what was decreed for him by a power outside himself he could not alter and need not bother to understand; he was definitely the captain of his soul, but made no pretense of being master of his fate. So the hero of tragedy knew that he must behave well as a man; the disasters that might befall him had no relationship with his own excellence.

Because the gods played so small a role in their daily existence, the Greeks were free to do whatever they wished, so long as it was honorable. The breathing of life into a Greek person's creative process may have been influenced by a heavenly source, yet the credit went to the individual responsible for the creation. Hence the fabulous 300-year-long cornucopia of creativity that was the Golden Age.

This is not to say that the Greeks believed what they were doing was 'creative,' however. Art was "the making of things according to rules," and did not seem to call for innovation (discussed by Tatarkiewicz in 1980).

Paganism Versus Fundamentalist Religion: The Medieval Europeans

As Roman culture died out and was replaced by vibrant new barbarian growths, people forgot many things – how to read, how to think, how to build magnificently – but they remembered and they mourned the lost peace. Call them the people of the Dark Ages if you will, but do not underestimate the desire of these early medieval men and women for the rule of law. (Cahill, 1995)

A squelching of free thought begins in the late Hellenistic period as paganistic Romans come to accept the claims of their all-powerful emperors to have become gods themselves. Under them, Rome became famous for its 'universal' codes of behavior, which covered one's duty to the state. On the other hand, the Romans were not so different from the Greeks in their attitudes toward religious imperatives. It was not until the rise of Christianity, with its fervent devotees, that we see a strict code of behavior, enforced by powers in this world who were exclusively backed by the power of the next.

This extensive change in philosophy was accompanied, and probably abetted by, another sweeping event. Barbarian tribes began attacking the Roman Empire from several sides in the fifth century, and systematically ravaged huge territories. This onslaught eventually destroyed faith in the Roman religion and prepared the ground for a new one.

The most notable group of invaders, the Vandals, deeply penetrated the Empire and nearly destroyed Rome.

The Vandals were a Teutonic tribe that governed their North African kingdom from 439 to 534. Other tribes, such as the Huns, Vikings, and Visigoths, also invaded and pillaged large tracts of the Empire. While in the process of rampaging the lands, and especially the cities they wished to conquer, they destroyed any books or other written materials they could find. They had a savage disregard for intellectual or spiritual enlightenment, being interested only in the spoils of battle and the domination of their victims.

An exception to this was Alaric, who together with his horde of Goths smashed through the gates of Rome at midnight, 24 August 410. He prevented his men from putting the torch to everything, saying that while he wished to destroy the Roman Empire, he had no desire to harm the many Christians who then inhabited the city. Soon a few treasured works hidden in the city were spirited off to Moslem strongholds. Throughout the medieval period other precious tomes were rescued by an unlikely source: the reclusive Christian monks based on secluded islands off the Irish west coast. They secretly made it their business to locate the hidden writing not only of Christians but, amazingly, of the pagan thinkers as well. Not only did the monks preserve these works, but they painstakingly and artistically handcopied the writings in an attempt to perpetuate these obscure pockets of intellectuality. The efforts of these monks must be considered a critical contribution to human creativity, for although the marauders were frequently successful in ravaging the lands, they were never able to destroy the words that would so stimulate thinkers in centuries to come.

The work of these monks is an example of how the Dark Ages' were not totally devoid of creative achievements. The famous *Book of Kells*, produced by the monks over many years, is an exemplar of the level of their creativity. Another such example is the work early in the fifth century of Saint Augustine, Bishop of Hippo. In his brilliant treatise *The City of God*, written between 413 and 426, he argued that Plato and the Greeks were wrong in their belief that life is a series of repetitious cycles. He offered the life of Christ and the subsequent new view of humanity offered by Christianity as a argument against that position. He was probably one of the first to discredit the idea that all creative ideas come straight from God, devout though he was. He was awed by the creative powers of his fellows, in fact, although he could not resist chastising them for the purposes to which such gifts were often put:

... man's invention has brought forth so many and such rare sciences and arts (partly necessary, partly voluntary) that the excellency of his capacity makes the rare goodness of his creation apparent, even when he goes about things that are either superfluous or pernicious, and shows from what an excellent gift he has those inventions and practices of his.

What millions of inventions has he against others, and for himself in poisons, arms engines, stratagems, and such like!

Further evidence of medieval creativity was the work of the Roman Boethius, who served as counselor to Theodoric, King of the Visigoths. This ingenious scholar single-handedly produced the *quadrivium*, which offered explanations of the four 'mathematical' disciplines: arithmetic, music, geometry, and astronomy. Together with the *trivium* (grammar, rhetoric, and logic) later assembled by others, they formed the basic

curriculum for the handful of scholars who struggled to keep knowledge alive during the Middle Ages.

Such contributions notwithstanding, the situation in the Western world in the fifth century was rather grim, as Christopher Dawson so succinctly describes it. He disagrees with Hadas' position that fundamentalism was the major cause of the lack of creative output, however. After all, he argues, the Moslems were as rigidly fundamentalist as the Christians and yet the Moslems made many creative contributions. He ascribes the superiority in creative output of the Greek and Moslem cultures over the medieval Christian culture rather as the result of the Christians having been reduced to a simple agrarian culture by the invasions of numerous outsiders. It may well have been the case that the tight grip of the Church on the minds of the population was welcomed as a consoling relief from the fear of vandalism and starvation alike. In fact, as is so often the case at the macrosocial level, establishing causation is a perilous pursuit. For example, it could well have been that the fundamentalist posture of the medieval Church and the low level of creative output in medieval times were both the result of the destabilized political and economic environments brought about by the widespread vandalism. As Dawson states:

But while there is no reason to suppose that the Dark Ages were dark [solely] because they were religious, it is none the less difficult to exaggerate their darkness, both as regards scientific knowledge and the completeness of the break between the science of antiquity and the science of modern times. Here the traditional view is justified, and it only becomes false when this judgment is extended from the early to the late Middle Ages so as to make the scientific development of Western Europe begin with the Renaissance. In reality the recovery of Greek science and the restoration of the contact with the main tradition of Greek thought was one of the most striking achievements of medieval culture. And it is even more than this: it is the turning point in the history of Western civilization, for it marks the passing of the age-long supremacy of oriental and eastern Mediterranean culture and the beginning of the intellectual leadership of the West. It is, in fact, a far more important and original achievement than anything that the Renaissance itself accomplished. For the Renaissance scholars, in spite of their originality, were carrying on a tradition that had never been entirely lost: the tradition of humanism and classical scholarship that was founded on Cicero and Quintillian. But the rediscovery of Greek thought by the medieval scholars was a new fact in the history of the west: it was the conquest of the new world.

The Renaissance and the Beginnings of Humanism

Dark as the medieval period was, nothing that happened during its 800 years could compete with the catastrophe of the Black Plague which, by the time it ended around 1350, had decimated fully one-third of the population in the West. As a result, however, new emphasis on the individual took place and with it came a loosening of reflexive obedience to clerical rule. Because workers had become so scarce, they found they were in a much stronger bargaining position with the feudal hierarchy as well. This change brought about a shakeup of the entire social structure, and with it a widespread challenge to the belief system of the previous millennium.

For example, artisans began to win acclaim and patronage for themselves. This is similar to the attitude of the ancient

Greeks who took pride in all their creations, from the most minimal to the most spectacular. Painters again signed their artwork, abandoning pious humility for personal pride in their craft. Guilds were formed to foster the growth of individual crafts and skilled trades. The principal source of patronage was no longer the Church, but rather wealthy princes and merchants whose pride in artful possessions was no longer considered a sin. The emphasis in the work of the poets, painters, and philosophers was still on the glory of God, but as reflected in the countless joys of *human* existence.

Also at this time we see widening criticism of what has been considered the acme of Church power, the inquisition. This tribunal, with its witch hunt for heretics and its infamously murderous 'auto-de-fé ("prove your love of God by admitting your guilt!") had exerted a chilling influence over independent thought for many years. As it lost its power, the Holy Roman Empire declined in importance and the papacy was weakened by schism. Among the major causes of this breakdown were the executions by fire of such popular Church critics as Jan Hus and Girolamo Savonarola, and the publication of the 95 theses of Martin Luther, which began the Protestant Reformation. There was a reformation of the Church itself at this time, but it came too late to stave off the winds of change. Simultaneously, the national monarchies increased in strength and prestige. At the beginning of the 1400s, the population of Europe was better off financially than at any time since before the fall of Rome.

Now we see the inauguration of humanistic philosophy, the belief that we ourselves are responsible for much of what happens to us. This view was not generally antimonotheistic, but rather co-monotheistic. The resurgence of creative production on so grand a scale was inspiring, and piqued the curiosity of those who wished to understand the complexities of minds that were capable of such accomplishments.

The term 'renaissance' originally referred to the revival of values and artistic styles of the classical age. By the 1500s, the word had acquired a broader meaning: it was becoming known as one of the great ages of human cultural development, a distinct period signaling the dawn of the modern era. Essentially, a breakdown occurred in the rigid social order that had so dominated societies in Europe, manifesting itself in cultural and intellectual advances. The style of the Renaissance music, literature, and arts is quite distinctive, and ultimately this intellectual and spiritual revolution sparked a drive in the people to release themselves from the medieval traditions. The historian Nicolas Berdyaev describes the period this way:

In the creative upsurge of the Renaissance there occurred such a powerful clash between pagan and Christian elements in human nature as had never occurred before. In this lies the significance of the Renaissance for the world and for eternity. It revealed the activity of the pagan nature of man in creativeness, and at the same time the activity of his Christian nature.

The Christian ideas had been accepted for a long time, but the pagan ideas were rapidly being reintroduced. This came about through the influx of scholars from the Moslem countries, and by the circulation of the magnificent books, produced and kept safe over the centuries by the Irish monks. Spurred by these 'new' old ideas, the best minds experienced a sense of freedom encouraging an inquiry into everything, even

the most cherished of beliefs. From this resurgence sprang the scientific, artistic, philosophical and political revolutions that came to be referred to as the 'Age of Enlightenment.'

The Age of Enlightenment and a Flourishing Humanism

By the beginning of the eighteenth century, the spate of knowledge born of the work of such giants as Copernicus, Galileo, Hobbes, Locke, and Newton solidified belief in the scientific process. Faith in the ability of humans to solve problems through their own mental efforts (known as *humanism*) grew rapidly. Spiritual works such as the Bible waned in their authority, and were viewed with impunity by some scholars as literary efforts rather than as the word of God. The right of individuals to come to their own conclusions began to gain acceptability.

In 1767, the first major inquiry into the creative process took place. William Duff was one of the first to write about the qualities of *original genius* (as distinguished from talent, which is productive but breaks no new ground), and his insights were strikingly similar to more modern attempts to unravel the mysteries of the creative mind. What set Duff apart as an important figure in the study of creativity is that he was the first to suspect the biopsychosocial nature of the process.

Duff was principally interested in determining the cognitive traits that were responsible for the variance he observed in the accomplishments of people. He was not only concerned with hereditary influences, but also with the times in which his subjects lived. As we shall see, it would be quite some time before others would agree that social influences play a role in creativity.

The main qualities that Duff considered fundamental to genius were imagination, judgment, and taste. Any one of these three characteristics alone would not result in the caliber of genius of Shakespeare; rather he thought the combination of the three ingredients to be essential. He argued that imagination contributed the most, in that the mind not only reflects on its own functions, but also organizes its ideas into new associations and combinations of an infinite variety. Duff felt that all discoveries and inventions in science and art were the result of imagination. Judgment, he asserted, is that ability that evaluates ideas or options, and acts as a counterbalance to the influences of imagination. Taste supplements judgment, providing a sense of aesthetic quality to the cold evaluative nature of judgment.

The publication of Duff's work was one of several events that set the stage for scientific research on human thought, which would later prove essential to the demystification of the creative act. Here is a brief list of major Enlightenment milestones that helped break the path:

- The spread of social and philosophical opposition to church and state authority.
- The institution of the British Royal Society, the first research organization.
- A plethora of developments in the natural sciences.
- Separation of the idea of creativity from more ordinary notions of genius (as in "He has a genius for poetry").
- The doctrine of individualism.

- Three enormously influential books: Francis Bacon's *Advancement of Learning*, Adam Smith's *The Wealth of Nations*, and Thomas Malthus' *Essay on Population*.

Robert Albert and Mark Runco have summed up the contributions of this period to a new concept of creativity:

Tedious and tangential as they were at times, nevertheless, the debates through the eighteenth century eventually came to four important acceptable distinctions, which were to become the bedrock of our present-day ideas about creativity: 1. Genius was divorced from the supernatural; 2. Genius, although exceptional, was a potential for every individual; 3. Talent and genius were to be distinguished from each other; 4. Their potential and exercise depend on the political atmosphere at the time (this last distinction would not be recognized for many years, however).

The Debate over Associationist and Gestalt Views

Throughout the nineteenth century, a major shift in the conception of the creative act occurred. With the renunciation of divine inspiration as the sole cause of creativity came a transmigration to what may be the opposite extreme: great men are great because they have inherited a serendipitous combination of genes from their forebears, which produce a mind of intensely fine acuity (decades would pass before the recognition of women of genius). This assumption grew as medical science produced evidence of heritability of physical traits. Moreover, this concept seemed to jibe with the recognition that high level mental ability runs in families.

For a while, a debate raged over just how specific inherited traits might be. Jean Lamarck believed that learned traits could be passed on genetically. Charles Darwin demonstrated that he was wrong, confirming that genetic change occurs not as the result of practicality but through random mutation, over eons of time.

So what explanation did nineteenth-century science offer as to how geniuses formulate their brilliant ideas? A subordinate question was, does a genius search for knowledge elementally (from parts or elements of a problem to the whole), or holistically (from a sense of the whole of the problem to its parts)? Two scientific camps were formed. They have become known as the associationist (a branch of behaviorism) and the *Gestalt* positions. From this seemingly academic debate came one of the greatest advances in our understanding of the creative act itself.

Research on the history of creativity often cites Sir Francis Galton as having conducted the first scientific research on the nature of genius. He was the second great associationist, after Aristotle, and was highly respected in nineteenth-century England as a multifaceted scientist. He was a eugenicist, meteorologist, evolutionist, geographer, anthropologist and statistician, and he probably should be credited as the world's first cognitive psychologist. Building on his friend Charles Darwin's groundbreaking insights of evolution, natural selection (survival of the fittest), general diversity and adaptation, he made inestimable contributions to our thinking about creativity.

One of his most interesting experiments was his attempt to measure the workings of his own mind. The descriptions of his findings have been insightfully analyzed by Crovitz in

his book, *Galton's Walk* (1970). The walk referred to is one taken by Galton down London's Pall Mall, during which he meticulously recorded every thought that crossed his mind. His goal was to:

... show how the whole of these associated ideas, though they are for the most part exceedingly fleeting and obscure, and barely cross the threshold of our consciousness, may be seized, dragged into daylight, and recorded. I shall then treat the records of some experiments statistically, and shall make out what I can of them.

He was awe-stricken by his tabulations:

The general impression they left upon me is like that which many of us have experienced when the basement of our house happens to be under thorough sanitary repairs, and we realize for the first time the complex systems of drains and gas- and water-pipes, flues, and so forth, upon which our comfort depends, but which are usually hidden out of sight, and of whose existence, so long as they acted well, we had never troubled ourselves.

His most important conclusion:

The actors on my mental stage were indeed very numerous, but by no means as numerous as I had imagined. They now seemed to be something like the actors in theatres where large processions are represented, who march off one side of the stage, and going round by the back, come again at the other.

At first glance, this conclusion may not seem earth-shaking, but Galton had actually discovered two principles which have had enormous impact on our thinking about thinking. The first is his notion of 'recurrence.' This holds that the conscious mind is like a plenum. A plenum is a space which is totally filled up with objects. An example would be the ball-bearing ring which supports the fluid motion of wheels. Little balls fill two concentric rings, and roll around in the hub of the wheel, making the wheel spin much more freely than it would otherwise. Each ball can only move by taking the place of the ball in front of it. There is no place else to go. The only possible movement is cyclical movement.

Galton argued that this is what happens in the conscious mind. It is always, at any one point in time, filled up, and thoughts can only follow each other around. He found this positive, because otherwise, he believed, conscious thought would be random and would have no order. Orderliness is essential to logical thought.

However, if this were the only way the mind could process information, there could be no new thoughts, and therefore no creativity. The second and more important discovery Galton made was that new input can come into this plenum from another part of the mind. The source of this input is the unconscious, the 'basement' of the mind. And most important of all, the unconscious can be made conscious through association of thoughts. Thus was discovered the critical notion of 'free association.' The concept was certainly revolutionary: "ideas in the conscious mind are linked to those in the unconscious mind by threads of similarity." At the turn of the century, Sigmund Freud and his associates would bring this notion to fruition.

Of particular note in Galton's research is his use of statistical analyses in the study of individual differences among geniuses. The modern statistical principles of correlation and regression evolved from Galton's findings, gleaned from

biographical sources for his subjects in various fields and their families. This methodology was incorporated into the studies of other researchers who pursued the study of creativity at the onset of the twentieth century and the years to follow.

Galton was convinced that mental capacities are inherited. He believed that these capacities follow certain laws of transmission that can be determined by observation. He examined the hereditary nature of mental abilities in subjects recognized by society as 'geniuses' in an attempt to show that genius is an inherited trait in the same manner that physical features are inherited. In Galton's view, geniuses possess natural ability in terms of intellect and disposition that leads to this reputation, urged on by some internal stimulus that strives to overcome any obstacles.

This definition originated with Galton. Historian Jacques Barzun describes several iterations in the meaning of genius:

In ancient and medieval times, a genius or a demon was a person's guardian spirit, giving good or evil advice on daily affairs. Then genius came to mean a knack of doing a particular thing – a gifted person was said to 'have a genius' for calculation or public speaking. It gradually acquired a more honorific sense. By the 1750s genius was defined by the poet Edward Young as "the power of accomplishing great things without the means generally reputed necessary to that end." This notion fitted Shakespeare's case, for he was thought lacking in discipline, learning and art. He had a wild, untutored genius.

In the next generation came the subtle shift from 'having' genius to 'being' a genius, with no limitation such as Young included in his praise. A genius was now a fully conscious, competent and original 'creator', and only two classes of artists were recognized: the geniuses and the non-geniuses, the second group being dismissed as 'talents'. Unable to create, they followed the path blazed by the geniuses.

For Galton, then, genius resides in persons who are the beneficiaries of exceptional inheritance, especially of brain cells. He refused to believe that early experience or the immediate environment played much of a role in the creative act.

Opposed to Galton and his associates was the other group of theorists, known collectively as Gestalt psychologists. They argued that creativity is a much more complicated process than merely associating ideas in new and different ways. They believed the whole of any idea always amounts to more than merely the sum of its parts, and referred to associationism as 'brick-and-mortar' psychology. Gestalt psychology started with the work of von Ehrenfels, also in the latter half of the nineteenth century. It was founded originally on the concept of 'innate ideas,' that is, thoughts that originate entirely in the conscious or unconscious mind, and do not depend on the senses for their existence.

Max Wertheimer, an early twentieth century Gestaltist, wrote this stinging indictment of his opponents:

In [the associationists] aim to get at the elements of thinking, they cut to pieces living thinking processes, deal with them blind to structure, assuming that the process is an aggregate, a sum of those elements. In dealing with [creative] processes, they can do nothing but dissect them, and thus show a dead picture stripped of all that is alive in them.

The Gestalt position held that creative thinking is the formation and alteration of 'Gestalts,' which is German for 'mental patterns or forms.' The elements of Gestalts have complex relationships, and are far more than merely 'associated' with

each other. Great paintings are made up of elements, all of which are interrelated such that the whole is greater than the sum of the parts.

Wertheimer stated, for example, that creative musicians do not write notes on paper in hopes of achieving new associations. Rather, they conceive of a half-formed idea of the finished piece of music and then work backward to complete the idea. They develop an overview of the entire structure and then rearrange its parts. Creative solutions are often obtained by seeing an existing Gestalt in a new way. This can happen when we change the position from which we view a scene or problem, or when the personal needs that affect perception change.

Imagine that coming back to work after lunch, a person notices the display window of a clothing store. Brightly colored apparel stands out in the foreground. The pastel curtains behind are not so prominent. This individual does not notice at all that the window dresser has left part of a sandwich on the floor. However, suppose he looks at that store window when he is on his way to lunch. The sandwich will leap into the foreground, and he will hardly notice the clothing.

Gestaltists argued that getting a new point of view on the whole of a problem, rather than rearranging its parts, is more likely to produce creativity. Why is a new point of view so hard to achieve? Many impediments exist. First of all, most people do not like problems, because problems are stressful. Distressed thinkers usually react to problems with rigidity.

As is often the case in scientific inquiry, the disagreements between the advocates of the associationist and Gestalt positions still produce wonderful new insights into the process even today. In many ways, the current field of cognitive psychology represents an amalgam of these two positions. Co-existing with the struggle to understand the workings of genius was the zealous effort to reveal the workings of the brain itself. This endeavor also contributed to a new, more scientific understanding of the creative act.

Nineteenth Century Biology of the Brain

It should be no surprise that our knowledge of the way the human brain works is quite recent in the history of medical research. Less than 200 years ago, no one was sure that the various areas of the brain had isolable functions. The first person to suggest this was a German anatomist, Franz Gall, who did so early in the nineteenth century. His research led him to believe that speech is located in the frontal lobes, those sections of each hemisphere located toward the front of the head.

This is the doctrine of *cerebral localization*. Unfortunately, most scientists dismissed his report because he included in it the argument that the shape of the skull reflects the person's personality traits, and so it would be possible to study those traits by examining bumps on the head. This idea became known as 'phrenology,' and has long since been discredited.

Although most doctors branded Gall a quack, he did have some followers. The French professor of medicine, Jean Bouillard, offered a large sum of money to anyone who could produce a patient with damage to the frontal lobes who had no loss of speech. The knowledge of the landscape of the brain

was so primitive in those times, however, that for some years the question remained unresolved.

In 1861, the stalemate ended dramatically. A young French surgeon, Paul Broca, learned of cerebral localization at the meeting of the Society of Anthropology and was reminded of a patient of his who had long suffered from speech impairment and some right side paralysis. Two days after the meeting, the man died. Broca quickly got permission to autopsy his brain, and found what he was looking for: a region of tissue damage (a lesion) on his left frontal lobe. Some months later a similar situation occurred to another patient with the same results. Broca brought this patient's brain with him to the next Society meeting, and created a furor. Many were impressed, but those who dismissed localization accused him of lying.

Interestingly, while everyone noted that in both cases the lesions were frontal, no one seemed to see the *left side* link. Only after eight more autopsies did Broca publicly announce this finding. The notion that the left side of the brain could more powerfully direct mental processes in some persons, and the right side in others, was put forth even later. It came about mostly because it was learned that equal amounts of lesion do not have equal amounts of disruption. By 1868, John Hughlings Jackson, the eminent British neurologist, was guessing that one side may 'lead' the other. Increasingly, there was evidence that the interactions between halves are complex, and different in different people. It was learned that areas involved in speaking are not the same as areas given to understanding the speech of others. The discovery of 'apraxia,' the inability to perform physical functions such as combing one's hair, led to many new hypotheses.

Eventually, it was accepted that most people are right-handed because their left brains are dominant. It was concluded that the right brain had few important functions, serving mainly as a backup to the more powerful left. In the nineteenth-century biological battles, we see the dim beginnings of the debates over how interactions of the two hemispheres across the corpus callosum contribute to creative thinking. The general position of those students of genius and of brain biology was that genetic inheritance rules creative ability. The first scholarly questioning of this position came at the turn of the century from the man some have called the first true psychologist, William James.

Nature and Nurture

William James was the first scientist to make a case for the interaction of the environment with genetic inheritance. As James put it, "The only difference between a muddle-head and a genius is that between extracting wrong characters and right ones. In other words, a muddle-headed person is a genius *spoiled in the making.*" Thus James argued that environment is a more powerful influence than genetic inheritance in determining ability. Whereas Galton claimed that the frequency of creative ability within certain well-known families was due to genetics, James believed that the conditions of one's upbringing, such as the philosophy of the parents, were more important than genes. In his time, he was virtually alone in putting forth this idea.

With Galton and Freud, James was a leader in thinking that the ability to get in touch with one's unconscious ideas is vital to giving birth to originality. This is how he described the process:

Most people probably fall several times a day onto a fit of something like this: the eyes are fixed on vacancy, the sounds of the world melt into confused unity, the attention is dispersed so that the whole body is felt, as it were, at once, and the foreground of consciousness is filled, if by anything, by a sort of solemn surrender to the empty passing of time. In the dim background of our mind we know meanwhile what we ought to be doing: getting up, dressing ourselves, answering the person who has spoken to us, trying to make the next step in our reasoning. But somehow we cannot start; the *pensee de derriex la tête* [literally, 'thoughts of the back of the head'] fails to pierce the shell of lethargy that wraps our state about. Every moment we expect the spell to break, for we know no reason why it should continue. But it does continue, pulse after pulse, and we float with it, until – also without reason that we can discover – an energy is given, something – we know not what – enables us to gather ourselves together, we wink our eyes, we shake our heads, the background-ideas become effective, and the wheels of life go round again.

James clearly recognized the importance to creativity of "thoughts of the back of the mind," but he did not pursue it. If he had, he might have added the third piece to the modern concept of creativity, the psychological element. The progenitor of this element would be Sigmund Freud.

Sigmund Freud and the Psychological View

The chief proponent of the view that creative ability is a personality trait that tends to become fixed by experiences that take place in the first 5 years of life was Sigmund Freud. In general, he and his early psychoanalytic mentees saw creativity as the result of overcoming some traumatic experience, usually one that had happened in childhood.

Often such an experience is buried in the unconscious. Although hidden from conscious awareness, this material could nevertheless have a powerful impact on a person's behavior. In his 1895 book with Josif Breuer, *Studies on Hysteria*, Freud discussed his discovery that the contents of the unconscious could be revealed by suggesting certain key words to patients (as well as by hypnosis). The contents of their unconscious would come forward through their seemingly random associations to those words. These contents are then dealt with by allowing conscious and unconscious ideas to mingle into an innovative resolution of the trauma. The creative act is seen as transforming an unhealthy psychic state into a healthy one.

Freud characterized the unconscious mind as having a weak concept of time and space, and as being largely involved with images rather than words. He saw the unconscious as being limited to a more primitive language that is likely to take place in dreams and in so-called 'Freudian slips.' He also was adamant that creativity almost always stems from original ideas, often first produced in symbolic form, in this nebulous world of the unconscious mind.

Freud's explanation of the creative process depended heavily on his ideas about defense mechanisms, which are unconscious attempts to prevent awareness of unpleasant or

unacceptable ideas. The literature describes almost 50 different kinds. Because defense mechanisms prevent an accurate perception of the world, and because they use up psychic energy, they usually interfere with creative productivity.

Freud firmly believed that people are most motivated to be creative when they cannot directly fulfill their sexual needs. Hence he believed that sublimation is the primary cause of creativity. The link between unconscious sexual needs and creativity begins in the early years of life. Although many people do not think of children as having sexual needs, Freud argued that at the age of four, it is typical for children to develop a physical desire for the parent of the opposite sex. Since this need is virtually never met, sublimation sets in, and the first vestiges of a fertile imagination are born. He traced many specific artistic works to the artist's sublimation. For example, he suggested that Leonardo da Vinci's many paintings of the Madonna resulted from a sublimated longing for sexual fulfillment with a mother figure, having lost his own mother early in his life. As he put it:

Should we not look for the first traces of imaginative activity as early as in childhood? The child's best-loved and most intense occupation is with his play or games. Might we not say that every child at play behaves like a creative writer, in that he creates a world of his own or, rather, rearranges the things of his world in a new way that pleases him?

Some of his followers disagreed with his emphasis on sublimation, ascribing other defense mechanisms as the source of creative thought. For example, Ernst Kris argued that only people who are able to "regress in the service of their egos" into a more childlike mental space are likely to be creatively productive. Thus for Kris, regression was the most productive defense mechanism.

In the writings of James and Freud, we see the beginnings of a biopsychosocial model of creativity. Despite an enormous surge in research on the topic since the middle of this century, however, the fruition of the concepts they pioneered has been seen only recently.

Summary

In conclusion, there have been three distinct stages in the history of the concept of creativity. From prehistory until well into the medieval period, it was generally considered to be a mysterious, supernatural process – a gift from the gods or from God, depending on the religion of the culture (e.g., Greek, Hindu, Egyptian or Incan versus Moslem, Jewish or Christian). As the Renaissance led to humanism, the concept of inherited genius took over. Gradually, psychological and contextual influences received more recognition.

New conceptualizations have proliferated in this century: the cognitive theories of Wallas, Terman, Kohler, Piaget, and Wertheimer, the personality theories of Freud, Jung, Adler, Rank, Rogers, MacKinnon, Barron, Roe, Helson, and Maslow, the research on the brain of Penfield and Sperry, to name only some of the most highly regarded early work. Where are we headed? The biopsychosocial model, which seeks to 'stand on the shoulders of giants' by combining the three essential elements into new explanations, is in the ascendancy. The other articles in this encyclopedia are filled with ideas about the recent past, the present and the future of thinking about creativity. It will be fascinating to see whether these efforts will prove as productive as those of the brilliant foreparents of creativity theory.

See also: Associative Theory; Componential Models of Creativity; Creativity Through History; Families and Creativity; Genius and Greatness; Historiometry; Paradigm Shifts; Social Psychology.

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Historiometry

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Glossary

Content analysis A method of measuring psychological variables by applying objective coding schemes to personal documents (letters, diaries, etc.) and creative products (poetry, musical compositions, etc.). Some content analytical methods have taken the form of computer programs that can directly extract measurements from the primary source material, most frequently written or transcribed text.

Idiographic research Investigations that concentrate on discerning the distinctive features of a specific individual or event. To be distinguished from nomothetic investigations (q.v.).

Multivariate statistics A collection of techniques that permits the simultaneous analysis of numerous variables having a great variety of possible interrelationships. Examples include factor analysis, multiple regression, path analysis, latent variable models, and covariance structure analysis.

Nomothetic research Investigations dedicated to the discovery of general laws, principles, or regularities that transcend the particulars of a given time, place, or person. To be distinguished from idiographic inquiries (q.v.).

Quasi-experimental designs A methodology that permits more powerful causal inferences than traditional correlational methods, but less powerful than conventional experiments. The most common quasi-experimental design in historiometric research is time-series analysis, which allows the inference that the variation in one variable precedes or follows variation in another variable.

Unobtrusive measures Data gathered in such a fashion that the subjects' behaviors, thoughts, and feelings cannot possibly be influenced by the measurements. All measures based on archival data are unobtrusive (or nonreactive). In contrast, laboratory experiments and psychometric assessment techniques lack this quality, and can at least potentially alter the activities of those subjects under investigation.

Background

Historiometric research examines the big names and important happenings that can be considered historic in the sense of 'making history.' For example, the subjects of historiometric studies may involve eminent artists, writers, or scientists (e.g., Leonardo da Vinci, Cervantes, or Einstein) or they may entail major acts of creativity such as musical masterworks or major scientific discoveries (e.g., Beethoven's Fifth Symphony and the heliocentric theory of Copernicus).

The database concerning these historic subjects is compiled from various archival sources, such as histories, biographical dictionaries, encyclopedias, anthologies, and collections. The data may also be derived from the content analysis of creative products, including the computer analysis of music and literature. Because historiometric research concentrates on individuals or products that are highly distinguished, the archival information on these cases is often extremely rich.

The goal of the study is nomothetic rather than idiographic. Nomothetic research involves the quest for general psychological laws or patterns, whereas idiographic research concentrates on those features that are unique to a particular individual or event. Thus, nomothetic research addresses such questions as whether creative development is enhanced when talented individuals are exposed to models of creativity. In contrast, idiographic research might address an issue such as the reason why van Gogh cut off his ear. Hence, in this sense historiometrics has goals comparable to other methods that psychologists use to study creativity, such as psychometrics.

In line with this focus, historiometric research favors multiple-case investigations. Only by obtaining a large sample of eminent personalities or important events can the researcher ensure that the findings are truly general rather than particular. It is rare for a historiometric inquiry to analyze fewer than a dozen cases, and sometimes the sample sizes may run into the thousands. Indeed, the largest number of cases ever examined in a single historiometric inquiry was 15 618 – a very large sample size indeed!

Also consistent with the search for nomothetic results, historiometric research invariably entails quantification. Variables are first quantified from the available archival materials, and then these variables are subjected to statistical analysis. Because the number of variables studied will often be very large, the investigator usually must apply sophisticated multivariate statistics to tease out the complex interrelationships among the variables. The most commonly used statistics are multiple regression and factor analysis, but occasionally one sees studies using path analysis, latent-variable models, time-series analysis, multidimensional scaling, and hierarchical linear models. Needless to say, given the typical sample sizes and the complexity of the statistical analyses, historiometric studies almost invariably must be executed on a computer.

Comparisons

It is important not to confuse historiometric research with several alternative approaches. To begin with, historiometry differs substantially from psychobiographical and psychohistorical studies

of creativity. The latter almost always employ qualitative rather than quantitative methods, and they tend to be idiographic rather than nomothetic in orientation. In addition, psychobiographical and psychohistorical inquiries are very often psychoanalytic in theoretical emphasis. These characteristics are evident in the classic psychobiography of Leonardo da Vinci that was published by Sigmund Freud. Historiometry, in contrast, is a method designed to test hypotheses that might be drawn from any theoretical framework, psychoanalytic or otherwise. An excellent example is Colin Martindale's book *The Clockwork Muse*, in which the author tests a formal model of stylistic change that has roots in psychoanalytic theories of creativity.

Another approach is sometimes confused with historiometry is the comparative. Comparative research takes a modest size sample of individuals or events and then tries to discern consistent patterns or regularities. Although the goal is often nomothetic, the method is qualitative. A good illustration is Howard Gardner's book *Creative Minds*, in which he carefully compares and contrasts the lives of seven eminent individuals. Comparative studies can lead to important insights about creativity and other phenomena but do not share historiometry's capacity for more precise model testing and prediction.

Lastly, historiometry must not be equated with cliometrics. Although the two terms have similar etymologies – both literally mean 'history measurement' – cliometrics has become associated with quantitative research in economic history. Here, the goal is to test a historical question by applying econometric methods and economic theory to archival data. A classic example is the cliometric research on whether slavery was a profitable business in the antebellum US South. Although important, this issue has no psychological content, nor does it concern creative geniuses.

History

Surprisingly, historiometry actually represents the earliest scientific approach to the study of creativity. In 1835 Adolphe Quetelet published a quantitative analysis of eminent English and French playwrights in which he established the relationship between age and creative output. The next important historiometric inquiry was the 1869 book *Hereditary Genius*, in which Francis Galton documented how eminent creativity (and leadership) tends to run in family lineages. Other pioneer historiometric investigations include Alphonse de Candolle's study of eminent scientists and Havelock's study of British geniuses.

However, none of these researchers explicitly identified their work as historiometric, for the term had not yet been invented. The word was not coined until the first decade of the twentieth century, when Frederick Woods, a geneticist, patterned the term after biometrics. Although Woods's own historiometric research focused more on famous leaders than creators, the term was adopted briefly by others. Most notably, Catharine Cox's 1929 study of the *Early Mental Traits of Three Hundred Geniuses* was explicitly labelled a historiometric inquiry. This monumental investigation, which constitutes the second volume of Lewis Terman's *Genetic Studies of Genius*, provided quantitative assessments of the intelligence and personality of famous creators and leaders.

Cox's work inspired other historiometric studies, but unfortunately both the method and the term virtually disappeared from the research literature on creativity. Beginning in the mid-1970s, Dean Keith Simonton began to revive the technique and the name. At present, historiometry seems to represent a relatively rare but nonetheless acceptable approach to the study of creativity. Indeed, from time to time it has attracted the efforts of eminent psychologists whose primary contributions have employed very different methods. Among these holiday historiometricians are James McKeen Cattell, Raymond B. Cattell, B. F. Skinner, Lewis Terman, and Edward L. Thorndike.

Research

One of the reasons that historiometric research may be here to stay is the tremendous amount of important empirical results it has generated. The great diversity of findings may be grouped into two inclusive categories: those concerning the creative individual and those concerning the creative product.

The Creative Individual

The largest proportion of historiometric studies of creativity examines those individuals who have achieved acclaim for their original contributions to some domain. These studies have tended to focus on the following three topics.

Individual differences

Even among eminent creators, the cross-sectional variation in creative success is quite substantial. To appreciate the contrast, we need only compare Newton with William Higgins, Descartes with Henri Duroy, Shakespeare with Chatterton, Michelangelo with Hendrick Bloemaert, Beethoven with Anton Reicha – all pairs of individuals who have rubbed elbows in the same historiometric samples. Much of the contrast in differential reputation can be ascribed to differences in creative output. Accordingly, many studies have examined individual differences in lifetime productivity, including the peculiar skewed (or elitist) distribution of that output. Other studies have examined the personality and intellectual factors responsible for the cross-sectional variation in output and eminence. For example, Cox showed how success required a combination of both high intelligence and unusual motivational persistence. She also demonstrated how the distinctive personality profiles of eminent creators vary according to the domain of creative activity.

Life-span development

Rather than concentrate on individual differences, many historiometricians have studied how creativity develops and manifests itself across the life span. These developmental inquiries fall naturally into two distinct categories. In the first category are those that look for the early antecedents of adulthood creativity. For instance, researchers have examined the impact of such variables as family pedigree, socioeconomic class, childhood precocity, birth order, orphanhood, role models and mentors, crystallizing experiences, and formal education or special training.

In the second category are those developmental studies that scrutinize how creativity varies across the course of the career. Most of these studies are concerned with how the rate of output changes with age. The expected age curves tend to vary systematically according to the specific type of creativity. For example, poets and mathematicians tend to produce masterworks at younger ages than do novelists and earth scientists. Other studies have examined the longitudinal relation between total quantity of output and the odds of producing a masterwork. Significantly, a creator's best work tends to appear in those periods of the career in which he or she is the most prolific overall.

Sociocultural context

Illustrious creators are not randomly distributed across history, nor are they evenly spread across the globe at any one time. On the contrary, creative genius is more prone to appear during 'golden ages,' less likely during 'silver ages,' and supremely unlikely during 'dark ages.' The Golden Age of Greece is a classic example. Such uneven distribution suggests that political, economic, social, and cultural forces may play a major role in the development and manifestation of creative talent. Historiometric investigations have specifically examined such factors as war, political system, ideology, and general intellectual ferment. These studies show that the 'spirit of the times,' or the *zeitgeist*, claims a crucial part in the origination of creative genius. The *zeitgeist* influences not only the number of eminent creators that appears in a given time and place, but also the particular domains in which creativity is most likely to be displayed.

The Creative Product

Because the eminence of a creator is very much contingent on the works he or she contributes to posterity, it is natural for historiometricians to investigate the characteristics of these artifacts of the act of creation. Some of this research has examined scientific discoveries and technological inventions. For example, several studies have been published on the multiples phenomenon where two or more scientists independently (and sometimes simultaneously) arrive at the same idea at about the same time. Classic illustrations include the proposal by Charles Darwin and Wallace of the theory of evolution by natural selection and the invention of the calculus by Newton and Leibnitz. Surprisingly, certain distinguishing features of these events – such as their timing and the number of participants – can actually be accurately predicted using mathematical models.

However, most inquiries into the creative product focus on the arts. Many of these studies are specifically devoted to the determination of the factors responsible for esthetic effectiveness of compositions in literature, music, or the visual arts. For instance, the application of computerized content analysis to classical music has enabled researchers to predict the relative performance frequencies of works in the repertoire. Similar historiometric techniques have had comparable success in the prediction of the differential popularity of literary creations, such as poetry. In addition, several historiometric studies have been concerned with qualitative changes in the nature of the works produced over the course of a career. Of special interest are inquiries into the swan songs of classical composers and the late-period style changes in visual artists. The research

shows that toward the very end of a creator's life the very nature of her or his creative output may undergo a dramatic transformation.

Evaluation

The reason why the behavioral scientists have so many different techniques at their disposal is because no technique is perfect. Each enjoys certain assets, and each suffers from certain liabilities. Historiometry is no exception. It, too, has both advantages and disadvantages. Let us look at the latter before turning to the former.

Disadvantages

Any researcher interested in applying historiometric methods to the study of creativity must often confront one or more of the following four problems.

Causal inference

Methodologists sometimes distinguish between internal and external validity of a technique. The former criterion concerns the security of the causal inferences the method permits. Laboratory experiments enjoy very high internal validity because the experimenter actively manipulates the independent variables and randomly assigns subjects to experimental and control groups. Historiometric research, in contrast, is inherently correlational in nature. The best the researcher can do is to determine how measured variables are associated. Because other unmeasured factors may contaminate the observed relationships, conclusions about causal influence are invariably insecure. Correlation can never be taken to prove causation. Thus, the internal validity of historiometric work is almost always inferior to that found in the experimental literature. For example, one of the oldest debates in the study of creativity is the relationship between genius and madness. What makes this issue especially irksome is the difficulty of determining which of three distinct possibilities is most likely to hold: (a) a proclivity toward psychopathology might make a positive contribution to creativity; (b) exceptional creative achievement might put exceptional strain on creative individuals, thereby making them more disposed to mental and emotional breakdowns; and (c) neither creativity nor psychopathology may have any direct causal relationship with each other but rather might be the consequence of some other factor or factors (e.g., traumatic or unconventional childhood experiences).

Data quality

Because the historiometrician must rely so much on the historical and biographical record, sometimes the available information leaves much to be desired from a scientific standpoint. For example, when Cox attempted to calculate IQ scores for historic personalities, she lamentfully discovered that she had to exclude William Shakespeare from her sample. There exists very little data about the Bard's personal life and virtually nothing about his early years. Even when enough pertinent information could be found in the historical record for a particular individual, Cox found that the reliability coefficients for her IQ assessments could vary substantially from genius to

genius. Moreover, when she wished to estimate 67 personality traits for her subjects, she was obliged to restrict her sample to the 100 famous people about whom the most data were available.

Substantive applicability

Closely related is the fact that some important issues in the scientific study of creativity probably cannot be addressed using historiometric methods. For instance, one of the central questions in the creativity literature is the very nature of the creative process. What is the role of intuition or unconscious processes? What is the function of logical analysis? Yet the biographies and published letters of eminent creators do not contain the necessary information in any systematic fashion, and when the records do, they cannot always be trusted as sources of solid data. For example, Samuel Coleridge's description of the creative process underlying the composition of 'Kubla Khan' is inconsistent with his own unpublished manuscripts that contain the various drafts of the poem. It is now apparent that he distorted his narrative to render the episode more consistent with romantic notions of the creative process.

Labor requirements

Perhaps the most prohibitive drawback of historiometric research is the sheer amount of work required to carry out a project. Collection of the raw data may require many trips to the library and special archives, followed by the arduous coding of qualitative information to get the data in quantitative form. Even after the content analytical, historical, and biographical data have been reduced to numbers, the statistical analyses may consume considerable amounts of time. Historiometric data sets often involve numerous variables with highly complex interrelationships that can only be teased out using the most advanced statistical techniques. As a consequence, it is not uncommon for a major historiometric study to require several *thousands* of hours of effort to produce a single journal article. That is a small payoff in comparison to, say, a laboratory experiment in the area of creative problem solving. Naturally, monograph-length investigations may demand even more time and effort. To offer one dramatic example, Frank Sulloway's book *Born to Rebel* represents the culmination of 26 years of intensive data collection and analysis.

Advantages

The forgoing liabilities notwithstanding, often one or more of these problems can be alleviated if not entirely removed in well-conceived historiometric research. First, multivariate statistics and quasi-experimental designs have immensely increased the power of drawing causal inferences from correlational data. One especially potent inferential tool is time-series analysis. Second, data quality problems can often be handled by the introduction of more sophisticated statistical methods, such as latent-variable models. These permit the explicit incorporation of measurement error into the causal model. Third, the substantive applicability of historiometry can often be greatly extended if the investigator exercises care in selecting the optimal research site. For instance, sometimes a researcher may examine famous creators from non-Western civilizations precisely because the biographical and historical information

is available regarding a particular set of variables. Fourth, if the investigator plans carefully and compiles a rich enough database, it is possible to generate more than one publication from a single data collection. For example, once a researcher decides on using a particular sample of Nobel laureates as the basis for the investigation, he or she can gather a great diversity of biographical, historical, and content analytical data that can be used to test a wide variety of hypotheses.

Besides these extenuating circumstances, researchers often have very strong reasons for adopting historiometric methods for a particular investigation. The following five assets may be the most important from the standpoint of creativity research.

Criterion validity

One of the main problems in studying creativity is how to measure the phenomenon. Some researchers may define creativity in terms of scores on a psychometric instrument, whereas others may rely on judges' evaluations of creative products. Although these conventional assessments have much to recommend them, they are also not without conspicuous limitations. For example, a measure cannot be called a 'creativity test' without first validating the instrument against some more secure criterion of creativity. Perhaps scores on such tests have absolutely nothing to do with real-life creativity. Historiometric research circumvents this problem by studying those individuals who have made a name for themselves precisely for their creative achievements. If the investigator examines persons like Planck, Sartre, Joyce, Picasso, or Stravinsky, we have no other option but to assume that these individuals exhibit creativity. If we were to deny that attribution, the term *creative* would lose all meaning. Hence, historiometric methods take their point of departure at those individuals who best exemplify the phenomenon under investigation.

Variable accessibility

There are many important influences on creativity that for both practical and ethical reasons can only be examined using historiometric methods. If the goal is to determine the sociocultural milieu that best contributes to the development of creative development, it is hard to imagine a better method than to scrutinize the historical record with respect to the coming and going of creative genius. For instance, if we want to test the hypothesis that wartime conditions inhibit the expression of creativity, we probably have no other choice than to conduct a time-series analysis comparing the output of creative products against the magnitude of political violence. Even if the focus is on creative careers, the assets of historiometrics are paramount. The researcher can examine the emergence and manifestation of creative genius from the moment of conception (e.g., family pedigrees) to the moment of death (e.g., swan songs) and everything in between (e.g., birth order, childhood trauma, role models and mentors, education and special training, and career trajectory). Historiometry is thus truly life-span developmental in scope.

Unobtrusive measurement

Ever since the advent of the Heisenberg uncertainty principle in quantum theory, physicists have learned that the very act of measuring a phenomenon may interfere with the phenomenon under scrutiny. A similar consequence often may be seen

in many standard methods in the behavioral sciences. For example, the very act of studying the creative process in the laboratory may distort the observed behavior to such a degree that it becomes unrepresentative of what would happen under more natural conditions. Similarly, the application of psychometric measurement, surveys, and one-to-one interviews to samples of contemporary creators may produce expectancy effects, 'guinea-pig' effects, and other kinds of artificial reactions. Historiometric measurement, in contrast, is totally unobtrusive. The subjects in historiometric inquiries do not know that they are under observation. Indeed, because the subjects are most often deceased, they will never find out the results. Accordingly, the phenomenon of creativity can be investigated without fear of inducing unnatural responses from the subjects of the study.

Cross-cultural and transhistorical invariance

Behavioral scientists seek general laws or principles of behavior that transcend place and time. If an empirical relationship only holds for a particular culture or is merely valid for a single historical period, it cannot have the claim to universality that is the hallmark of all nomothetic science. For example, Newton's law of gravitation holds not only for apples falling from trees in seventeenth-century England but also for all massive bodies in the universe throughout the history of time. One great asset of historiometric research is that it can sample creators from all civilizations of the world and from every major historical period. Hypotheses tested on such diverse samples have a much higher probability of claiming cross-cultural and transhistorical invariance. For instance, one historiometric investigation of literary creativity showed that poets produce their best works at younger ages than prose writers. Furthermore, this differential was shown to be invariant across historical time and geographical origins. Because the sample consisted of hundreds of literary figures drawn from all the world's major literatures from antiquity to the present day, we can have greater confidence that this result is not confined to, say, such nineteenth-century British authors as Keats, Shelley, and Byron.

Unit replicability

One of the peculiarities of historiometric research is that the subjects who compose its samples can all claim a permanent and distinct identity. After all, the individuals under scrutiny have made a lasting name for themselves on the basis of their creative contributions to human culture. As a consequence, it is not uncommon for historiometric studies to identify their subjects by name, listing them either in a table or in an appendix. For instance, Cox listed all 301 geniuses whom she studied along with some of the basic information compiled about each, including the estimated IQ scores. Other times the researcher will give sufficient details about the sampling procedures – such as the precise biographical dictionaries used – that any reader can easily determine who the famous personalities under investigation were. In any case, because the subjects are identified or identifiable, subsequent investigators can study exactly the same individuals, adding new variables and altering the statistical analyses performed. For example, the eminent persons in the Cox study have been re-examined in several follow-up inquiries published over an 80-year period.

This asset of unit replicability allows the historiometrician to improve on previous results in a manner that can accelerate the accumulation of scientific knowledge. Most alternative methods lack this feature. A laboratory experiment can always be replicated in terms of method, but not in terms of subjects. As a consequence, when experiments fail to replicate a previously published finding, it is uncertain whether the contrast may be ascribed to the change of participants in the study. In contrast, when a historiometrician scrutinizes the exact same subjects as analyzed in a previous study and fails to obtain identical results, the cause of the discrepancy can be more easily isolated.

Conclusion

Because historiometry has already been around in the behavioral sciences for more than 170 years, its use will likely continue in the future. The technique has already made considerable contributions to our understanding of creativity in its most historic manifestations. Moreover, the method enjoys many methodological advantages over other research strategies. Above all, it is the technique of choice for anyone who wants to test nomothetic hypotheses about history-making creativity. No alternative method features the same inferential rigor and quantitative precision. Moreover, despite various methodological disadvantages, many of these drawbacks are becoming ever less critical. Certainly statistics for analyzing correlational data are becoming increasingly sophisticated, permitting ever more powerful causal inferences. Even more important, the quality of the data about historic creators is becoming increasingly better with time. After all, creativity is not dead in the world, and each generation will usually produce a new crop of eminent creators that can serve as subjects in future historiometric research. Furthermore, there will probably be more and better information about these forthcoming creative individuals than holds for those born in earlier historical periods. Indeed, historiometric research has actually demonstrated that the reliability coefficients for many variables have increased over time. Finally, with the advent of the internet, the available information has not only become more detailed but also more accessible. The investigator can often download all or most of the data for a particular historiometric inquiry directly from an internet database.

In a sense, the situation for the historiometrician is very similar to that of the astronomer centuries earlier. The first astronomical measurements were rather too imprecise to support anything more than the crudest planetary theories. But as observations became more precise, the archival records collected by astronomers began to encourage the development of increasingly sophisticated theories. I predict that historiometry will enjoy the same historical trend with respect to its own phenomena. In fact, in some respects it has already done so. As mentioned in the section on the method's history, the first historiometric study ever published dates back to 1835. That investigation concerned the relationship between age and creative productivity. Since that pioneering inquiry, many investigators have scrutinized the same question using ever more precise measurement and statistical analysis. Now the cumulative body of evidence on this question has reached the

point that researchers have begun to propose mathematical models that provide rather precise predictions about how creative output changes across the life span. Hence, in this substantive domain at least, historiometrics can indeed provide the foundation for scientific progress in our comprehension of creativity. The same progress should be seen with respect to other topics that attract historiometric inquiry.

See also: Art and Aesthetics; Creative Products; Enhancement of Creativity; Families and Creativity; Mad Genius Controversy; Prodigies; Zeitgeist.

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Grace Murray Hopper 1906–1992

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General Introduction

Grace Brewster Murray Hopper, an early computer scientist, entered the world of computers as a result of the entry of the United States into the Second World War. An associate professor of mathematics at Vassar College when the Japanese bombed Pearl Harbor, she, like many others, wanted to contribute to the war effort, and her choice was to join the navy. Despite multiple obstacles, she became a WAVE at the end of 1943 and was commissioned a lieutenant (j.g.) in 1944. Her entry into the navy was also her entry into the world of computers; she was assigned to the team working on the Mack 1, the first electromechanical computer, at the Bureau of Ships' Computation Project at Harvard University. As quoted by Charlotte Billings, Hopper described responding to the Mack 1 as "the prettiest gadget" that she had ever seen (p. 49). Hopper remained involved with computing and with the navy for most of the rest of her life. Hopper's creative contributions to computing included the development of the first compiler and of the first nonmathematical programming language, developments which, like many creative contributions, came to be taken for granted but which were unthought of – not merely nonexistent – prior to Hopper's development of them.

Biography

Family

Hopper was born Grace Brewster Murray in New York City on 9 December 1906, the oldest child of Mary Campbell Van Horne Murray and Walter Fletcher Murray. Her parents subsequently had two other children, Mary Campbell Murray and Roger Franklin Murray II, three and five years younger than Grace, respectively.

In some respects, Hopper's family may seem typical of educated families of the era. Her father was an insurance broker, as his own father had been. Her maternal grandfather, John Garrett Van Horne, was a surveyor. One of her great-grandfathers, whom she had met as a very small child, had been a rear admiral in the navy – a fact which Hopper herself would mention during her navy career.

In other respects, however, they were an unusual family. Walter and Mary Murray believed that their daughters as well as their son should be well educated and should be able to support themselves as adults. They also believed that their son as well as their daughters should be able to perform such homely (stereotypically feminine) tasks as cooking and mending. Both parents served as role models for their children. Walter, despite the loss of both of his legs because of problems with circulation, lived a long and active life, serving as an example of perseverance in the face of potentially daunting difficulties, and treated his disability with wry humor (e.g., joking that he changed his socks only when they became dusty). Mary, like her elder daughter, loved mathematics, but

her opportunities for formal study were limited by her era; as Billings (p. 15) noted, "special arrangements" had to be made for Mary to study geometry in high school, and those arrangements precluded her actually sitting in the classroom. Mary also, because of her husband's health problems and her own consequent fear of widowhood, managed the family finances. In both of these ways, she demonstrated to her children that women could be mathematically capable.

All three children graduated from college, and two (Grace and Roger) also earned doctoral degrees. Additionally, all three had careers related to mathematics. Grace was a mathematician and computer scientist, her sister a statistician for an insurance company, and her brother a banker.

Grace remained close to her family as an adult. After she married a man whom she met in Wolfboro, where her family had a summer home, Grace and her husband went to Europe with her family rather than honeymooning alone. As a young couple, they lived near her parents and also bought a house in Wolfboro. Although Grace had no children, she was close to the children and grandchildren of her brother and sister.

Childhood and Early Adulthood

As might be expected given her parents' attitudes, Grace's childhood activities were not limited to those prescribed by the times for little girls. Although she played with dolls, she also played with construction sets; she was an avid reader; and she was an athlete (her athletic experience later played a role in her development of the first compiler).

In adulthood, Hopper was an inveterate story-teller, and she frequently told a story of an episode in her childhood which both indicates her early interest in things mechanical and foreshadows her later response to the Mack 1 as "the prettiest gadget" she had ever seen. She took apart an alarm clock when she was seven years old. Unable to put it back together, she continued taking apart other alarm clocks, trying to use them as models, until she had disassembled every alarm clock in the house.

Grace received her primary and secondary education at academically rigorous schools in New York City and New Jersey. As an undergraduate at Vassar, Grace majored in mathematics and physics and anticipated her later professorial activities by helping other students with mathematics and science. She was skilled at contriving demonstrations which helped make abstract concepts concrete. One example from her undergraduate days was an occasion when she asked one student to climb into a full bathtub to demonstrate for a group the concept of displacement of water. A later example for which she was famous was her distribution of "nanoseconds" at her lectures; the "nanoseconds," literally pieces of wire approximately one foot long, showed how far an electron could travel in one one-billionth of a second (a nanosecond).

Hopper graduated from Vassar with honors and with a grant to support her continued education. She received both

a Master's degree (1930) and the Ph.D. (1934) in mathematics from Yale University. She also married in 1930; her husband, Vincent Hopper, was another academic, an English scholar at New York University.

Hopper began her professorial career while she was a graduate student, appointed an instructor of mathematics at Vassar in 1931. She remained on the Vassar faculty after finishing her doctorate, advancing through the ranks to associate professor by the time she joined the navy in 1943. Her position at Vassar and her husband's at New York University resulted in their living mostly apart, although Vincent did travel to Poughkeepsie on weekends. The Hoppers separated in 1941 and were divorced in 1945.

Second World War and the Navy

Although Hopper wanted to join the navy in the aftermath of the attack on Pearl Harbor, she had multiple obstacles to overcome. In the first place, because professors of mathematics were considered to be essential to the war effort, arranging to leave her faculty position at Vassar was a difficulty. Additionally, Hopper was considered too old (at age 35) and too light (at 5' 6" tall, she weighed 105 pounds) to join the navy. Eventually, however, she was permitted to become a WAVE, attended the Northampton Midshipmen's School, finishing first in her class, and was commissioned a lieutenant (j.g.) in 1944.

Hopper's assignment to the Bureau of Ships' Computation Project at Harvard University was her introduction to computers, and she spent the rest of her career working with computers, sometimes with the navy and sometimes in private industry. Her contributions to the development of computer science will be described in a separate section below.

By the end of the Second World War, Hopper had become a lieutenant. She wished to remain on active duty in the regular navy, but this choice was not open to her. Her age was again the problem. Although she did have the option of returning to her faculty position at Vassar (with a promotion to professor), she chose instead to remain at Harvard to continue working with computers.

The end of the war did not mark the end of Hopper's navy career, however. She remained in the naval reserve, and, as a reserve officer, rose to the rank of commander by 1966. In 1966, however, the navy decided yet again that she was too old to serve. As she told the story to Billings (p. 87), she received a letter from the Chief of Naval Personnel informing her that she had "been on reserve duty for twenty-three years, which was more than twenty. 'I knew that,' Grace said. Another paragraph stated she was sixty years old. 'I knew that too,' she said." Against her own inclination, then, she submitted the requested application for retirement.

As had happened twice before, however, the navy's decision in this case was not final. Hopper shortly was recalled to active duty, not simply reserve duty. The specified term of six months was extended and, by its conclusion, had lasted approximately 20 years. During these years, she headed the Programming Languages Section of the Naval Information Systems Division. Also over these years, she rose in rank to commodore.

In 1986, more than 40 years after the navy first had rejected her because of her age (among other reasons), Hopper was

again requested to retire because of her age, this time for the last time. At her retirement, she held the rank of rear admiral; she was not only the oldest serving officer but also the only former WAVE on active duty. Hopper returned to the private sector on her retirement from the navy. The value that she herself placed on her navy service is revealed not only by the length of her service but by her habitually closing her lectures with a comment on "the privilege and responsibility of serving very proudly in the United States Navy," as she put it in a keynote address published in 1981.

Hopper in the Private Sector

When Hopper was discharged from the navy at the close of the Second World War, she remained at Harvard so that she could continue working with computers. Over the next few years, she, along with the other members of the team, worked on the Mack 2 and the Mack 3, the successors of the "gadget" she had found so appealing in 1944. Because remaining at Harvard was not a viable option for the long term, though, Hopper moved into the private sector, going to work for the Eckert-Mauchly Computer Corporation; she remained with this company, through mergers and takeovers and the accompanying name changes, until her 1971 retirement from what had become the Sperry Corporation. By 1971, of course, she had for several years been back on active duty as a naval officer.

After her second lengthy term of active-duty service, lasting from the mid-1960s through the mid-1980s, Hopper, the navy's opinion notwithstanding, did not consider herself ready to retire. Thus, she returned to the private sector as a senior consultant at Digital Equipment Corporation. In that capacity, she continued to travel and to lecture for the next several years, until 1990. She thus was active nearly until her death on 1 January 1992. Befitting her years of service and her dedication to the navy, she is buried in Arlington National Cemetery.

Hopper, Computers, and Computer Science

When Hopper joined the navy and was assigned to the Bureau of Ships' Computation Project, computers were in their infancy. The Harvard team which she joined was working on the Mack 1, the first electromechanical computer, and she was only the third person (and the first woman) to program this computer. This early computer stands in remarkable contrast to computers of the twenty-first century; a huge machine, it was also hugely slower and less powerful than even an inexpensive modern desk-top computer. Processing speed of readily available twenty-first century personal computers is measured in megahertz or gigahertz; the Mack 1 performed three operations per second. By the standards of the era, however, and in contrast to human computers, the Mack 1 was impressively rapid.

Human-computer interactions in the mid-twentieth century in many respects were even more different from those of the twenty-first century than were the machines themselves. Computer users of the twenty-first century are accustomed to user-friendly operating systems and point-and-click environments. The programmers of the Mack 1, in contrast, wrote the instructions to the computer in machine language. Sets of instructions

to perform specific tasks (programs, in the modern parlance) as well as the data to be processed were punched on paper tape, not stored in the computer. The paper tapes, however, could be kept and could be reused when needed. By making such a collection, Hopper and her colleagues began building a library of programs.

Probably more importantly in terms of the development of computer programming, Hopper and her colleagues collected standard sets of instructions for sets of operations which were common to multiple programs. In the abstract, these standard instruction sets were equivalent to what modern programmers think of as subroutines. In their instantiation, however, they were primitive compared to their modern descendants. Rather than being built into the software or the hardware, these “subroutines” were written on paper and collected in notebooks. In order to use one, a programmer had to copy it by hand into the program being constructed. Although this procedure reduced the mental labor of programming substantially, there still was ample room for human error; in fact, there were now two separate occasions for transcription errors, first in the process of copying subroutines into programs as they were written, and second, as always had been the case, in keypunching the programs once written.

It occurred to Hopper that the problem of transcription errors (along with other problems) could be addressed by using the computer itself to make copies of stored subroutines. This insight eventually led to her development of the first compiler in the early 1950s, while she was working at Eckert-Mauchly. Her idea – and her implementation of it – flew in the face of the conventional wisdom that “computers could only do arithmetic,” as she expressed it in the 1981 keynote address (pp. 13–14). As she described it in the now classic paper, “The Education of a Computer,” by writing this first compiler, called the A-0, she made the computer into its own programmer.

Her refusal to accept conventional wisdom and her rejection of the way things were as the only way they could be were persistent characteristics of hers, and she encouraged others to take unconventional tacks as well, often saying “It is easier to ask forgiveness than it is to get permission” (or some variant of this line). Her office clock, which was numbered and which ran counterclockwise, was a concrete example of her acceptance and her encouragement of novel ideas.

Another characteristic of this first compiler remained impressive – and startling – to her colleagues even after they had accepted that compilers were possible, and that was that the A-0 was a single-pass compiler. As Hopper described the problem in a 1980 oral-history interview,

obviously you couldn't do that, because you'd run into a place where in the flowchart, for instance, you could have two kinds of tests. One would jump back to somewhere you'd been and you knew where you put that program piece, but you would have another test that jumped forward and you haven't processed that yet, so you didn't know where it was going to go (p. 7).

Hopper solved the problem of not knowing where to jump forward to by analogy to a very different domain, using a memory of her experience playing girls' basketball in high school. She built into the compiler a “neutral area,” and, when the compiler needed to jump forward to a place not yet

specified, it would jump instead to the neutral area and put a flag in this neutral area; this flag then would trigger a jump to the appropriate operation once the compiler had progressed that far.

A-0 was a major advance in computer programming, both conceptually and practically. It still was written in machine language, though. In the 1950s, with computers increasingly in commercial use and in use for functions beyond computation, the requirement that computer instructions be written in machine language was hampering the development of needed programs. Hopper was one of the first to consider using forms which looked like natural language (strings like *count* and *divide*) for writing computer programs. For all that programming and programming languages are foreign to most twenty-first century computer users, Hopper's and others' development of high-level programming languages might be considered first steps in the direction of user-friendly computers. Hopper herself, in a 1969 oral-history interview, attributed both the development of the initial compiler and the development of high-level programming languages to the realization that “we had to make it easier for people to use computers” (no page number).

Like the original idea of a compiler, this idea flew in the face of established wisdom. Everyone knew that “computers couldn't understand English words,” as Hopper later put it in the 1981 keynote address (p. 16). Hopper, of course, also knew that computers could not understand English. What was required, however, in her view, simply was another version of a compiler, in this case one which would translate instructions using words (which made sense to people) into machine language (which the computer could process). This new compiler, B-0, was introduced in 1955. With this development, working computer programs could be written using such statements as “INPUT INVENTORY FILE A; PRICE FILE B” and “OUTPUT PRICED INVENTORY FILE C.”

Hopper and her team wrote other versions of the compiler which used French or German words rather than English. This, however, seemed from her later description to have been considered carrying innovation too far for the corporate management. As she said in the 1981 address (p. 17),

it was absolutely obvious [to management] that a respectable American computer, built in Philadelphia, Pennsylvania, could not possibly understand French or German! And it took us four months to say no, no, no, no! We wouldn't think of programming it in anything but English.

Although Hopper's FLOW-MATIC (a name assigned by the marketing department) is no longer in use, it was and is important for several reasons. It was one of the first high-level programming languages to be widely used, and it was the first which was specialized for nonmathematical uses. More importantly, FLOW-MATIC was not only the precursor of but the model for COBOL (Common Business Oriented Language), one of the most important programming languages of the twentieth century and still important in the twenty-first century.

The development of COBOL has often been attributed to Hopper. Although this attribution is false, Hopper's influence on COBOL, both at its outset and later, was substantial. For example, she belonged to the group which initiated the

development of COBOL and provided technical advice to the group which actually constructed the language. Jean Sammet, who was a member of the latter group, wrote in 2000 that

without the existing practical use of Flow-Matic, I doubt that we would have had the courage to develop a language such as Cobol (p. 31).

Over the years after its release, as COBOL was used for various purposes in various sites, programmers at different sites modified the language to fit it to their local needs. The small-scale utility of the resulting different versions of COBOL created problems on a larger scale: Programs written at one site in one version of COBOL might not run – or might not run correctly – at other sites where COBOL had been modified differently. In other words, COBOL ceased to be effectively a common language, becoming instead a family of related languages.

It was to rectify this situation that Hopper was recalled to active duty in the navy in 1967 (only months after she had reluctantly retired from the naval reserve). Making yet another major creative contribution to the development of high-level programming languages, Hopper and the team she directed developed procedures for testing the various versions of COBOL to ensure consistency of performance across the variants. These procedures might be considered to stand in the same relation to COBOL as does the Academie Francaise to the French language.

Awards and Other Marks of Recognition

Hopper's contributions to the navy and to computing were recognized by the navy, by the computer science community, and by the broader community in many ways over the years, beginning early in her career. She was awarded the Naval Ordnance Development Award (1946), the Computer Science Man of the Year award (1969, the first year it was awarded), and the National Medal of Technology (1991). She was named a Distinguished Fellow of the British Computer Society in 1973, the first woman and the first American to be so honored. Her namesakes include the Grace Murray Hopper Award (established 1971; awarded annually at the meeting of the Association of Computing Machinery), the computer center at Brewster Academy (a private school in the community where both she and her parents had summer homes), the Grace Murray Hopper Service Center (a naval data processing center in California), the USS *Hopper* (a highly-computerized destroyer), and the Grace Hopper Celebration of Women in Computing (first held in 1994).

Grace Hopper and Creativity

Grace Hopper grew up in a family with some unconventional attributes, which may have contributed to her own acceptance of alternatives to the usual ways of being and doing. In particular, her mother offered a model of a mathematically competent woman, defying a stereotype much stronger early in the twentieth century but still strong in the early twenty-first century.

Hopper's story of her dismantling of every alarm clock in the house is emblematic of multiple characteristics which are likely contributors to her creative accomplishments as an adult. In the first place, she was curious, and she acted on that curiosity, setting out to discover for herself how an alarm clock went together. Second, she was persistent: She did not stop trying to solve the problem until she ran out of alarm clocks. The story itself is representative of another aspect of her creativity, her consistent use of her own history, personal and professional – her story-telling – to make and to illustrate her points.

Two other characteristics likely to have contributed to her creative accomplishments are distinct but closely related: She had a capacity for moving between the abstract and the concrete, and she had a knack for analogical/metaphorical thinking. Her practical demonstration of the displacement of water to her fellow students at Vassar and her use of lengths of wire to make the concept of a nanosecond comprehensible to those to whom she lectured both are examples of her skill at making the abstract concrete (her story-telling perhaps also falls under this aspect of her creativity). The nanosecond example also demonstrates her use of an analogy between spatial extent and temporal duration, an analogy implicit in much ordinary language usage but made explicit by Hopper's wire "nanoseconds." Her use of an aspect of the rules of girls' basketball as played in her youth to suggest a solution to the problem of forward jumps when compiling a program goes from the concrete to the abstract and also draws on a novel analogy.

Hopper's refusal to be bound by the way things traditionally were done or even by what "everyone knew" also contributed to her creative accomplishments. Both in writing the first compiler and in constructing an early high-level programming language using English words, Hopper made a computer do what "everyone knew" a computer could not do. Last, but not least, in both these cases, Hopper identified a state of affairs of which others also must have been aware as a problem to be solved. Her identification of the problems may be more truly a hallmark of her creativity even than her solution of them. Hopper herself, discussing her achievements in an oral-history interview in 1969, said about A-0 and B-0 that

the realization of what was needed and what could be done was more important than the actual doing of it (no page number).

In some cases, particularly on large-scale projects, creativity may emerge from collaborative rather than from identifiably individual activity. That Hopper and her Mack 1 colleagues realized that programs and subroutines could be collected and reused and that they made and used these collections may be instances of collaborative creativity, as may the later development of validating procedures for COBOL developed by Hopper and her team in the 1960s.

Hopper's frequently offered advice to dare and to do (*Aude et Effice*, in the original and in the form used for the emblem of the USS *Hopper*) was advice which her career exemplifies; Hopper practiced what she preached. She was intellectually daring and highly effective in contributing to the development of her chosen world of computers and computing.

See also: Analogies; Families and Creativity.

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Humor and Creativity

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Glossary

Bisociation Arthur Koestler's name for thinking which connects two or more planes. Perceiving a situation, event or idea in two self-consistent but normally unrelated and even incompatible frames of reference. An idea is linked to two associative contexts.

Divergent thinking Producing a large number or wide variety of responses.

Extraversion An enduring personality trait measuring the extent to which a person is socially outgoing or interested in things outside the self.

Fluency The total number of ideas produced.

Gelotophobia Fear of being laughed at.

Humor appreciation Understanding jokes, amusing situations, witticisms, etc., and finding them funny.

Humor production Creating jokes, stories, amusing situations, witticisms, etc., that other people find funny and/or laugh at.

Incongruity Pairing of ideas or situations that are not usually paired.

Psychoticism on H. J. Eysenck's Personality Inventory, a trait which involves being insensitive to others, impulsive, aggressive, etc.

Remote Associates Test (RAT) Sarnoff Mednick's measure of creativity in which respondents are presented with three words and are instructed to find a fourth word which somehow links the first three words together. For example, mouse, sharp, blue, —.

Resolution In creativity the idea that to be creative, an idea, act, or product needs to be appropriate, valuable, to solve a problem, or to fit the requirements of the situation. In humor, resolution of an incongruity means 'solving the problem,' or figuring out how two different ideas are related.

Sense of humor A personality or individual difference variable, in which people are characterized by willingness to smile or laugh, a cheerful disposition, using humor to cope with stressful situations, etc. Many different measures of sense of humor exist.

State-Trait Cheerfulness Inventory (STCI) A personality measure of the sense of humor, developed by Willibald Ruch and his research team, which includes subscales of cheerfulness, seriousness, and bad mood.

Introduction

An important milestone in the recognition of relationships between humor and creativity was provided by Arthur Koestler in 1964. He considered humor, artistic production, and scientific discovery to be forms of creativity because all of them involved a sudden change in the angle of vision on reality. Koestler thought that these three domains of creativity shaded into each other without sharp boundaries.

Over the past 50 years, there has been considerable research on the humor–creativity link. However, there is still little consensus about terminology, nor are measurements of either the humor or the creativity construct widely agreed-upon as definitive. Because terminology is so important to understanding the links between creativity and humor, it is helpful to narrow down the broad concept of 'humor.' We will discuss humor in three ways: understanding humor (humor appreciation), creating humor (humor production), and humor as a personality trait (sense of humor). To some extent, the difference between appreciating humor and producing humor is partly artificial. A person cannot *intentionally* produce humor unless he or she is capable of appreciating humor. However, the opposite is not necessarily true; there are people who claim that they do not or

cannot produce humor, even though they are quite capable of appreciating the humor of others.

The bulk of the literature in the creativity field that deals with humor is focused on humor appreciation, although humor production has received more attention recently. Considerable research has also examined sense of humor as a personality/individual difference variable. A few studies of humor and creativity have used behavioral measures of humor such as smiling or laughing. We will consider all of these types of humor measures. However, we will neither attempt to address 'humor' in the broadest sense, nor to provide a theoretical description of why people laugh and smile. Rather, we will concentrate upon humorous behaviors, personality variables, and cognitions that have been studied in relationship to creativity.

Similarity of Definition

Parallels in the definitions of humor and creativity are readily evident. Both experts and laypersons agree that one of the delineating characteristics of creativity is originality or novelty. Similarly, originality (or its close cousin surprisingness) is also

frequently suggested to be characteristic of humor. Funniness is often found to be related to surprise.

However, simple originality is not enough for the definition of creativity, and surprise is typically not enough for humor once a person is past the 'peek-a-boo' stage. At least one more dimension is needed. In the creativity field, that second dimension has been given many names (appropriate, useful, etc.). The name for this dimension which best links humor and creativity is *resolution* – the notion that to be creative, an idea, act, or product needs to be appropriate, relevant, or to fit the requirements of the situation.

Similarly, in humor appreciation and production, the simply bizarre will not often be seen as funny, but rather as weird or strange. Instead there must be a balance governed by a departure from one idea with the introduction of another idea, different but somehow related and appropriate: a relevant incongruity. Research on linguistic approaches to humor has shown that incongruity-resolution (figuring out how two different ideas are related) can make a significant contribution to funniness. Rod Martin illustrated the concept of incongruity resolution with this joke:

"Is the doctor at home?" the patient asked in his bronchial whisper.
"No," the doctor's young and pretty wife whispered in reply. "Come right in." (2007: 90)

The listener must resolve the incongruity of the initial expectation that the patient is seeking the doctor's care for his hoarseness, and the additional inference that perhaps it's not the doctor's company that the patient is seeking.

Thus, surprise is just part of the story. Some research has shown that relatively predictable punchlines are funnier. And incongruity recognition (rather than resolution) may be a better description of the process. Resolution sometimes increases funniness, but it depends on circumstances and personality.

Similarity of Cognitive Processes

An important way in which humor and creativity are similar lies in the cognitive processes involved. The classic incongruity theories of humor say that humor arises from the pairing of ideas or situations that are not usually paired. As discussed earlier, information-processing models of humor focus on the resolution of incongruities.

In linking humor and creativity, Koestler coined the term 'bisociation' to describe the mixing of ideas involved when a person abruptly perceives as similar two habitually-incompatible contexts. Understanding a joke requires the given data to be transformed or reinterpreted. A simple example is a pun, where two different meanings of a word or phrase are brought together simultaneously (e.g., a fake book entitled *Proper Use of Sunscreen* by Justin Casey Burns). Other names have been used for the same concept that Koestler named bisociation. For example, in the creativity field, Sarnoff Mednick called it 'remote association,' and D. N. Perkins called it 'contrary recognition.'

Humor comprehension and creativity should be similar because both require the ability to link disparities. Humor often depends upon unusual associations, so a person's ability

to generate and understand humor would seem to depend, at least partly, upon ideational fluency (the ability to produce many ideas to fulfill certain requirements, such as thinking of possible uses for a brick, or for a paperclip). Ideational fluency has been said by many authors to be an important component of creativity.

J. P. Guilford used a similar concept in his multidimensional theory of the structure of intellect. He proposed that there are five different types of mental operations, among them convergent and divergent thinking. In his theory, divergent thinking was defined as producing a variety of responses, in which the product is not completely determined by the information given to the respondent. Guilford considered that semantic transformations (puns) are evidence of divergent thinking, as well as one important source of wit and humor. He said that such transformations do not necessarily produce humor, but they often produce delight as well as surprise – an 'aha' moment or a 'eureka experience.'

Over time, divergent thinking has come to be considered almost synonymous with creativity. Tests have been devised to measure divergent thinking, the most widely-used of which are the Torrance Tests of Creative Thinking. Such tests are often considered to be measures of creativity, and adults and children who score high on them are considered to be 'creative.' As we will discuss later, several of these creativity tests assign points for humor, as Guilford did.

Convergent thinking has received somewhat less attention in the creativity literature. Mednick's Remote Associates Test (RAT), although sometimes considered to be a measure of divergent thinking, is scored with correct answers. In addition, the RAT correlates positively with standard tests of intelligence, which also measure convergent thinking. Thus, the RAT seems to be a better measure of convergent thinking than divergent thinking.

Logically, it is possible that humor production is more strongly related to divergent thinking, whereas humor appreciation might be more strongly related to convergent thinking. Some evidence that humor production is related to divergent thinking was provided by research of Peter Derks. Participants made up funny captions for still photographs from old movies, and their responses were judged by peers. Results showed that the best captions for people instructed to give quantity and not be critical were rated funnier than for those aiming for quality. There was also an indication of improved quality of the captions as the participants continued to make them up. Providing even more evidence for divergent thinking, the participants showed no evidence of running out of ideas for more than 10 minutes, regardless of whether caption production was guided by a goal of quantity or quality. Originality was also high, because <1% of the captions were duplicates.

Emotional Similarities

In both the creativity and humor fields, emotional themes of delight, surprise, and enjoyment are found. As noted earlier, Guilford discussed the delight and surprise that often accompanied divergent thinking in the form of semantic transformations. Frank Wicker stated that enjoyment of humor is in part an aesthetic enjoyment of a creative product. Several classic theories, including Freud's, emphasized the relaxing and

emotion-relieving characteristics of humor. Unfortunately, these theories are typically not consistent in whether they refer to the humor producer, the humor appreciator, or both. But in any case, relaxation, emotional release or 'liberation' from the bounds of rational thinking are consistent themes in classic humor theories. Thus, the joy of discovery seems to be a fairly common emotional theme in both humor and creativity. The discovery can be tiny or grand, but is typically accompanied by some delight, surprise, and enjoyment.

A second important area related to emotional similarities between the fields of humor and creativity lies in the research examining the effects of mood. Generally, results reliably show that individuals in positive mood states are more creative on a range of tasks. Some research shows that engaging in creative tasks can lead to a good mood. It is possible that positive mood could result in a self-instruction to be less critical; if that were true, one would expect greater ideational fluency as a result of lower self-censorship of ideas.

In 2006, Allan Filipowicz reviewed a considerable amount of the literature about the effects of positive mood (also called positive affect) upon creativity; his conclusion was that positive mood generally leads to higher creativity, but occasionally to lower creativity. In this body of research, positive mood has been manipulated in several different ways: by winning a small prize, being given a cookie or candy, being asked to imagine pleasant experiences, etc. But a complication in quite a few studies of the effects of positive mood upon creativity is that mood is induced by having participants watch humorous videos, or exposing them to other forms of humor in order to improve their moods. This is troublesome methodologically when we try to examine emotional similarities between humor and creativity, because the difference, if any, between humor and good mood is unclear.

The above research on the effects of mood has often focused on mood as a transitory experience, or a psychological *state*. Another related topic is the concept of positive affect as a psychological *trait*, or a long-lasting attribute of one's personality. For example, in 2008, Tammy Pannels and Amy Claxton Kozbelt and Nishioka concentrated on happiness as a positive personality characteristic; their findings were consistent with several theories suggesting that happiness should have a direct positive effect upon creative cognitive processes. Specifically, these authors found a moderate positive correlation (0.34) between happiness scores and creative ideation scores. Trait happiness might be considered to be related to the trait of cheerfulness, which has been studied quite extensively by Willibald Ruch and his colleagues in their development of the State-Trait-Cheerfulness Inventory (STCI), one of many measures of sense of humor. Interestingly, in one study using the STCI discussed by Ruch, the 'seriousness' scale was a better predictor of humor production (e.g., creating captions for cartoons) than the cheerfulness scale, although seriousness was associated with lower humor production.

Sense of Humor and Creative Personality

The topic of personality characteristics leads us to another dimension in which humor and creativity are seen to demonstrate similarities. The creative person, including characteristics of the creative personality, has been more widely studied in

the entire field than any of the other 'Four Ps' of creativity (the others are process, product, and 'press' or environment). Some examples of the many traits said to be typical of the creative person are originality, openness to experience, tolerance for ambiguity, self-confidence, unconventionality, and independence. Not surprisingly, many of the same characteristics are often linked to a person with a good sense of humor. Some researchers have found that extraversion, or the extent to which a person is socially outgoing, is correlated with self-reported sense of humor; however, the research evidence is somewhat mixed. The personality trait of psychoticism (being impulsive, aggressive, and insensitive to others) has been more consistently linked to sense of humor.

Despite a great deal of progress in the assessment of sense of humor, Ruch stated that there is still no standard measurement of sense of humor or theoretical framework upon which investigators generally agree. A complicating issue is that humor has been included in several measures which attempted to assess creative personality or creative potential, thus assuming that humor is a simply part of the creative personality and not conceptually distinct. For example, the Creative Personality Scale for the Adjective Check List includes 'humorous' (along with 'original' and 'clever') among its 18 items positively related to creativity.

Nonetheless, the definition of humor has been clarified by personality research. In 2008, Ruch demonstrated that nonsense and incongruity resolution appeal to different types of people, with nonsense more entertaining to the liberal, flexible, more creative individuals.

Social Factors

Israeli researcher Avner Ziv examined the possible relationship between humor and creativity in numerous studies. In discussing intentional humor (humor created by a person in order to be enjoyed by other people), he emphasized that humor is a form of communication. The communicator is the humorist (humor creator), the message is the joke or story (the creative product), and the listener is the humor appreciator. 'Humor production' is what we recommend calling humor creation in order to facilitate clarity of terminology.

Humor most often occurs naturally in social situations. When we analyze the cognitive and social processes that occur in a situation in which humor is produced, we see that the jester must typically utilize information quickly for the product (joke or witticism) to be successful. A scientist or an artist who is creating is usually not under such immediate time constraints. For a humor producer, not only must the incongruity be recognized, but the immediate interests and the intellect of the audience must be considered in formulating the communication. A successful new joke requires making a product, and communicating that product in such a way as to allow someone else to appreciate its 'artistry.' Stand-up comics plan their routines and modify them based on the feedback that they receive from audiences over time.

Many theorists and researchers in the field of humor have noted the importance of considering the audience in understanding the phenomenon of humor production. Research has been facilitated because the success of a humorous production can be readily and immediately identified by audience

laughter. For example, a classic study measured humor production by crediting a subject with a successful witticism when at least two other group members laughed; results indicated that persons who were spontaneously humorous were also spontaneously creative. In 2007, Martin investigated a further role of social interaction; he measured aggression and affiliation as humor styles and found that they differentiated individuals' preferences. Clearly the jester must keep the audience in mind, while the artist and scientist may be less immediately concerned.

During 2008, Ruch and his colleagues studied the sense of humor in depth, and developed several measures of different aspects of the sense of humor, including wittiness, originality of punch lines created, etc. Ruch pointed out that one can be witty without necessarily producing new humor; telling jokes and funny stories may require abilities such as a humor repertoire, social needs, and performance skills. Trait cheerfulness, as one measure of sense of humor, emphasizes its entertainment (or social) aspects.

In creativity, social factors may affect the scientist or the artist. In particular, scientific and artistic products must be recognized by others (such as journal editors or theatergoers) to be considered successful. Their work is judged within a societal milieu, which changes over time. An important social dimension in creativity, as well as humor, is the implicit or explicit evaluation of the creative idea or product. Not surprisingly, in 2009 Proyer and Ruch found that fear of being laughed at (called gelotophobia) accompanied reduced self-ratings of creativity and curiosity, and reduced peer ratings of curiosity. In a broader sense, social factors are part of the 'press,' or environment in which creativity takes place.

Another social factor to be considered is whether humor facilitates group problem solving. If a humorous atmosphere aids individual originality by increasing freedom and breaking boundaries, then it should also be helpful to groups. One study by Firestien and McCowan in 1988 found that groups trained in creative problem solving did indeed produce more ideas while showing more signs of humor, but inferring causality is a problem in that study because the groups were self-selected. Another study by Pollio and Bainum in 1983 composed groups by choosing individuals who had been more or less witty in earlier problem solving tasks, but the effect of having witty participants was not consistently positive. For groups, then, the value of humor is not as clear as for the individual. A sensible speculation is that humor, while it may 'break the ice' and relax the atmosphere in a group, can also consume time, distract group members from the task, etc. The relative impact of humor's potential positive and negative effects in groups is not well-investigated.

Relationship to Play

Playful behaviors have been linked to both creativity and humor. Play, although not synonymous with humor by any means, is related to humor through its association with light-hearted behavior, laughter, etc. In 2007, Martin noted that social play is an important way in which humor can be enjoyed entirely for its own sake. Indeed, he stated that the very definition of humor is based upon the distinction between playful and serious.

In the creativity literature, it is also common to find the theme of playfulness mentioned as being characteristic of

creativity or creative people. Both researchers and theorists have noted that play and creativity have similarities. In particular, play often involves symbolic transformations in which objects and actions are used in new or unusual ways, akin to the novel, imaginative combinations of ideas involved in creative thinking.

Survey of Research

Humor as a Form of Creativity

In surveying the humor-creativity literature, it is clear that several authors have assumed that humor is simply a type of creativity without examining the basis for that assumption. In fact, some studies of creativity have used the production of captions for a cartoon, drawing, or picture as the only measure of creativity. Valuable information can, however, be obtained from this approach. As mentioned earlier, Derks asked college students to make up funny captions for still photographs from old movies, and these responses were judged by peers. In a subsequent study in 1988 over half the captions were evaluated as 'relevant incongruities,' that is, attempts at humor. More recently Kozbelt and Nishioka used similar results to argue that humor production is divergent. They also found that humor appreciation depended on insight aided by hints and was, therefore, convergent.

The production of story titles or cartoon captions has a long history in the measurement of creativity. Guilford discussed 'cleverness tests' to measure originality, which he considered to be part of the concept of divergent thinking. The most commonly used was plot titles, in which participants made up titles for a short (one-paragraph) story, and the responses were judged for cleverness. Cartoons from magazines were also used, and participants were instructed to write punch lines for each one. The riddles task called for two solutions to each riddle, one of which was supposed to be clever; people quite commonly produced puns when instructed to be clever.

Besides Guilford, other classical theorists in the field of creativity have mentioned humor as being a characteristic of creativity or creative persons. For example, E. Paul Torrance noted that the work of creative children is characterized by humor and playfulness. His scoring instructions for the Torrance Tests of Creative Thinking include assigning a point to humor in assessing the Originality and Interest scores. Other tests of creative potential, such as Urban's Test for Creative Thinking-Drawing Production, include humor as one of the evaluation criteria.

Humor as a Correlate of Creativity

Many researchers have recognized the multifaceted nature of both humor and creativity. Therefore, attempts to predict creativity from humor (or vice versa) have employed a large variety of tests of both constructs. Humor has been measured by such things as appreciation tests (usually rating cartoons or jokes for funniness), writing cartoon captions which are judged for funniness, teacher ratings of sense of humor or humorous attitude, writing humorous definitions, completing jokes, peer nominations of individuals as funny, humor knowledge, humor reasoning ability, observer ratings of laughs/smiles/

behavioral attempts at humor, judges' ratings of how clever or humorous a product was, and many different tests of the sense of humor.

Creativity has also been measured in numerous ways, for example, the Torrance Tests of Creative Thinking (the most commonly used), the Remote Associates Test, Guilford's Plot Titles, teacher ratings, word atypicality, the Asymmetrical Preference Test, observer ratings, Wallach and Kogan's ideational creativity, Getzels and Jackson's Word Association Test, infrequency, and the originality subtest of the Comprehensive Aptitude Test Battery.

Obviously, there is little agreement about how best to measure either humor or creativity. Despite this lack of agreement on measurement, however, a meta-analysis conducted by O'Quin showed a fairly consistent tendency to find modest positive relationships (average correlation of 0.34) between measures of humor and measures of creativity. The lack of common agreement on measurement in one sense adds to the richness of the fields. Researchers bring different assumptions and theoretical views to their work. However, it also leads to unclear definitions of concepts, ambiguity of conceptualization, and consequently little forward momentum in the accumulation of knowledge about the humor-creativity relationship. When neither concept is clearly defined nor measured, little research progress is made.

Despite these limitations, there are many interesting studies in the humor-creativity literature. During 1974, for example, Ward and Cox asked judges to assess both the creativity and the humorousness of products created by entrants in a radio station contest. The radio listeners had been asked to send in 'humorous and original little green things.' Ward and Cox found high positive correlations between judges' independent ratings of originality and humor. Relatively few studies in the humor-creativity literature have directly examined creative products.

Numerous other studies have been conducted on the humor-creativity relationship. A frequent humor measure used, whether alone or in conjunction with additional tests, is nomination by others for being funny. For example, teachers may be asked to rate children on how often they produce humor in the classroom, and/or peers may be asked to nominate the 'funniest in the class,' or to identify the class clowns. The students in these studies vary from preschool age to college undergraduates. The creativity measures across these studies are also numerous, although some variation of Unusual Uses is the most common. The size of the correlations varies from study to study, but is usually positive. Several experiments have tested both male and female subjects, and similar results (small to moderate positive relationships between measures of humor and measures of creativity) are found for both sexes, with a slight tendency for the correlation to be higher for females.

Research on the relationship of humor to age was reviewed by Martin in 2007. For example, preadolescent children often define humor as involving funny actions and joke-telling, and adolescents tend to emphasize witty verbal skills. For younger children, humor initiation was unrelated to classroom behavior; however, by grade 7, children who engaged in more humor initiation were more disruptive in class and received more reprimands from the teacher. But by grade 11, humor in the classroom was no longer associated with acting-out behaviors

and was instead related to being popular with peers. Most of the research on developmental aspects of humor is cross-sectional in nature, so it is not possible to determine whether the child who is humorous in kindergarten continues to make his or her peers laugh in high school.

Most of the age-related research on the creativity-humor relationship showed that humor appreciation, comprehension, and production were moderately positively related to measures of divergent thinking and to general social competency. But the type of measurement was crucial. When humor was defined as making their peers laugh (i.e., being a class clown), it tended to be related to less positive outcomes, such as disruptive classroom behavior, aggressiveness, and a conflicted relationship with authority figures.

Comparing Humor Production and Humor Appreciation

When looking specifically at studies assessing the production of humor, the correlations with creativity are also moderate. Many of these experiments used samples of young adults, most often college students, but even preschoolers have been studied. There is no agreement across these studies about how to measure humor production (e.g., making up humorous captions for TAT cards, a Make-a-Joke test, funniness of slogans, cartoon captions, observer or teacher ratings of humor production). Similarly, no consistency exists for measures of creativity, although RAT scores and Unusual Uses have been the most frequently employed. To summarize the results of several studies, the correlations between humor production and a variety of creativity measures is about the same moderate size and positive direction as the correlation of other measures of humor, such as humor appreciation and sense of humor, with creativity.

Another way to examine humor production is to study professional humor producers, such as comedians and comedy writers. Kaufman and Kozbelt reviewed the literature on this topic in 2009. They concluded there was some evidence that professional humor producers (including writers) were creative and verbally intelligent, and that comedians tend to have overcome adversity in life and use humor as a coping mechanism. However, they also noted a dearth of empirically sound research.

Some authors have suggested that humor appreciation is not as close to the rigorous definition of creativity as humor production because the former appears to need cognitive processes that are less similar. But there is little difference in the size of the statistical relationships. Why? Humor production involves creating or making humor, and thus seems conceptually closer to the concept of creativity than humor appreciation. Perhaps this conceptualization is simply wrong. Another possibility is that the wide variety of measures used for both humor and creativity has obscured true differences in the size of the relationships. A third possibility is that the correlation between humor appreciation and creativity comes about more indirectly, maybe through humor's facilitation of a relaxing 'game-like' atmosphere. Let us look further at the latter possibility.

Humor as a Producer of Creativity

Theoretically, humor should have two related effects on thinking that would facilitate creativity. First, the cheerful mood

associated with humor should reduce tension and anxiety. In a state of relaxation, individuals would show less fixation and rigidity in their responses to problem solving situations. Second, beyond the reduced rigidity, there might also be a wider range of options that could be considered. The cognitive network could be expanded due to priming by the incongruous.

There is research evidence that both these factors can contribute to a relationship between humor and creativity. Many research reports in the humor–creativity literature have actually manipulated humor as an independent variable. In these studies, exposure to humor (typically in the form of cartoons, comedy films, or records) facilitated creativity or problem-solving in one or more forms (e.g., RAT score, unusual word associations, unusual uses, word atypicality).

Ziv has carried out several studies with humor as an independent variable. In one of his classic studies, some classrooms of Israeli adolescents listened to a comedy record; others did not. After the humor experience, there was an increase in creative performance on the Torrance tests of unusual uses and just suppose. The increase in divergent thinking was most marked for originality.

Psychologist Alice Isen and her colleagues have conducted numerous experiments demonstrating that positive emotion facilitates creativity. Although humor was not usually the focus of this research, in many of Isen's studies, positive emotion was manipulated by exposing participants to a comedy film. More generally, the effects of positive emotion have been widely studied; for example, Barbara Frederickson established the Positive Emotions and Psychophysiology Lab, whose web site summarizes a great deal of this research.

In the same vein, positive mood has been found to enhance flexibility and original thinking. Instructions, however, have been found to over ride the effect. In 1968, Liam Hudson told students to pretend to be a wild, free-wheeling artist and found the instructions increased unusual uses. Karen Gasper instructed participants to 'seek freely' and that all responses were acceptable in generating problem solutions. What had been a significant effect of mood was eliminated. Thus, it is possible that much of the effect of mood on creativity may be a result of self instruction.

A question left unanswered by these studies on humor as a producer of creativity is the duration of the effect. All the tests reported above were immediate; a humor experience was followed right away by creative tasks or problems to be solved. A fruitful testing ground for further research on this topic might be workshops or conferences that evoke humor to enhance creativity.

Methodological Issues

A problem for the comparison of creativity and humor, and an indication of their relevance to each other, is the recurrent inclusion of humor or funniness as an element in the scoring of creativity tests. When humor is one of the ways to get points on a creativity test, such as the widely-used Torrance Tests of Creative Thinking, it is easy to see how that may inappropriately inflate the humor–creativity relationship.

There is also evidence that alerting respondents to the possibility of humorous answers may positively affect their creativity scores. Ziv has found that instructions to 'be funny'

do, in fact, improve performance and originality on tests of unusual uses. Wallach and Kogan also suggested that a game-like, rather than a test-like, atmosphere will improve creativity test scores.

A second important methodological issue for both the humor and creativity literatures concerns validity of measurement. Kerr and Gagliardi reviewed the literature on creativity measurements during 2003 and criticized commonly used creativity instruments, such as measures of divergent thinking, for lacking predictive validity by failing to predict future behavior. Thus, people who score highly on tests of divergent thinking do not necessarily create products generally associated with the work of creative people such as artists, musicians, writers, etc. Few studies in the creativity–humor literature examined actual creative products rather than spur-of-the-moment creativity tests.

The state of affairs with regard to validity in the humor literature is somewhat better; at least criteria such as laughter and smiling are relatively objective. Humor production can be measured by the simple and obvious criterion of creating something judged by others to be humorous. Despite this relative advantage, however, the wide variety of humor measures chosen by researchers reveals that there is little agreement as to exactly what constitutes humor production and humor appreciation. Ruch discussed the lack of agreement on measures of sense of humor, pointing out that the plethora of approaches led to a hodge-podge of often-conflicting results.

Discussion

Unresolved Questions

First, can the effects of humor on creativity be more simply explained by positive affect or good mood? Is humor just a stronger laboratory manipulation of positive mood than most laboratory manipulations, or does humor make some unique contribution? A great deal of research has been conducted on the effects of mood. Isen and her colleagues found in 1987 that comedy films led participants to be more creative, compared to emotionally neutral or negative films, but they also found similar results with nonhumorous methods of producing positive emotion. Thus, one might infer that the creativity-enhancing effects of exposure to humor may simply be due to the effects of positive emotion upon cognition, rather than the idea that activation of multiple schemas in humor produces cognitive flexibility.

This question is not fully settled, however. Filipowicz used humorous videos in 2006 to induce positive emotion, and found that surprisingness fully explained its relationship to creativity. A 'game-like' atmosphere seems to facilitate optimal creative performance; humor and laughter can lead to such a relaxed, positive, game-like state. Another possibility is that 'game-like' conditions could produce self-instruction to reduce inhibition and a too-careful selection of responses caused by a fear of evaluation. But it has not become clear that humor manipulations of positive mood contribute to creativity above and beyond the effects of positive emotion.

Second, to what extent is humor appreciation different from humor production, and how are they related to sense of humor? Looking across many studies, the relationships among these three concepts are typically only modest, and in some

cases, no higher than their relationships to other constructs, such as creativity. Logically, it seems that one can certainly be an appreciator of humor without also being a producer, but the reverse does not seem at all likely. It is hard to imagine a humor producer who is not also capable of humor appreciation. However, comedians do not necessarily respond when comedic events are produced by others. To the best of our understanding, humor appreciation can exist without production, but humor production is much less likely to exist without the ability to appreciate humor. As we discussed earlier, it appears that humor production should be more closely related to creativity, but the research literature is not particularly supportive of this proposition. Humor production includes the social need for the audience to 'be there,' whereas creativity varies widely in audience relevance; that may provide a partial explanation. It is also possible, although research evidence is still inconclusive, that humor production is more strongly related to divergent thinking, whereas humor appreciation might be more strongly related to convergent thinking.

Third, to what extent is humor truly separate from creativity? Murdock and Ganim concluded in 1993, after reviewing theories that addressed both humor and creativity, that humor was sufficiently integrated to be considered a subset of creativity. However, our review of the broader empirical literature leads us to disagree with their conclusion. Rather, humor and creativity seem to be two interdisciplinary areas which overlap most clearly in the area of humor production. While it is possible to argue, based on the literature, that humor appreciation itself requires some creativity, humor production is logically more directly related to creativity. Our view is that greater creativity is required to make a joke, cartoon, or other form of humor, than simply to understand the same thing when it is made by another person.

However, another possibility is that humor and creativity are related because of their mutual correlation with another construct, such as intelligence, verbal ability, or cheerful personality. For example, in 1991 Feingold and Mazzella linked humor comprehension and humor cognition to intelligence in their theory of wittiness. It is also clear that some of the creativity measures typically employed in the literature (e.g., the RAT) place a premium on verbal ability or vocabulary.

Another possible candidate for one of the links in the relationship between humor and creativity is personality. Research by Kohler and Ruch in 1996 indicated that cartoon caption production, but not humor appreciation, showed low but significant positive correlations with the personality variables of extraversion and psychoticism. Ruch and his colleagues have devoted a great deal of attention to developing and testing different measures of the sense of humor, most recently the cheerful disposition, measured with the State-Trait Cheerfulness Inventory. The notion tying these measures to creativity is that the individual with a sense of humor is skilled in rapid cognitive or perceptual switches in frame of reference, an ability which is presumed to be important in creativity as well.

Summary and Suggestions

If creativity can be defined as 'successful originality,' then Eliot Oring's definition of humor as 'appropriate incongruity' seems a plausible parallel. For creativity the problem is to define

success and originality. For humor, 'appropriate' relates to the experience, personality, and circumstance of the individual and/or the group. 'Incongruity' plays a similar cognitive role to originality. A creative product is not always (or even usually) funny, and a funny idea is creative only in a very special way, involving originality and a resolution that takes social, human factors into account.

Granted, humor and creativity share similar cognitive, social, and emotional processes that give the two parallel psychological implications. Creativity requires flexible examination of the connections among ideas, and humor depends on the selection and evaluation of different associations at different levels of analysis. However, originality without resolution usually not considered creative. A joke that leaves the incongruity unresolved is nonsense, but might still be funny. Production of ideas is necessary for both humor and creativity, and evaluation of those ideas is critical (although not always acknowledged) for both. Creativity and humor do require similar cognitive processes, but the specific applications are different.

As discussed earlier, a major problem in investigating the humor-creativity link is a lack of clarity in defining the two constructs. Humor is sometimes considered to be a form of creativity. Creativity measures sometimes assign points for humor or include tasks that involve humor. Such confounds must be removed before the 'true' nature of the relationship between the two constructs can be thoroughly examined.

In addition, there still remain problems with basic theories in both fields. Many years ago, authors bemoaned the lack of a single and widely-accepted theory of creativity to focus research. Despite a tremendous surge in creativity research in the past 60 years, no absolute consensus or over-arching theory of creativity has yet been reached. To an extent, the abundant creativity exhibited by authors in the field of creativity research has impeded progress in that field. The pressure to be novel, which exists in many disciplines but seems to be particularly prevalent in creativity, often leads to reinventions, reimagining, and renaming of 'old' concepts. This leads to a subsequent lack of resolution, lack of agreement on the meaning of constructs, etc. Some choose to interpret the proliferation of hundreds of creativity models and instruments, only some of which are psychometrically sound, as indicative of a dynamic field rather than a handicap.

Similarly, there is no single theory of humor. As we have discussed, even basic differences such as those between humor appreciation and humor production have not always been made clear by either theorists or empirical investigators. Well-known humor researcher Victor Raskin has spoken of the problem of reinventing the wheel; he pointed out that first-timers in the study of humor, often established experts in their own fields, sometimes begin humor research without any idea of the vast body of knowledge that already exists. A number of 'new' theories are proposed each year that are indeed new to the author, but not necessarily to the discipline.

The interface between the fields of humor and creativity is thus clouded by these perplexities. Creativity researchers are often not familiar with the breadth of research and measures in the humor literature; for humor researchers, the reverse is also true. Sometimes, experts in one domain impose their own ways of thinking on another domain, which may yield insights which are original, but are not high in resolution.

Perhaps one day, a general unified theory of cognition will encompass both humor and creativity. Until then, we need more precise definitions and measures. Rather than simply saying 'humor,' researchers and theorists must be clear as to what, in the broad array of cognitions and behaviors that can be encompassed by that term, they mean. In the short run, rather than trying to come up with a grand and complete theory of humor, we need more 'mini-theories' to help explain individual phenomena. Similarly, in the creativity literature, researchers should be more aware that a vast amount of humor research exists, only a small part of which overlaps with 'creativity.' Equally important to furthering progress is to begin to converge on clear, precise and psychometrically sound measures in both domains.

See also: Divergent Thinking; The Four Ps of Creativity: Person, Product, Process, and Press; Play; Remote Associates; Testing/Measurement/Assessment.

Further Reading

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- <http://www.unc.edu/peplab/home.html> – Positive Emotions and Psychophysiology Lab. (Barbara Frederickson).

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Imagination

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Glossary

Default network The regions of the brain that remain active during rest periods; a psychological baseline that is active when external tasks do not require conscious supervision.

Imaginary companion An invented character that is talked about or interacted with on a regular basis.

Imagination The multifaceted capacity to transcend one's current time, place and/or circumstance in one's mind.

Mental time travel The capacity to project oneself back in time to re-live past events of one's life or forward in time to pre-live hypothetical events in the future.

Mind wandering A shift of attention away from a primary task toward internal information, including daydreams about fictional worlds, as well as memories and plans related to actual experiences.

Introduction

In common usage, 'creative' and 'imaginative' often serve as synonyms to describe innovative ideas/objects or the people who are responsible for them (e.g., "she is so creative/imaginative"). However, in the psychological research 'imagination' is becoming a broader term that encompasses the multi-faceted capacity to transcend our current time, place and/or circumstance to think about what might have been, plan and anticipate the future, create fictional worlds, become absorbed in the narratives created by others, and consider remote and close alternatives to actual experiences. With this definition, imagination includes everyday mundane thoughts (e.g., plans for tonight's dinner), as well as the creative insights that lead to progress in art and science. This definition also distinguishes imagination from imagery, with the latter being a tool of the imagination rather than equated with it.

The capacity to depart mentally from our current time, place and/or circumstance emerges early in childhood, develops substantially during the preschool years, and is inextricably linked with our understanding of reality throughout life. Theories that highlight imagination date to the earliest days in the history of psychology, but in recent years, the study of human imagination has moved from the margins of mainstream psychology to assume a more central role. This change is partly due to the findings of brain imaging studies that have revealed the close connection between the neural patterns for imagining a behavior and actually performing it. The science of imagination has also been elevated by studies that have identified a particular neural response associated with periods in which the participants are not involved in any experimental task, the so-called 'default network' that is believed to be associated with thoughts that are turned inward. In addition, there are many

new studies that show how imaginative processes have real world effects on our behavior and that introduce new concepts such as 'mental time travel' that have highlighted the role of imagination in everyday thought and united subtopics of research (e.g., counterfactual thinking and planning for the future). There is currently a renewed appreciation for the value of fictional narratives in enhancing our capacity for empathy and social inference and for the role of simulation in thinking about the future, remembering the past, taking another person's perspective and thinking about what does not exist. The connections between childhood imagination and highly valued adult behaviors (e.g., creative writing) are being re-examined and more generally, research on imagination is shifting from a story of decline after early childhood to a story of continuing enrichment in adulthood. Some theorists have proposed that imagination is the leading candidate for the 'spark' that distinguishes human beings from other animals.

The study of imagination is broad in scope, cross-cutting traditional areas in psychology and extending into other fields as well (e.g., philosophy, literature). Here I have focused on some of the interconnected topics that are driving research investigations: (1) pretend play, simulation, and emotion; (2) narrative, fiction, and testimony; (3) mind wandering, mental time travel, and counterfactual thinking; and (4) imagination and autism spectrum disorders.

Pretend Play, Simulation, and Emotion

Pretend Play

Pretend play provides some of the earliest evidence of imagination, as well as a potential training ground for its

development. Young children understand pretense in other people by 18 months or earlier and at two years are able to act in accord with requests for pretend actions (e.g., dry off a stuffed pig that had been soaked with imaginary tea). The first spontaneous acts of pretend play (simple actions directed toward the self) occur in the second year of life followed by pretend actions directed towards another individual (e.g., pretending to feed a doll) and the acting out of scenarios in which the other is the initiator of the action (e.g., animating a doll who feeds a stuffed animal). Once children start to incorporate the behavior of others into their pretend play, they quickly start to attribute thoughts and feelings to imaginary others and to produce narratives to accompany their actions.

In western cultures, children do not simply imitate or reproduce the characters and events they have encountered; they exhibit a striking ability and inclination to invent imaginary characters and act out fantasy scenarios. Sometimes their pretend play involves social contexts in which young children's activities are scaffolded by mature play partners (parents, older children) or coordinated with the pretending of peers, but they also pretend when they are alone. Imaginary companions – the characters created by children that are talked about or interacted with on a regular basis – provide particularly interesting examples of developing imaginative skills because they are usually created spontaneously by young children and can assume important roles in children's lives.

Imaginary companions provide evidence of children's early developing capacity to create elaborated and idiosyncratic fantasies. Imaginary companions are diverse in form and function. They vary in size from a speck to ten feet or taller, can be newborn infants or ancient (e.g., 1000 years old), are every possible species, and may even be from another planet. They differ in vividness, personality development, longevity, and activities. Sometimes they are completely invisible and sometimes children use props to represent them, including a variety of idiosyncratic objects (a leaf, a stick, a finger, etc.), as well as toys such as dolls and stuffed animals (if the child treats the toy as having a distinct personality and talks and listens to it on a regular basis). It is not unusual for three-year-old children to have imaginary companions and by the time children are seven, as many as two-thirds have had some experience with them. In some cases, children move from having imaginary companions to the creation of 'paracosms' – private, elaborate, and enduring imaginary societies or worlds.

A number of studies have investigated personality and other types of possible differences between children with and without imaginary companions. The emerging view is that, in most respects, the similarities between the two groups are more striking than the differences. However, fantasy activities during the preschool period are related to a number of positive social characteristics. For example, high fantasy children are rated by teachers as showing higher levels of energy, concentration, self-reliance, and tolerance for frustration. Young children who create imaginary companions show higher levels of positive affect, social competence, and creativity. Jean Piaget described imaginary companions as distorted assimilations of reality to the child's own ego, but research indicates that having an imaginary companion is positively associated with performance on cognitive tasks that require accommodation of

thought to reality. Rather than promoting an exclusive focus on the child's own subjective experience, pretend play involving imaginary companions is related to a greater ability to adopt the perspective of another person.

Later Forms of Imaginary Relationships

Imaginary companions and other types of pretend play become less common in later life, but philosophers have pointed to the continuity of childhood pretending with adult activities involving drama, film, art, internet role play games, and fiction (both reading and writing). Adult novelists, playwrights, and screenwriters provide interesting examples of adults who are preoccupied with the production of fantasy and there is a growing literature investigating the psychological significance of these activities. More generally, imagined interactions continue beyond childhood in various guises, from intellectual exercises such as imagined conversations with historical figures to more fully developed and maintained fantasies. The social worlds of many people can be described as including individuals whom they know only through television, books, movies, and other forms of media, as well as the people they interact with face-to-face in their everyday lives. The experience of having a personal 'parasocial' relationship with a famous individual who has never actually been encountered in real life is quite common and can go beyond interest and admiration to involve imagined conversations, meetings, and extended interactions. Other types of imagined interactions are important in rehearsing messages, managing emotions, and coping with life events. Recently researchers have found that imagined interactions with members of a minority group can reduce the individual's level of prejudice.

Emotional Responses to Fiction and Pretend Play

The pretend play of children has several features that are significant for understanding the fundamental role of imagination in human thought. First and foremost is children's emotional investment in their pretend activities. For example, children often become afraid when engaged in scary pretend play and they claim to love their imaginary companions. Throughout life, the capacity of fantasy to engage our emotions is one of the most intriguing and potentially significant characteristics of our imagination. The affective response to imagining a pretend scenario seems to closely track the affective response that would occur if the person came to believe that the scenario was real.

In the past, children's emotional reactions to fictional characters and scenarios were sometimes interpreted as reflecting an immature understanding of the distinction between fantasy and reality. However, research evidence suggests that children have fewer problems with the fantasy/reality distinction than has previously been supposed. Currently, emotional reactions to fantasy in childhood are viewed as similar in many respects to adult emotional responses to fantasy. The child who retreats from a scary game of monster is akin to the adult who stops reading a novel when it becomes too creepy. In both cases, the emotion elicited by the fantasy crossed the line of what was experienced as pleasurable, but the individuals were not

necessarily confused about the reality of the situation. The emotional reactions simply reflect the human capacity to react emotionally to fantasy, rather than a breakdown of the boundary between fantasy and reality.

The capacity to experience emotional reactions to imagined events is consistent with the view that an important function of pretend play is the management of emotion. In their pretend play, children explore real-life themes and challenges that are significant to them and discover new insights and understanding. Thus, children can benefit in real life from their pretend play, for example, deriving real emotional support from an imaginary companion that increases the child's resilience. The influence of imagination on real behavior is not limited to children. Clinical research indicates that throughout life, we are able to explore emotional space via our imaginations in a way that provides insight into the real life emotional experiences of ourselves and others. This is the basis for many types of clinical interventions in which adults use imagined interactions or scenarios in therapy to cope with trauma, anxiety, or other types of problems.

The Simulation of Experience

Why do we have emotional systems that can be driven by fictional as well as real input? One answer is that the ability to produce and comprehend acts of pretense is a consequence of the early development of the simulation process that underlies our understanding of the real actions and thoughts of other people. There are different accounts of how simulation might work, but the basic idea is that information about the person and the situation is fed into the same system that determines our own reactions to events and the output of the simulation is attributed to the other person. The process of simulation is of crucial importance for interpersonal understanding, decision-making, and communication. Simulative processes are involved when we consider how someone might feel if he or she lost a job or how we might feel in the future in that scenario. What is particularly important about simulation from the point of view of research on imagination is that the system underlying the processing of real life events can also be driven by fictional input. Thus, simulation theory provides a link between imagination and our understanding of reality.

The discovery of the mirror neuron system in macaque monkeys has special significance for simulation accounts. Mirror neurons fire when one performs an act and also when that same act is observed being performed by others. Some only fire when there is a close match in the form of the action, but others are less specialized, firing for actions that have the same goal or intention. If observations of others activate one's own internal representations of the perceived actions, intentions, and emotions, as research on mirror neurons suggests, this system might allow for the direct experiential detection and understanding of mental states in other people. Neuroscientists vary in their appraisal of the promise and current state of research investigating a human analog of the mirror neuron system; however, what is known about the mirror neuron system has an impressively close fit with the simulation account of how we understand other minds. Thus, the discovery of mirror neurons has increased the prominence

of simulation theory, and along with it, elevated the study of how fictional content in role play, narrative, and mental time travel is processed.

Narrative, Fiction, and Testimony

In addition to pretend play, the production and comprehension of narratives are activities that explicitly display children's early developing capacity to imagine scenarios beyond their immediate experience. Narratives are stories with sequences of causally linked events that unfold over time involving characters and a point of view. The earliest narratives may be those that are implicit in the context of pretend play, with parents sometimes telling a story to accompany the children's pretend actions. By three years of age the children themselves start to narrate their pretend play, a development that enriches its thematic possibilities. In both pretend play and narrative, children create characters, imagine a scene, and develop plot lines that include goals, conflicts, and/or problems to be resolved. The research on character representation suggests that pretend play and storytelling have somewhat different developmental origins and trajectories, but that these two activities become increasingly coordinated in middle childhood.

Narrative and Social Understanding

The ability to create narratives and to comprehend the stories of other people provides an important vehicle for reflecting on experiences in adults as well as children. In adults, the extension of experience beyond personal circumstance that is possible through narrative is believed to promote deep insight into human behavior and contribute to the development of wisdom. Experimental research shows that readers follow a narrative by adopting a psychological vantage point within the narrative – taking the visual, spatial, and mental perspectives of a main character and tracking the perspectives of multiple characters. Some theorists have suggested that these simulations of a character's emotional reactions to the events in a story help to develop the reader's 'theory of mind' – the understanding of people's behaviors as reflecting their beliefs, desires, and other mental states. This hypothesis has received empirical support from research showing a relation between reading fiction and higher scores on tests of interpersonal understanding.

There are several possible overlapping explanations for the relation between reading fiction and interpersonal understanding in the real world. Fictional narratives provide an abstraction of social experience in which attention can be focused on nuances of social interaction that might be overlooked in real life. Thus the reader is guided to attend to the important parts of the interaction. In addition, the author's commentary on the unfolding events might provide insight into behavior that in real life might be misunderstood. Perhaps the benefits derived from reading fiction are primarily due to the extensive practice in the type of simulation that is used in real life encounters. There also is a structure to fiction that some theorists have suggested could help reorganize and make sense out of real life experiences. More research is needed to understand how reading fiction can affect real life social behavior, but current

work in this area suggests that the consumption of fictional narratives has significance beyond 'mere entertainment' by enhancing empathy and social inference in real life.

Learning Real World Knowledge from Testimony

In addition to connections with theory of mind and social understanding, the ability to immerse oneself in a narrative is fundamental to our acquisition of real world factual knowledge. This point is sometimes overlooked, but the capacity to learn from what other people tell us (i.e., referred to as 'testimony' in the literature) relies upon imagination. Much of our historical and scientific knowledge concerns events or entities that have not or could not be personally observed. The acquisition of knowledge requires 'testimony' when there is no possibility for first-hand experience. Thus our capacity to understand narratives outside of our experience is involved in our learning about Ancient Rome, black holes, micro-organisms, and the Milky Way. Developmental research on imagination has recently extended beyond fictional content to investigate children's ability to learn factual information from what they are told, including simple statements and descriptions as well as more fully formed narratives.

Children's success in learning via testimony depends upon their ability to evaluate such information and from an early age, children have been shown to assess the reliability of information acquired from what other people say and to construct a mental model of the world that incorporates these claims. Importantly, this developmental research connects the work of the imagination more generally with the acquisition of knowledge about the real world, rather than conceptualizing imagination as concerned primarily with fiction or fantasy content. Our ability to imagine what we are told about but have never seen also plays an important role in the acquisition of religious beliefs. On this vein, some have argued that the development of pretending and narrative in childhood lays the groundwork for the capacity to have religious faith.

Mind Wandering, Mental Time Travel, and Counterfactual Thinking

In the past, 'daydreaming' (i.e., shifts in the contents of one's thoughts away from an immediate task to unrelated images or thoughts) has tended to be associated with fantasy content and the suggestion of psychopathology. For example, individual differences in 'fantasy proneness' are correlated with a history of trauma and considered to be a risk factor for emotional or cognitive problems. However, daydreaming is only one part of the construct of fantasy proneness and currently, the mind's tendency to wander is being taken more seriously as a fundamental aspect of everyday thought rather than a marker of possible pathology. This idea dates to William James or earlier and was extensively researched by Jerome Singer and his colleagues, but recent advances in cognitive and social psychology, along with the development of brain imaging techniques, have led to an increased interest in mind wandering and the development of theories for why we have evolved minds that tend to wander from the task at hand. The research on mind wandering demonstrates not only the capacity to mentally

transcend our current time, place, and/or circumstance, but a surprising propensity to do so. Mind wandering is ubiquitous rather than exceptional. As the mind wanders, remote associations are brought together into consciousness and, thus, mind wandering is likely to play an important role in facilitating creative breakthroughs.

A variety of terms with partially overlapping meanings are associated with this type of research, including 'default network,' 'mental time travel,' 'stimulus independent thinking,' as well as 'mind wandering.' The large literatures on counterfactual thinking and on dissociation are also relevant to this topic. These concepts all share a connection with earlier work on daydreaming, but vary in numerous ways, including the extent that they suggest a particular type of content and whether the thoughts are intentional or spontaneous. In what follows I briefly discuss a subset of these ideas and findings.

The Default Network

Recent brain imaging studies indicate that we have a particular pattern of neural activation that occurs during 'rest' periods when participants are not doing anything (e.g., sitting in a chair with no assigned task). The 'default network' is the term given to this psychological baseline from which people depart when attention is required to perform a task and to which they return when the external task no longer requires conscious attention. The default network turns off and on, depending upon how focused we need to be to complete different tasks; its activation has been interpreted as signaling mind wandering. For example, people who report more mind wandering during a task also show more activation of the default network. In addition, the default network is more active during conditions in which the task has been well practiced than when the task is novel. The default network varies somewhat from person to person; some people tend to show a pattern suggesting thoughts about the past whereas other people tend to wander to thoughts about the future. This finding points to the potential of brain imaging research in this area to shed light on individual differences as well as general processes. There is much more to be learned about the default network, but the basic finding of a recurring neural pattern associated with mind wandering has been partly responsible for making off-task thoughts a focus of research rather than dismissed as experimental noise.

Mind Wandering and Mental Time Travel

The term 'mind wandering' refers to a shift of attention away from a primary task toward internal information, including daydreams about fictional worlds, as well memories and plans related to actual experiences. Mind wandering can occur without intention or even awareness that one's mind has wandered. Individuals often fail to notice that their immediate goal of task completion has been temporarily displaced by another concern. As our minds wander from a present task toward unrelated inner thoughts, fantasies, feelings, and other musings, we shift our attention among competing goals, including goals that were being pursued outside of conscious awareness.

Why do we have minds that wander away from the tasks that we are performing, often without conscious awareness? There are a variety of explanations (e.g., the importance of multi-tasking, maintaining an optimal level of arousal, etc.), but most researchers include the benefits of relating current thoughts to past experiences and future plans. This type of mind wandering is sometimes referred to as 'mental time travel,' a term that suggests more intentionality than mind wandering and tends to be more associated with content about the self – the person mentally projects him or herself back in time to mull over past events or forward in time to anticipate and plan for future ones. This process helps to give coherence to one's past, present, and future experiences and contributes to a concept of self as persisting over time.

Early signs of mental time travel include children's anticipation of future events in pretend play and narrative activities. Mental time travel occurs in other contexts as well, indicating that a sense of self that extends in time from the past through the present and into the future (the 'temporally extended self'), is in place by the end of the preschool period. By five years of age, there is considerable flexibility and foresight in children's ability to mentally project themselves forward in time to make plans for the future and to explain their choices by referring to future states. An awareness of the future is also demonstrated in children's performance on prospective memory tasks (e.g., following through on a plan to do something in the future) and delay of gratification tasks.

An important finding of this research is that children's performance on tasks assessing the past self is correlated with performance on tasks assessing the future self. This developmental synchrony between the capacity to project oneself mentally into the past and into the future is consistent with neurophysiological evidence that thinking about the future and the past are closely related. On some accounts, mental time travel is said to have evolved primarily because it increased the capacity to act in the present to increase future survival chances. Thus the capacity to think about the past is secondary. Similarly, some theorists have claimed that the reason we have the capacity to imagine fictional worlds is because of the significance of being able to anticipate the possible consequences of future courses of action. On this view, the evolution of an ability to simulate the emotional consequences of hypothetical events that could actually happen in the future allows for emotional reactions to purely fictional events.

Counterfactual Thinking

Mental departures from our current time, place and/or circumstance include many varieties of counterfactual thoughts about alternatives to the actual events of one's life. The integration of thoughts about what is currently happening with thoughts about what could have happened helps to make sense of events and plan for the future. Mind wandering and mental time travel can involve content that is remote from everyday experiences, but the imagination is closely tied to reality when we engage in many types of counterfactual thinking. With our imaginations we reconstruct and reinterpret past experiences in light of present understanding. This process involves the generation of counterfactual premises, the simulation of how an alternative past might have resulted in a

different outcome in the present and the integration of that information with actual events and outcomes. Counterfactual thinking is believed to underlie everyday causal understanding of our experiences, as well as the capacity to plan for the future. Thus, the work on counterfactuals rests upon the idea that imagination is rational and closely tied to our understanding of reality.

An important component of counterfactual reasoning is the capacity to anticipate the emotional consequences of different courses of actions, often by linking past experiences with hypothetical future possibilities. Imagining different possibilities for future outcomes can be accompanied by worry about past negative outcomes and plans for preventative action. In addition, the capacity to compare actual outcomes with counterfactual alternatives provides the foundation for moral reasoning and judgment.

There is a large literature investigating the types of counterfactuals that are most common and their effects on our understanding of everyday events and our emotional reactions to them. For example, although it is possible to generate a large number of counterfactuals for most scenarios (e.g., close vs. remote, concerning actions vs. failure to act), this is not what people do. Usually a very small number of possibilities are generated when people consider alternatives to reality. When they think about how an event might have turned out, most people are influenced by counterfactuals that are close plausible alternatives to what actually did happen. In addition, counterfactuals involving the most recent step in a causal sequence are common. People can easily imagine a causal sequence that is missing the last step and so counterfactuals in which the last event did not occur are particularly likely to influence our reasoning. Another find from this literature is that most counterfactual thinking occurs after a negative event. How might it have been prevented? How could it have been avoided? This type of thinking is particularly likely to help individuals learn from experience.

Counterfactual reasoning underlies our understanding of causal relations and thus helps us build causal models of the world that are used to understand ongoing events and to imagine fictional possibilities. We also gain insight into the emotional consequences of various scenarios when we transform the facts of our experiences into alternative realities and experience the emotions associated with those counterfactual possibilities. Some types of emotional experiences are particularly dependent upon our ability to generate counterfactual accounts of past experiences. For example, thoughts about what might/should have been give rise to shame, guilt, relief, and regret (e.g., "If only I hadn't been rushed, I would have noticed the red light. . ."). The experience of regret requires the consideration both of reality and a more positive counterfactual. Although developmental research indicates that preschool children can think counterfactually in some contexts, children's capacity to report which characters in a story might experience regret indicates that an adult-like processing of counterfactuals might be in place around seven years of age.

Some research has focused on the limits on our ability to anticipate the emotional reactions to future events. For example, research on 'affective forecasting' indicates that although people can predict whether they will react positively or negatively to a future event, they are not very accurate in

predicting the intensity and duration of their emotional reactions. We tend to overestimate how much we will think about the event in the future, underestimate the extent that other events will influence our thoughts and feelings, and fail to anticipate the extent that we will be able to adjust emotionally to even very negative events (e.g., diagnosis of a serious illness). Biases in the imagined experiences of counterfactual pasts and hypothetical futures are an important direction for future research. More generally, the extent to which thoughts about the counterfactual past and the hypothetical future permeate our thinking in the present and influence our actions is an important area of research showing the role of imagination in everyday cognition.

Imagination and Autism Spectrum Disorders

Disturbances of imagination are associated with many types of mental illness and neurological disorders. Our capacity to imagine alternatives to our current experience can lead to the development of worldviews that are not shared with other people and difficulties in distinguishing fantasy from reality (e.g., the delusions of a person with paranoid schizophrenia). Sometimes the association between mental illness and imagination is framed as enhanced creativity – interpreted by some as the silver lining to the experience of depression, schizophrenia, or, most recently, bipolar disorder. Disorders that increase the flood of thoughts and mind wandering can lead to original ideas, but in most cases such products do not have the utility in addition to novelty that characterizes creativity. On the other hand, some have argued that the ideas generated during a bout of mania, for example, can be usefully developed during periods of mental health when the individual is not experiencing symptoms.

For other disorders, there appear to be deficits of imagination, most notably in the autism spectrum disorders. A deficit in imagination is widely considered to be one of the triad of symptoms that characterizes people with autism (the other two being problems with socialization and communication). In general, research on autism spectrum disorders has been very informative about typical and atypical functioning, and has the potential to provide new insights about imagination. There is still much to learn about how imagination functions in individuals on the autism spectrum, but some of research findings suggest connections with the topics discussed in this essay. For example, children on the autism spectrum tend to not spontaneously engage in pretend play. However, they have less difficulty comprehending the pretend acts of others than producing their own, which suggests their difficulty is in generating play ideas rather than difficulty understanding the underlying representations. Other types of tasks suggest that children on the autism spectrum have particular difficulty in imagining something that does not exist in the real world. For example, whereas children with cognitive delays are able to produce drawings of a person who could not exist (e.g., a person with two heads) and imagine scary things that are fictional (e.g., monsters), children on the autism spectrum struggle with these types of tasks. In addition, first person accounts from high functioning adults on the autism spectrum indicate that the problem with generativity might be specific to

the unreal or impossible rather than a more general problem with generating any type of new idea. High functioning adults with autism also express difficulty understanding fictional narratives about interpersonal scenarios. Future research with this population is a very promising direction for the development of more elaborated theories about the development of imagination and its role in understanding the world.

Conclusion

The study of imagination is currently somewhat fragmented, spread across developmental, social, clinical, and cognitive psychology, as well as neuroscience and other disciplines. Much of the research on imagination has focused on children and their developing capacities for pretend play and narrative. Children's thoughts about the nonactual and the fictional in these activities are seen as helping them process real-life events and enriching their understanding of self and other. In addition their ability to follow narratives is crucial in the acquisition of real world knowledge from the testimony of other people.

There is also growing recognition that fantasy activities such as reading fiction have real world consequences for adults. The exploration of emotional space via simulation in fiction leads to real world insight and affects behavior. There is likely to be an increased number of studies comparing the processing of fiction and real life social scenarios and investigating the relation between reading fiction and social abilities. In this area, brain imaging research is helping to disentangle the way information about the self and other is processed and could yield new insight about the development of simulation and the neural correlates of different components of imagination. In addition imaging research on the default network has contributed to the growing recognition of the prevalence and importance of mind wandering.

The development of children's imagination is facilitated when they have some amount of unstructured time and are provided with a few props, space, and the encouragement of a supportive adult – conditions that vary considerably as a function of religious, economic, ethnic, and family context. The influence of culture has not been discussed here, but cultural studies of pretend play in nonwestern societies are raising many questions about imagination. For example, children raised in Mayan communities in the Yucatan do not engage in the types of fantasy pretend play that are so common in Euro-American children. The form and frequency of pretending and the extent that children are private about their fantasy lives are clearly influenced by the cultural perspective of their community and this perspective needs to be taken into account in future research.

There are many questions about imagination that are unanswered and many issues to be resolved, but there has been a surge of interest in this area of research and some progress has been made. In general, the advances of the past decade or so emphasize that imaginative processes are fundamental to everyday thought throughout life and are inextricably linked to our understanding of reality.

See also: Definitions of Creativity; Everyday Creativity; Play; Synchronicity and Creativity; Time.

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Implicit Theories

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Glossary

Discriminant validity The distinctiveness of creativity from related characteristics and talents (e.g., intelligence).

Explicit theories Opinions and views held by scientists. They are explicit in the sense that they are shared with other scientists and testable.

Implicit theories Opinions and views held by people other than scientists. They are often personal rather than shared, and they may not be in a form that allows testing.

Personal explicit theories These are the implicit theories that are held by scientists. They are personal and thus implicit, but because they can influence the research of the scientist, they are explicit as well.

Social validity A psychometric technique relying on judgments given by parents, teachers, or others who are important in the lives of the research subjects (e.g., children). The assumption is that these judgments will have more ecological meaning than will test scores and judgments given by trained professionals.

Tacit knowledge Personal understanding about the world. Often we know something about the world (e.g., gravity pulls objects toward earth), yet many of us cannot give a precise explanation for why this is the case. Our knowledge is in that sense tacit.

Introduction

Good scientific theories are testable. Hypotheses are easy to draw from them, and they are precise enough to know if data support or refute them. In this sense scientific theories must be explicit. They are made explicit to share, as well as to test. Scientists share ideas by publishing them, along with the results from their investigations. Other scientists can then attempt to replicate or utilize the research. Science is a social endeavor. Implicit theories, on the other hand, reflect the opinions held by parents, teachers, children, managers, and others who need not articulate their views. Although implicit theories are manifested in opinions and expectations, they are largely personal. They reflect a kind of tacit knowledge, which is quite common. Often we know something about the world (e.g., gravity pulls objects toward earth), yet many of us cannot give a precise explanation for why this is the case (other than referring to the mass of the earth or Newton's observation of an apple falling from a tree). Implicit theories allow us to judge creative behavior even if we cannot define creativity.

Implicit theories are important because they are related to the standards used in making many judgments – including judgments about creativity. They are also related to expectations, and a corpus of research has demonstrated the impact of expectations on development and behavior. Teachers' expectations, for example, may actually influence the rate of learning by students. Parental implicit theories and expectations are similarly important. If a parent has reasonable expectations for his or her child, for example, the child will be more appropriately challenged. The parent will give the child activities and tasks that require some effort, but they will not be so difficult that the child is frustrated. Most of the research on implicit theories has focused on the opinions of teachers and parents. A few isolated studies have been conducted with other samples. Some research has, for instance, been conducted with

managers in organizations. Their implicit theories presumably are important in that these will influence what expectations they hold for their employees. The most recent research has examined the implicit theories held by scientists who are studying creativity. These were labeled 'personal explicit theories' because they are both implicit and explicit. The reasonable assumption here is that the implicit theories of scientists influence their thinking and the development of their explicit theories. This is analogous to what was noted above about parents' and teachers' expectations reflecting their implicit theories, only for scientists the expectations influence their work and research.

Methods Used in the Study of Implicit Theories

The methods used to study implicit theories vary. One method utilizes the social validation technology. Social validity was developed in the clinical setting as a means of ensuring that treatment outcomes would be meaningful in the natural environment. Treatment outcomes are frequently validated, but often this validation process relies on judgments of therapists. Social validation is based on the judgments of parents, teachers, and individuals who are likely to be involved in the lives of the client in the natural environment. They are, then, based on implicit theories rather than on explicit theories. Social validation requires two phases. First the sample whose implicit theories are of interest receive openended questions (e.g., what characteristics are shared by creative individuals?). The most commonly nominated characteristics are identified and placed on a questionnaire. This can be used in the second phase of the research to obtain ratings about particular individuals. The ratings on the questionnaire are usually categorical (e.g., Likert) but allow parametric statistical techniques to test group differences or relationships with other variables.

There is some subjectivity involved when the implicit theories of the individual are being compiled. Different individuals may express their implicit theories in different ways, so two individuals may both believe that creative persons are always original, but one of them describes this as being prone to novelty and the other as characterized by unusual behavior. The researcher attempting to identify the most commonly nominated characteristics may have difficulty determining which nominations refer to the same trait and which do not. Is 'original' the same as 'novel,' 'unique,' and 'unusual'? We cannot be certain, even if we consult a standard dictionary, because we are dealing with implicit theories. One person may say 'original' and mean the same thing someone else means when he or she says 'novel.'

For this reason the first phase of social validation work may avoid open-ended questions. In Mark Runco's work with parents and teachers, the Adjective Check List was used in the first phase. This contains 300 adjectives, alphabetically arranged, and the individuals nominating traits simply choose which of those 300 are descriptive of creativity. The range of possible traits may be slightly truncated with this technique but it does avoid the subjectivity mentioned above. (Social validation using the Adjective Check List has not been conducted on anything other than creativity. Social validation is a part of some clinical assessments, but there the 'significant others' are given the open-ended questions in the first phase of the research.)

Another advantage of the Adjective Check List is that it facilitates comparisons with explicit theories. This is because it contains several creativity scales. In fact, the Adjective Check List also has a social desirability scale, and this too has been used in the research examining the traits suggested by the implicit theories of creativity. This particular comparison is interesting because previous research indicates that teachers' views of the 'ideal student' contain traits such as conforming, considerate, and so on – traits which may be unrelated to creativity. The creative student may daydream, only concentrate on intrinsically motivating tasks (rather than assignments), and do things in an original fashion. One socially valid measure is the Parental Evaluation of Children's Creativity (revised). It was constructed from the traits parents most agreed on when asked to use the Adjective Check List to describe creative children. It contains 75 items, but only 24 of them (32%) are part of the scale that is relevant to social desirability. (The Adjective Check List scale used for social desirability is the 'Favorable traits' scale.)

Empirical Research on Implicit Theories and Group Differences

Runco and colleagues have found that parents and teachers believe creative children to be active, adventurous, alert, ambitious, artistic, capable, curious, dreamy, energetic, enthusiastic, and imaginative. There were, however, differences between these groups. Teachers pointed to cheerful, easy-going, emotional, friendly, and spontaneous as characteristic of creativity. Parents chose enterprising, impulsive, industrious, progressive, resourceful, and self-confident.

Artists have been found to distinguish between artistic creativity, scientific creativity, everyday creativity, and 'noncreativity.' Imagination, emotion, and expressiveness were tied to

artistic creativity, while 'patient' and 'thorough' were tied to scientific creativity. Clearly, the domain differences that are recognized in explicit theories of creativity are also recognized in implicit theories. The social validation technique has also been used to empirically examine sixth- and seventh-grade children's implicit theories about creativity. In the first phase of the investigation the students were required to 'list synonyms of creativity, behaviors they observed in peers they considered to be creative, and personality traits common to creative peers.' Helen Miller and Janet Sawyers identified the most common items and placed them in their Students' Self-Evaluation of Creativity. They added several items (e.g., Conforming) to minimize the chance of response sets. These negative items were theoretically antithetical to creativity. As was the case with the implicit theories of artists, some of the characteristics nominated by the children (e.g., Imaginative and Interested in Many Things) are entirely consistent with explicit theories of creativity. Some of them reflect unfortunate biases. The item Artistic, for example, reflects the widely held but incorrect assumption that creativity is only possible in the arts.

Ratings from a second group of students (fifth-grade students) on this new instrument were correlated with originality scores on divergent thinking tests. They were also unrelated to the IQ, which gives the self-report some discriminant validity. Robert Sternberg has also reported evidence for the discriminant validity of implicit theories of creativity. He found differences among people's conceptions of creativity, intelligence, and wisdom.

Creativity is associated with certain traits (e.g., originality and intrinsic motivation) and is inhibited by other traits (e.g., conformity and conventionality). For this reason those describing their implicit theories should be asked about traits that are related to creativity and those that are unrelated to creativity. The latter question may be asked something like, "what traits are uncommon in creative people," or "what traits are found only in uncreative persons?" Runco and colleagues did exactly this. They then constructed two indices in the ratings obtained from mothers, fathers, and children. One was indicative of creativity and one contained contraindicative items. These showed good agreement among the groups. In particular, the indicative index of the mothers was positively related to that of the fathers, but negatively associated with both the mothers' and the fathers' contraindicative ratings.

In one study of personal explicit theories, Runco and colleagues asked creativity researchers to rate behaviors that were the most important for recognized creative achievement. Motivational behaviors received the highest ratings, with problem finding and questioning skills rated next most important, and adaptive cognition the third most important. The researchers were also asked about developmental influences on creativity. Here education and learning received the highest ratings, with Cultural and Social Factors and Family and Early Background receiving lower ratings. The final question to the researchers asked about important topics for future research. The rankings of these indicated that actual creative behavior, motivation and drive, imagery, imagination, and creative products are of critical interest.

Interestingly, the differences in the ratings of researchers who had experience teaching creativity courses and those who

had published a book or article, and of those who had not, were very slight. Additionally, only slight group differences were found for ratings of important research topics. There were a few differences in the interests (i.e., writing and music) of the researchers which were related to selected ratings of creative achievement variables and important research topics.

Conclusions

Even with some group differences (including those implied by a comparison of characteristics across studies), there is some consensus about certain correlates of creativity. The characteristics Artistic, Capable, Clever, Curious, Imaginative, Individualistic, Intelligent, Wide Interests, Inventive, Original, and Resourceful are the most commonly recognized, for example. In a sense, these may be considered the core characteristics of the creativity complex.

The inclusion of Intelligence in that list may come as a surprise. Yet it may be that creativity does require some basic information processing skill. The relationship between creativity and intelligence is often described as a threshold, with some of the latter necessary for the former, but beyond a low level, the two are unrelated.

Alternatively, it may be difficult to justify the inclusion of Intelligence in the implicit theories of creativity. It suggests a lack of discriminant validity (creativity being just another sign of intelligence). This is, however, an inherent feature of

implicit theories: They differ from explicit theories. Moreover, explicit theories may not be able to justify implicit theories. If they could, there would be no reason to examine implicit theories. As it happens, implicit theories of creativity do differ from explicit theories in several ways, and they should be examined and respected. They tell us how people in the natural environment really think about creativity.

See also: Divergent Thinking; Intelligence (as Related to Creativity).

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Improvisation

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Glossary

Commedia Dell'arte A popular form of theater in Europe in the sixteenth through eighteenth centuries. Although the basic plot was worked out in advance, most of the dialogue was improvised on stage.

Ethnography of speaking A branch of linguistic anthropology that studies the improvisational creativity of folklore performers.

Method acting A type of theater rehearsal that requires the actor to improvise a character's behavior, as a way of better understanding the character's psychology.

Developed in New York City, method acting was based on the theories of Russian director Konstantin Stanislavsky.

Motivic improvisation In musical improvisation, the use of a set of motifs – melodic fragments between 4 and

10 notes in length – as the basic building blocks of an improvised melodic line. The same motifs may be used in many different songs, resulting in improvisations that have no necessary relationship to the original melody.

Oral tradition In contrast to written tradition. Oral tradition includes all of the performances that are important to a society but are not written down. Oral tradition is particularly important in nonliterate societies, and can include religious rituals, stories, jokes, political oratory, and theater.

Paraphrase improvisation In musical improvisation, an elaboration of a basic melodic line, using embellishments or rhythmic changes, such that the original melody remains recognizable.

Introduction

Since the 1950s, creativity researchers have focused on product creativity – the creativity that results in the masterpieces of Western art, or the grand theories of science. Improvisation is a relatively new topic for creativity research, only beginning to receive attention in the 1990s. Two unique characteristics of improvisation have led to this increased focus.

First, in most creative domains, the creative process results in a *product*, such as a painting, a scientific article, or a musical score. Unlike product-oriented creativity, the goal of improvisational performance is to entertain an audience by exposing them to the creative process itself. Because the performance is live, in front of an audience, there is no opportunity for reflection or revision in the creative process. The audience observes the creative process in action. In a sense, the creative process is the creative product.

Second, almost all improvisations are performed by an ensemble, and require collaboration among all of the performers. For example, in a small jazz group with four to six musicians, no one musician can control or conduct the performance. Instead, all of the musicians have to listen closely to one another, responding to each other in a give-and-take that many jazz musicians call a 'conversation.' A jazz performance is a collaborative, group improvisation. Improvisational theater is also an ensemble art. An improvisational theater troupe typically has between five and eight actors. During a scene, no single actor takes on a director's role and guides the performance. Instead, the dialogue is collaboratively created, from line to line, as the actors respond to each other's words on the spot. Like jazz, improvisational theater is a collaborative, group improvisation.

These two unique characteristics make the study of improvisation potentially valuable for the study of creativity more generally. For example, improvisation gives the researcher an opportunity to observe the creative process in action, potentially providing insights about the creative process more generally. In creative domains that result in creative products – like art and science – the creative process usually takes place in isolation, in a studio or a laboratory. It can take months or years before the final product is completed. This isolation and the long time period make the creative process difficult for researchers to study directly. But with improvisational performance, the creative process occurs on stage, in front of the audience.

In addition, because collaboration is central to improvisational performance in both music and theater, improvisational performance can help creativity researchers understand how collaboration influences the creative process in all domains. For example, most modern scientific laboratories involve the efforts of many top scientists, Ph.D.-level researchers, and graduate assistants. Conducting a scientific experiment is a highly collaborative endeavor. In a broader sense, an entire scientific discipline evolves and grows as a result of collaborations – ideas and theories published, rejected, and elaborated in the pages of journals, constant emails across the country among leading researchers, grant proposals accepted, edited, and revised by committees of experts in Washington. Although the collaborations of stage performers are obviously very different, some aspects of improvisational performance may be common to all collaborations.

In recent European history, improvisational performance is relatively unusual, because our performance traditions have emphasized the composer and the playwright. In Western music, we have a long tradition of scored music – written by

a composer and later performed by a professional musician. This tradition extends at least back to the medieval period. In Western theater, we have an even longer tradition of scripts that are written by a playwright and then later directed and performed by professional actors. Since the nineteenth century, all of our serious, high-art performance forms have been scored or scripted, and improvisational performance has generally been associated with uneducated or rural subgroups. Examples include the fiddle dances of Ireland and the blues and jazz of African Americans. Partly because of these cultural and economic associations, improvisational performance has faced an uphill battle to gain respect in mainstream culture.

The current predominance of scored music and scripted theater makes it hard to imagine a time when *all* performance was improvised. But of course, this was the case at the beginning of human culture, when writing systems had not yet been developed. The idea that a composer would write down a score for later performance is a relatively recent innovation in human history. Yet, human societies have always had musical and ritual performances, *oral traditions* that were passed from one generation to the next. And until at least the late medieval period, many European actors remained illiterate, and stage performances retained improvisational elements.

Theater Improvisation

All modern theater is rooted in ancient, prehistoric ritual performances. These performances, since they predate literacy, were essentially improvisational. Of course, some rituals are more structured and repetitive than others; nonetheless, all rituals that are not scripted display variation from one performance to the next. Contemporary anthropologists, who study verbal ritual performance around the world, have documented variations even in the most sacred rituals. For example, in many performance traditions only experienced elders have acquired the skills required to speak at important rituals. But even after a lifetime of performing prayers, incantations, and sermons, an examination of different audiotapes always shows differences between performances.

These observations have led to a revolutionary change in the way that folklorists conduct their research. For decades, until the late 1970s, folklorists were primarily concerned with discovering traditional folklore – stories, prayers, jokes, games, songs, dances – and transcribing the words as they were told or sung. In many cases, there was a very real concern that this folklore would die along with the sometimes elderly people who were the only performers.

But there was always a problem with the approach of trying to identify *the* correct, official version of a song or a story. The problem is that these traditions are *oral traditions*; they are almost never written down. Every performance of a North Carolina tall tale or an Appalachian fiddle tune is a little different. Folklorists initially viewed this as an annoying problem. Their goal was to write down the correct version of the story, ritual, or game, but each time they observed a performance, it was different. In the 1970s, a branch of linguistic anthropology, called the *ethnography of speaking*, began to accept that oral traditions are not fixed and verbatim, like the performances of a literate culture. Instead, these anthropologists

realized that oral folklore is an improvised tradition. Trying to identify the source text was no longer the goal. Instead, these researchers began to study the improvisational creativity of the performer, and began to emphasize the ways that folklore was a living, practiced tradition.

History in Europe

These realizations have recently begun to change the way early European theater is analyzed. Modern theater is often traced to a popular form of entertainment, called the *commedia dell'arte*, a partially improvised genre of plays originating in sixteenth-century Italy and thriving for the next 200 years throughout Europe. The *commedia* is a classic example of an oral performance tradition. Theater historians have long guessed that the early actors were not literate, and no one has ever found a script for a *commedia dell'arte* performance. Instead, what historians have found are rough outlines of plot, with brief descriptions of the characters. The actors could easily memorize these rough outlines, called *scenarios*, but all of the dialogue was improvised in front of the audience. The success of a *commedia dell'arte* performance depended on the actor's improvisational creativity.

The improvisations were guided by the scenario, which specified the characters of the play, an outline of the plot, the order of entrances and exits and the action for each scene, and summarized important conversations and monologues. These scenarios always used the same stock characters, and each character was always performed by the same actor. This allowed the actor to refine his performance, and allowed him to develop portions of speeches and dialogue that worked well. Each actor memorized particularly successful monologues, called *lazzi*, that he could fall back on if necessary.

Commedia is the kind of theater one would expect when most actors are unable to read. Even though many things are decided in advance, this early form of improvisation displays the key features of all improvisation: The dialogue is not scripted, but is improvised anew in each performance; and the performance is collaborative, with the final performance emerging from the creative improvisations of many actors.

Literacy became more widespread in Europe during the same years that improvisation was fading out of our performance tradition. Over the 200-year period that *commedia dell'arte* was popular, literacy became much more common among actors, and the scenarios developed into more highly scripted plays. By the nineteenth century, this form of early improvisation had been largely replaced by scripted theater.

In an interesting parallel development, during the same period, improvisation became less and less accepted in musical performance, as well. Composers began to write much more detailed scores, leaving less room for embellishment and improvisation. Musicians were expected to stick to the score, and improvisation was restricted to an optional *cadenza* at the end of a piece (see below). The influence of increasing literacy on these changes has recently received increasing attention from historians, literary theorists, and psychologists.

Recent History

Character improvisation was an important rehearsal technique for the Russian director Konstantin Stanislavsky. In character

improvisation, actors improvise a monologue, going beyond the script to better understand the character. Influenced by Freud's psychology of the unconscious, Stanislavsky taught his actors to emphasize the feelings, moods, and expressions of a character, so that the performance would seem more authentic. Stanislavsky called this new technique *psychological realism*. Stanislavsky's techniques have been influential for decades, leading to *method acting* and the *New York school* of actor training. Many contemporary theater and movie directors use character improvisation. But these improvisational techniques are used only in the privacy of rehearsal.

In a parallel development in France, the influential director Jacques Copeau began to transform French theater by drawing on improvisation and by reviving the techniques of the *commedia dell'arte*. His vision for *la comédie nouvelle* (the 'new comedy') was based on improvisation, and his innovations in training and directing influenced almost every modern theater group, including those in England and the United States. In 1913, Copeau was the first to use semi-structured *improvisational games* in rehearsals, drawing on his insight that children's games are fundamentally improvisational.

The first theater to improvise dialogue on stage was the 'Theater of Spontaneity,' created by Moreno in Vienna in 1923, and which performed to rave reviews in New York a few years later. Despite Moreno's initial success in New York, this innovation did not catch on. Contemporary American improvisational theater – using many techniques originated by Moreno in the 1920s – are usually traced to Chicago in the 1950s. In addition to Moreno's techniques, Chicago-style improvisational theater drew on a series of games developed for children's peer play. These games were developed by a drama teacher, Viola Spolin, in the 1930s and 1940s. Her son, Paul Sills, used these games to found the first improvisational comedy group, The Compass Players, at the University of Chicago in 1955. The Compass later evolved into the well-known improv group, The Second City, the model for the popular TV show *Saturday Night Live*.

Classic Chicago improv performances begin with the stage lights up and the ensemble standing on an empty stage. They ask for a suggestion from the audience – a location, a relationship, a problem. After repeating the suggestion to be used, the actors immediately begin improvising a dialogue based on the suggestion. Nothing is planned in advance – they develop characters, plot lines, and dramatic tension as they go along.

Since its origins in the 1950s, improvisational theater has grown dramatically in Chicago and in other urban centers. With this growth has come a remarkable variety of styles and approaches to improvisation. These styles can be grouped loosely into two main approaches. The most well-known groups perform short *games*, five minutes or less, which start from one or two audience suggestions. There are dozens of different games widely used by improvisational ensembles; each game is distinguished by a unique set of constraints on how the performance will proceed. A common game is Freeze Tag.

After asking for an audience suggestion, perhaps a location or a starting line of dialogue, two performers begin to improvise a scene. The actors accompany their dialog with exaggerated gestures and broad physical movements. The audience is instructed to shout 'freeze' whenever they think the actors are in interesting physical positions.

Immediately, the actors must 'freeze' themselves in position. A third actor then walks up to these two and taps one of them on the shoulder. The tapped actor leaves the stage, and the new actor must take his place, in the same position, and then begin a completely different scene with her first line of dialogue, playing on the ambiguities inherent in the physical relationship of the frozen actors.

A second style of performance is referred to as *long-form improv*. The ensemble asks for an audience suggestion, and then begins to improvise a one-act play which typically lasts for 30 minutes without interruption. These performances often are so good that many audience members assume a script is being followed. Yet this is never the case with authentic improv groups. The actors work very hard to avoid repeating even brief segments of a performance from a prior night. Long-form improv is less focused on comedy than are game performances, instead focusing on character and plot development.

Using Improvisation to Develop Scripts

Many directors and playwrights have begun to use ensemble improvisation in their rehearsals, as a way of collaboratively developing new script ideas. Their belief is that by freeing the natural creativity of the actors, a more believable drama can result. They also believe that the 'group mind' is capable of creative innovations that may be more inspired than even the most creative playwright's imagination.

There are two parallel traditions. In Britain, the director Mike Leigh has been using improvisation to develop plays since the mid-1960s. He later shifted to movie producing, and his innovative technique has led to several award-winning and popular movies. For example, his 1996 film 'Secrets and Lies' won the Best Director award at the Cannes film festival.

In 1959, The Second City theater formed in Chicago, and from the beginning they used improvisation during rehearsal to develop their comedy scripts. Although this group originated live improvisation, today their shows consist almost exclusively of scripted sketch comedy. However, they continue to teach and use improvisation as a technique for developing comedy scripts.

Conclusion

In conclusion, improvisation has always been an important component of theater performance. In a preliterate era, in the early roots of European theater, improvisation was a necessary skill for any performer. And since Stanislavsky and Copeau transformed modern theater, improvisation has become more and more central to theater training and performance. In historical perspective, the last few centuries of European theater have been perhaps the least improvised theater performances that any society has ever created.

Musical Improvisation

For most of history and in all cultures, musical performance has been improvised. The style of musical performance that has been predominant in the West for several centuries – European art music like the symphony, which is elaborately

scored by a composer and then performed by noncomposing musicians – is found in only a few cultures. A partial list of musical traditions in which improvisation is a key element would include, at a minimum, many genres of Indian music, the Arabic *maqam*, the Persian *dastgah*, African drum ensembles, Indonesian gamelan, flamenco, European baroque and organ music, American jazz and rock, and folk musics throughout Europe. In fact, almost all of the world musics that have been documented by ethnomusicologists and folklore researchers contain elements of improvisation. Nonetheless, most of Western musicology has focused on composition and written scores, and performance as a whole has been neglected.

Certain stereotypes follow from this bias toward composition: improvisation is spontaneous, primitive, and natural; composition is calculated, sophisticated, and artificial. For example, a common misconception about improvisation is that the performers are playing without any preparation. But there is always some musical structure, and ‘improvisation’ can refer to many different types of music, ranging from relative freedom to relative fixity. For example, many people think that jazz musicians simply play whatever comes into their heads, in contrast to the years of training and practice that classical musicians go through. Recent research, by psychologists and musicologists both, has demonstrated what jazz musicians have known all along: playing jazz well takes a lifetime of learning, and requires discipline, rehearsal, and preparation.

Only a few cultures have the ‘composer – score – performer’ division found in Western music. A relatively small percentage of musical traditions use any notational system. Even in musical traditions that have notational systems, the written notations are often only rough guidelines for a performance, with the expectation that a trained performer will improvise on the basic form of the piece. And in many musical traditions, these notations are not composed by anyone – they are transcriptions of traditional pieces that have been performed for generations.

Even early European composers did not have to write down every note, because they could assume that all performers were talented improvisers. Improvisation flourished in the music of the Baroque period. For example, most Baroque scores used a partially improvised system known as *basso continuo*, with a notated bass line and chords. The keyboard player was expected to use this shorthand notation to improvise the accompaniment. Along with this improvised accompaniment, the solo instrument that performed the melody was also expected to employ extensive variation and ornamentation of the written score. Even after the Baroque period, improvisation survived in the *cadenza*, a short section at the end of a movement where the composer would indicate that the performer should improvise. This provided the performer with an opportunity to demonstrate virtuosity. Improvisational and compositional creativity often went together – many famous European composers were also talented improvisers, including Mozart, Bach, Handel, and Beethoven.

Musicologists distinguish between two types of improvisation. The first is *paraphrase improvisation*, the ornamental variation of a written melody, such that the melody remains recognizable. The performer is allowed only minor *embellishments* on a standard

melody, and the variations that are allowed are limited in number and must be placed in certain standard parts of the melody. An example of improvised embellishment is the performance of the melody of a Baroque composition, where the performer was expected to vary and embellish the written melody.

In paraphrase improvisation, we often say that the performer is *improvising on* the basic song. Although the song remains recognizable, each performance is clearly unique and different. But it turns out that not all cultures share this idea of improvisation; in some traditions that use extensive embellishment that we would call paraphrase improvisation, musicians of that tradition feel that they are performing the ‘same song’ each time, even though tape recordings clearly show the differences. The ethnomusicologist Bruno Nettl wrote about a Persian *dastgah* performer, who was asked to comment on the differences between two performances of the same *dastgah*. He denied there was a difference. When the researcher played the two tapes for him, pointing out the differences, the musician admitted the differences, but claimed they were not significant – that the essence of the song was the same. It seems that different musical traditions have different concepts of ‘sameness.’ These differences could be related to musical literacy – with our notational system, we believe that ‘the same’ means note-for-note verbatim.

In the second type of improvisation, *motivic improvisation*, the musicians arrive at the performance with a repertory of patterns – called *licks* or *motifs* – stock phrases that the musicians then combine and draw on in each of their song performances. The set of patterns can be specified by the musical tradition, or may be the shared repertory of a single group or a single musician. For example, the jazz saxophonist Charlie Parker created his own repertory of about 100 motifs, each of them between four and ten notes in length. In Javanese *gamelan*, a much smaller set of motifs is specified by the musical tradition, and the same patterns are used by many different groups.

In motivic improvisation, the creative challenge for the performer is to artfully weave together the motifs, molding them into a coherent whole. Different traditions vary in the rules for combining motifs, and in the degree of melodic creativity and variation that performers can use to connect motifs. Charlie Parker typically improvised completely new melodic material in between his standard motifs; the Javanese *gamelan* performer is not permitted to insert any new material, but must use only the motifs specified by the tradition.

Within a culture’s musical tradition, the motifs and their style of combination tend to be similar in both composed and improvised performance. Typically, the set of motifs used in a culture’s improvised performances is less extensive than that same culture’s composed music.

In the United States today, musical improvisation is almost exclusively associated with blues and its descendants, jazz and rock. These are all examples of motivic improvisation. American jazz is one of the most highly developed genres of improvisation; musicians must go through years of intensive training and apprenticeship. Many do not reach their peak until middle age, with decades of performing experience behind them. Jazz requires of the performer a deep knowledge of complex harmonic structures, and a profound familiarity with the large body of *standards* – pieces that have been played by jazz

bands for decades. Standards are typically based on the 32-bar pop song, with four subsections of 8 bars each. Usually one or two of the 8-bar sections is repeated, resulting in song forms such as 'aaba,' a song where the first 8 bars are the same as the second and fourth 8 bars. A standard is outlined on a *lead sheet*, a shorthand version of the song, with only the melody and the chord changes written. None of the musicians' parts are notated explicitly; all of the musicians have to improvise their own parts, around the outline that is represented by the lead sheet. After playing through the verse and chorus once or twice, the band then moves into the improvisational portion of the performance, taking turns soloing over the basic song form. Although these ensemble improvisations can diverge dramatically from the original melody, all of the players in a virtuoso ensemble remain connected to the basic outline of the song.

There are other ways that preparation helps to structure a jazz performance. Most jazz performers use private rehearsals as an opportunity to develop *licks*, personal motifs that can be inserted into a solo for a wide range of different songs. Still, the choice of when to use one of these motifs, and how to weave these fragments with completely original melodic lines, is made on the spot. In group rehearsals, jazz groups often work out ensemble parts that can be played by the entire band at the end of a solo. If listeners have never heard the musician or the band before, they will generally not be able to detect which portions of the song are completely new that night, and which portions have been rehearsed or played before.

These examples reveal an important property of all musical improvisation: no performer ever makes up everything from scratch every time. There is a constant balance between preparation, tradition, and spontaneous creativity. No matter how spontaneous it sounds, there is always some structure that holds the performance together and guides the musicians. The completely spontaneous creation of new forms through free improvisation, without any preexisting framework, is quite rare in jazz and worldwide. Even the least-structured genre of jazz, called *free jazz*, often depends on themes, motifs, and other prearranged schemes such as the sequence of soloists.

Anthropologists have studied performance genres from around the world, and have found that there is no sharp line between completely scripted performance and completely free improvisation. Even cultures that have no notation system for music often have multiple genres of performance, each defined by style, rhythm, and melodic regularities. Most cultures have genres that are quite rigid, and are supposed to be performed essentially the same way each time, as well as other genres that are extremely open to improvisational creativity, even demanding improvisation from the performers. Cultures with a range of genres include the Plains Indians, various Eskimo tribes, and Yemeni Bedouins. In these cultures, musicians and nonmusicians alike are quite aware of the different types of creativity required in each genre. The more structured genres generally require more preparation and memorization; the more improvised ones require more spontaneous skill. The worldwide existence of highly structured musical genres suggests that 'composed' songs predated the first invention of written notation, although the origin of these traditional songs will never be known.

Jazz demonstrates almost all of the characteristics of improvisation. First, it depends on a complex balance of structure and free improvisation. Second, jazz is an ensemble art form. Perhaps the defining feature of jazz is the musical conversation on stage. Each musician must listen intensely to the other members of the band, both to coordinate with them, but also to draw inspiration from their last melodic phrase or rhythmic pattern, and to incorporate those musical statements into their own evolving part. In the best jazz performances, this conversation results in a constant give and take between the musicians. A collaborative performance emerges from the improvisations of all of the musicians working together, a performance that no one musician could have controlled or predicted.

Summary

Improvisation is present in all creativity. For example, a painter is constantly responding to his canvas and oils as he is painting. More importantly, each step of the painting changes the artist's conception of what he is doing – the first part of a painting often leads to a new insight about what to do next. Fiction writers are constantly interacting with the story as they write. A character or a plot line frequently emerges from the pen unexpectedly, and an experienced writer will respond and follow that new thread, in an essentially improvisational fashion. Most television comedy writing is collaborative and improvisational, with plot twists and bits of dialogue emerging during discussions with a writing team.

Improvisation is most essential in performance creativity, because unlike the painter or the writer, performers do not have the opportunity to revise their work. Where the improvisations of the painter can be painted over or discarded, and the writer has the power of a word processor to generate the next draft, the improvisations that occur on stage are exposed to the audience. As a result, the audience observes the creative process in action, sharing in every unexpected inspiration, but also in those disappointing attempts that fail. Even the most famous artists often destroy or paint over a significant number of their canvases, but these aborted attempts are generally lost to history, and not available for study. Improvisational performance is the creative process made visible, and as such it can teach us about the creative process in general.

The collaborative nature of improvisational performance also makes it a promising field of study for creativity researchers, because collaboration is important in most creative domains. In a biographical and interview study of creative partnerships, Vera John-Steiner demonstrated the ways that collaboration enhanced creativity, in fields as different as physics, writing, and dance. Michael Farrell demonstrated the important role played by creative circles in many artistic fields, including nineteenth century French impressionists, the Fugitive poets, and the Inklings, the British group that included novelists J. R. R. Tolkien and C. S. Lewis. Keith Sawyer demonstrated the improvisational nature of the collaborations behind many business, scientific, and technological innovations. These collaborations range from the group work that goes on in the laboratory to informal conversations over late-night coffee.

In business teams, innovation often emerges from collaborations that are essentially improvisational – in that the team does not know in advance where their creative discussions will lead. Gay Lemons studied seven individuals who had used improvisational techniques in business policy, early childhood education, jazz and dance, as well as improv theater. She found several central elements of improvisation across these domains that paralleled creative thinking more generally: communication, teamwork, emotional expression, challenge, safety, self-actualization, and joy. The creative interactions of a jazz or theater group are much easier to study than many of these other collaborations, since the analyst can hear and transcribe how this interaction affects each performer's creative process. Studying improvisational performance could potentially help creativity researchers better understand all group collaborations.

Modern European performance traditions have been the least receptive to improvisation of all the world's cultures, and this bias against improvisation is found in both the theater and musical communities. Improvisation has often been considered to be a less refined, 'popular' or 'folk' genre, and all of these terms tend to devalue improvisational creativity, relative to composed or scripted performance. Because most creativity researchers are also European, they have tended to focus on these more highly valued performance genres. As anthropologists, ethnomusicologists, and cross-cultural researchers begin to join in the study of creativity around the world, improvisation will become an increasingly important part of the field of creativity research.

See also: Acting; Collaboration; Dance and Creativity; Music; Theater.

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Incubation

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Glossary

Fixation A persistent block to memory or problem solving.

Illumination A sudden unexpected insight into a problem solution.

Implicit Without conscious awareness.

Incubation A temporary break from creative problem solving that can lead to insight.

Insight A deep understanding that sometimes occurs all at once.

Mental set An approach to solving a problem that causes fixation.

Set-breaking Discarding a fixating mental set, using a new approach.

Historic Cases of Incubation

Of the many celebrated anecdotes that describe historically important ideas that appear to have been the result of incubation, it is sometimes difficult to separate fact from fiction. Nonetheless, there is an interesting consistency among these stories, threads, or elements that resonate with commonplace experiences of ideas that seem to flash spontaneously into mind, unheralded by a succession of incremental steps, and that seem to occur outside of the typical workplace. For example, there is the story of Archimedes, a great mathematician, who was trying to determine the volume of a highly irregular solid, namely, the crown of his cousin, King Hiero of Syracuse. Archimedes began as most of us might, trying to reduce the volume into set of regular solids, such as sphere or rectangular block, but after many long and fruitless hours, he found that task to be impossible. Importuned by his friends to go to the baths, he went to the public baths, leaving the problem behind – or so he may have thought. As he lowered himself into the bath water, Archimedes realized that the water his body displaced was equal to the volume of his body; therefore, the crown's volume could be determined by measuring the volume of water it displaces when submerged – the displacement principle. Archimedes is said to have raced through the streets when he realized his discovery, naked from the bath, shouting, "Eureka! I have found it!"

Henri Poincaré, the brilliant polymath who made important contributions to mathematics and physics, and whose work served as the foundation for the theory of relativity and chaos theory, had at one time been working on a problem dealing with Fuchsian functions. At an impasse for many days, Poincaré was stepping onto a bus on a vacation when he suddenly realized that these functions were the same as another set of transformations in non-Euclidean geometry, an insight that allowed him to solve the problem that had him stumped. Once again, it is noteworthy that the sudden unexpected insight did not occur when Poincaré was at work on the problem, but rather occurred when he was away from the task. This is a hallmark of incubation effects. Other famous historic cases of incubation effects include Kekulé, whose insight about the ring-like structure of benzene supposedly came while he was dozing

before a fireplace, Nobel Laureate Kary Mullis, whose insight about the polymerase chain reaction (PCR), a method for replicating and amplifying DNA, came to him as he was driving along a highway one evening, and NASA engineer James Crocker, whose insight about how a spacewalking astronaut could repair the Hubble Space Telescope occurred while he was taking a shower during a break. These historically significant anecdotes, and many others, serve as an important backdrop for the understanding of this mysterious phenomenon, and they may provide important clues as to the causes of incubation.

Mundane Incubation

Because of the impressive nature of historic cases of unexpected illumination, or incubation effects, people usually associate the phenomenon of incubation with insights of larger-than-life qualities. It doesn't take a lot of self-monitoring, however, to begin noticing cases of incubation effects in everyday life. Mundane types of problems, whether they deal with one's home, relationships, work, or recreation are often facilitated by taking a break from the problem, especially if solutions to these everyday problems are not found during one's preliminary attempts to solve the problems.

Theories of Incubation

Because people have recognized their own unexpected moments of inspiration throughout history, there has been a historical progression of explanations of incubation effects [Table 1](#). Since classical times, the notion became popular that magical spirits called the *Muses* visited individuals unpredictably, through their minds, provoking unexpected inspirations for amazing and new creative ideas. These inspirational Muses, conceived as sisters, were entities external to the people visited by these magical beings. A genius, according to this view, was not someone with a personally powerful intellect, but rather someone with the luck to have a Muse who lived close by.

As knowledge supplanted magical explanations, the notion of an unpredictable and inexplicable inspirational power

Table 1 Theories of incubation effects

Conscious Work	Intermittent conscious work during the incubation period.
Recovery from Fatigue	Recovery from fatigue built up during the preparation period of problem solving.
Forgetting Inappropriate Mental Sets	Inappropriate initial strategies and responses are forgotten over time or with changes in one's mental set.
Remote Association	Unusual responses emerge because common responses have been exhausted.
Opportunistic Assimilation	Remaining sensitive to information related to unsolved problems, one assimilates chance environmental events into problem solving during the incubation period.
Unconscious Work	Associations made among ideas in one's unconscious or recognized in spontaneous environmental events.

shifted from something external to an internal ability of individuals. A creative genius was a rare individual with inexplicable mental powers. Most people believed, and many continue to believe that creative genius reflects a special personal mental power, an incomprehensible ability, and probably not subject to scientific examination.

Changes in this view can be traced to a scientific description of the process of creative problem solving by Wallas in 1926. According to Wallas, the process of solving creative problems began with *preparation* (materials, knowledge, and information seemingly relevant to the problem are fore-grounded, and common approaches and solutions are examined), followed by *incubation* (following an impasse, or fixation, the problem is put aside), then *illumination* (a sudden inspiration or insight, the 'aha' experience), and finally, *verification* (checking the efficacy of the insight). For the first time, a logical sequence of cognitive states and operations, rather than an inexplicable magical force, was used to describe the experience of unexpectedly realizing the solution to a problem. On the one hand, this list of problem solving stages was an important step forward in terms of explaining this mysterious phenomenon. On the other hand, the term was not clearly explained, and the use of the expression *incubation* has been a drawback in terms of understanding the phenomenon.

Unconscious Work

The very term *incubation* implies both a phenomenon that people experience, and a mechanism for what causes the observed experience. This is an unfortunate conflation because, although there is ample evidence that the phenomenon actually occurs, there is little or no evidence for the mechanism that many people suppose is the cause of incubation effects. *Incubation* refers to an artificial means of supporting the development of a fragile developing system, such as the development of an infant born before reaching full term, or an egg after being laid (e.g., by a hen) before hatching. When an egg farmer places a freshly laid egg in an incubator, the unseen insides develop, bit by bit, out of sight, until at long last, miraculously, a live chick emerges where once had been only albumen and a yolk. This unseen development has served as an analogy for the notion that unconscious processes in the mind develop insightful ideas bit by bit, out of sight of the conscious

mind, until at long last, miraculously, an insight emerges into consciousness. The analogy is a compelling one; unfortunately, there is no scientific evidence that unconscious cognitive processes autonomously put together the necessary steps for the emergence of an insightful idea.

Opportunistic Assimilation

The *opportunistic assimilation* hypothesis is, in part, a variation of the *unconscious work* explanation of incubation effects. This explanation has multiple components. First, it states that when someone has repeatedly tried to solve a problem, but experienced repeated failures, then that person's cognitive representation of the problem becomes *sensitized* to stimuli in the environment that are related to that unsolved problem. That is, the unsolved problem gathers enough mental energy that, although it is not activated enough to be consciously on one's mind, it is just barely below the threshold of conscious awareness. This sensitization is the result of emotional experiences associated with repeated failures, such as frustration or desire. The next component of this explanation is the random or serendipitous encounter one has with a stimulus in the environment that is related to the eventual solution to the unsolved problem. When, by blind luck, one stumbles across a related stimulus, it triggers activation of the sensitized problem, bringing it to conscious awareness. Now, when the relevant stimulus is apprehended and considered in association with the unsolved problem, it can be used as a helpful hint that provides insight into a possible solution to the problem. Thus, one can opportunistically assimilate this serendipitously encountered hint with the unsolved problem, yielding a novel solution to the problem.

Conscious Work

Another explanation of incubation effects is the *conscious work* hypothesis. This rather mundane, yet plausible idea is that people spend periods of time consciously working on unsolved problems, yet people forget those episodes of work, even though the progress on the problem has advanced. Eventually, enough piecemeal progress on the problem is made that a final step brings one to the solution. Because the previous episodes of conscious work are forgotten, realization of the solution comes as a surprise, and the problem solver may attribute their progress to unconscious processes. This type of explanation is referred to as *incremental*, because progress toward the solution is made in discrete increments or steps.

Recovery from Fatigue

A different explanation of incubation effects is the *recovery from fatigue* theory. This rather straightforward idea states that when people are fatigued, their tired minds are not up to the task of solving a difficult problem. After a break, they are mentally refreshed, and better able to solve difficult problems. This clear explanation has some support; clearly refreshed minds will be better able than tired ones to solve difficult problems. On the other hand, many experiments have controlled for mental fatigue, and have shown that neither fatigue, nor relief from fatigue are necessary for incubation effects to occur.

Forgetting Fixation (also, Set-Breaking)

The *forgetting fixation* theory of incubation effects, also known as the *set-breaking* theory, takes a quite different approach from most explanations of incubation. Whereas most theories focus on what processes can add to one's progress and bring a problem solver closer to a solution, the forgetting fixation theory focuses on how a problem solver can disengage from counterproductive activities. Forgetting fixation is a type of creative destruction; that is, this theory posits that for incubation to help, one must destroy or abandon work on unproductive ideas. This explanation states that incubation periods do not really have the effect of moving the problem solver in the right direction; rather, such breaks allow the problem solver to stop moving in the wrong direction.

Fixation refers to a block or impediment to successful problem solving, usually because one is stuck on inappropriate ideas or problem solving approaches that are doomed to fail. *Set* refers to a readiness or preparedness to do something, as in the phrase 'ready, set, go!' One can be set to remember an episode from one's past, set to perceive an ambiguous picture in a certain way, or set to solve a problem with a particular mental strategy. The last of these has been referred to as a *mental set*, such as a series of mathematical operations for solving a certain type of problem. A mental set can be very useful and efficient when one is solving many problems that can be solved with the same set of operations; in such circumstances, one can mindlessly reapply the same formula, again and again, using little mental effort. The upside of mental sets is that it is economical in terms of mental resources, freeing such resources to be used on activities other than solving repetitive problems. The downside of using mental sets is that they can prevent people from seeing more elegant solutions to problems, and worse, their mindless and automatic use can prevent people from solving problems that require creative solutions.

The forgetting fixation theory attributes incubation effects to cases in which time away from unsolved problems allows people to break out of fixating mental sets; hence, the term *set-breaking*. A mental set is a type of cognitive structure, consisting of a collection of operations that are automatically reapplied to new problems. This automatic engagement of mental operations is referred to by cognitive psychologists as *implicit*, which means a cognitive process that occurs without conscious awareness, such as a habit or a skill that has been acquired through practice. The implicit use of a mental set can occur because the set was used recently, frequently, and/or if the set was previously associated with the same context in which a problem occurs. If the implicit use of a mental set is caused by recent use of that set, then time away from the problem may help one forget that set of mental operations. If the engagement of a mental set is due to its association with a particular context, then changing contexts might likewise facilitate forgetting to use the fixating mental set. In either case, time away from a fixated problem, particularly if one shifts contexts, might lead to an incubation effect by helping the problem solver forget and break out of the fixating mental set.

When simplified, the logic of the forgetting fixation explanation is very compelling. A problem can be classified as one of three types: (1) a problem can be immediately solved by the

problem solver; (2) A problem can never be solved by the problem solver; or (3) a problem potentially can be solved, but it cannot be immediately solved. Only problems of the third type are candidates for incubation effects. Therefore, one might ask what makes a problem of the third type difficult or impossible to solve in one's initial attempts? A likely answer is *fixation*, that is, a cognitive impediment to successful completion of a task. Therefore, forgetting fixation, or at least temporarily keeping incorrect answers and inappropriate approaches out of mind, can cause an incubation effect, facilitating resolution of unsolved problems by escaping from counterproductive efforts.

Empirical Research on Incubation Effects

For decades, many popular psychology books, as well as introductory psychology textbooks cited the dissertation experiments of Silveira in 1971 as evidence that incubation is a real phenomenon. Few of these references, however, noted that only one of Silveira's two reported experiments found a reliable effect of incubation, and that experiment was never replicated by another scientific study. When Olton reviewed all of the published experiments that studied incubation in 1979, he found no reliable, replicated evidence of the effect, numerous failures to find incubation effects, and furthermore, Olton presented a new experiment that also failed to document an incubation effect. Thus, early attempts to study incubation effects scientifically were not particularly reliable, making the phenomenon seem more like a mythical fantasy than a real phenomenon.

Forgetting Fixation Research

The first replicated experimental findings of incubation effects to be published were reported by Smith and Blankenship in 1989, who used the forgetting fixation theory to guide their experimental methodology. These experiments, and many others to follow, found that if fixation is experimentally induced, then incubation periods reliably relieve this experimentally caused fixation (e.g., Kohn and Smith, 2009, 2010; Smith and Blankenship, 1989, 1991; Vul and Pashler, 2007). In these published experiments, fixation was induced before people had their initial attempts at problems. Typically, the experimental participants are presented with information that deceptively resembles problem solutions, but which are really wrong answers.

These scientific studies show that incubation effects are likely to occur for people who are fixated. That is, when problem solvers are stuck on wrong answers and inappropriate approaches, taking a break from the problem increases the likelihood that the solution will be discovered. On their own, problem solvers might find themselves fixated on inappropriate solutions to a problem. The key to these experimental studies of incubation, however, is to experimentally cause fixation. That way, it is much more certain that experimental participants will experience fixation. Following the experimental induction of fixation, we can be more certain that periods of incubation, where the problem is temporarily put aside, will help forgetting the initially induced fixation.

An example of forgetting fixation experiments from Smith and Blankenship in 1991 can help illustrate this experimental methodology. Smith and Blankenship showed their participants numerous Remote Associates Test (RAT) problems. Each problem consists of three words, such as *APPLE – HOUSE – FAMILY*. The problem can be solved by thinking of a single solution word that forms a common two-word phrase or a compound word when that solution word is combined with each of the three problem words. The solution to the example problem is *TREE*, which links to each of the three problem words: *APPLE–TREE*, *TREE–HOUSE*, and *FAMILY–TREE*. To induce fixation before participants saw this problem, they were shown inappropriate associates of the problem words, such as *APPLE–PIE*, *HOUSE–BOAT*, and *FAMILY–REUNION*. When participants first saw *APPLE–PIE*, *HOUSE–BOAT*, and *FAMILY–REUNION*, and then tried to solve the *APPLE – HOUSE – FAMILY* problem, they did poorly, indicating that induction of fixation with the inappropriate associates was successful. After this fixation was observed on participants' initial test of the RAT problem, a second opportunity to solve the problem was given. The second attempt was either immediately after the first attempt (the No Incubation treatment), or after 15 min had passed (the Incubation treatment). Smith and Blankenship found an incubation effect; the initially unsolved problem was more likely to be resolved after an incubation period, as compared to the No Incubation control condition. Importantly, this incubation effect was not found when there was not a fixation treatment before the first attempt. This study, and others (e.g., Kohn and Smith, 2009, 2010; Smith and Blankenship, 1989; Vul and Pashler, 2007) show that incubation effects can be scientifically demonstrated if fixation is initially induced.

The forgetting fixation theory has been supported by experimental research on incubation effects, not only in problem solving, but also in recovering blocked memories. For example, Smith and Vela showed in 1991 that when memories of a list of pictures has become blocked or fixated on one recall test, more initially blocked memories can be recovered on a second recall test if the second test follows an incubation interval. In another study, Choi and Smith showed in 2009 that if an initial attempt to remember a general knowledge question fails, and the participant feels as if the correct answer is on the tip of their tongue (referred to as a *tip-of-the-tongue* or *TOT* state), then the answer is more likely to be accurately recalled if a subsequent recall attempt is made not immediately, but rather after an incubation period. Finally, Leynes, Rass and Landau showed in 2008 that a powerful implicit or unconscious memory blocking effect (e.g., Smith and Tindell, 1997) disappeared after an incubation period of 72 hours. These memory experiments provide further support for the forgetting fixation hypothesis of incubation effects.

Opportunistic Assimilation Research

The *opportunistic assimilation* theory of incubation effects focuses on taking advantage of stimuli that one encounters some time after putting aside an initially unsolved problem. This theory states that when people must postpone goals of solving unsolved problems, or remembering things they could not initially recall, they form a plan to be sensitive to anything they later encounter that might be related to those postponed

goals. The key to this opportunistic notion is that one must be prepared to notice things encountered by chance that might be useful in terms of fulfilling postponed goals. For example, Patalano and Seifert showed in 1997 that when experimental participants were given the problem of finding a way to remove a ring stuck on one's finger, and given the hint that Vaseline might be useful for the problem, they were especially likely to notice an incidental mention of Vaseline stored under the sink.

Interestingly, these participants were not very likely to notice other things that might solve the problem, such as soap or butter, which can also act as lubricants. In other experiments, however, when participants were given the 'Vaseline' hint, they also received the hint about the general use of the Vaseline, namely, to serve as a lubricant. Given this more abstract hint, participants were likely to notice the mention not only of the specific lubricant, Vaseline, but they also noticed other lubricants, such as butter (Seifert and Patalano, 2001). These experimental studies show that when problem solvers are prepared to notice specific things needed for solving problems, they may be limited to those specific objects, but when they are sensitized to notice a more general category of needed objects, then they are more likely to benefit from unanticipated stimuli that are serendipitously encountered. Importantly, this sort of *prepared mind* may benefit from chance encountered things even after an initially unsolved problem has been put aside, thereby triggering an incubation effect.

Principles of Incubation

It is clearly true that incubation effects are *multiply caused*. That means that there are many causes of incubation effects, and furthermore, that different cases of incubation effects occur for different reasons. Scientific studies show clearly that incubation periods can allow initial fixation to be forgotten, or escaped. Other experimental studies show that when people are frustrated in their preliminary attempts to solve problems, they remain sensitive to stimuli related to the problem, and serendipitously encountered hints can trigger incubation effects. Furthermore, recovering from mental fatigue after a rest can cause incubation, and conscious work that is forgotten may appear to cause incubation effects. Finally, combinations of these factors are also likely the multiple causes of incubation effects that people experience.

Understanding incubation effects requires that we understand the fixating effect of mental sets. It is important to be able to recognize when one is fixated, because that is the time to put the problem aside, at least temporarily. By recognizing one's own fixation and taking a break, people might be able to stop blocking themselves. The absence of fixation, however, is not sufficient for successful incubation, even if it is necessary. Stopping one's counterproductive work is essential for incubation, but there remains the issue of which direction will lead to a solution. Although there is no clear answer to this question, it is nonetheless clear that stimuli that are related to the fixated problem can sometimes provide useful hints. Therefore, carrying your troubles around with you, especially in new contexts, can sometimes trigger new and useful ideas.

An important principle to keep in mind for understanding incubation effects has been referred to as TANSTAAFL, an

acronym that stands for *There Ain't No Such Thing As A Free Lunch*. There is a widespread notion that incubation effects are not the results of hard work; that is, the myth that incubation results from essentially effortless unconscious cognitive processes. Nothing could be further from the truth. Incubation requires hard work. First there must be the initial preparation, where the problem solver tries all of the solutions that are at hand. Then, one must recognize one's impasse, and put the problem out of mind, while paradoxically remaining sensitive to stimuli and ideas that might be related to the unsolved problem. Finally, the problem solver must maintain a prepared mind, considering newly encountered stimuli and ideas to see if they shed any new light upon the fixated problem. With luck, vigilance, and hard work, an incubation effect might be achieved.

Summary and Conclusions

Incubation is a phenomenon that definitely does exist, both in laboratory experiments, and in historic cases. There has never been any reliable evidence that autonomous unconscious processes cause incubation effects. Incubation is multiply caused; contributing factors include forgetting fixation, sensitization to hints in serendipitously encountered the environment, and sometimes repeated bouts of conscious work in contexts not associated with fixated approaches.

See also: Implicit Theories; Problem Solving.

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Innovation

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Glossary

Actor network theory (ANT) A systems theory originally developed by Bruno Latour to explain how innovation occurs in scientific settings, and then later expanded to a more general systems theory. This theory posits that system elements only have meaning based on their purpose in a given system, and that all elements require equal study to understand how the system operates.

Creativity The generation and development of new useful ideas.

Innovation Creativity purposefully applied to solving a given problem. Such an application can be applying a

completely new idea to the given problem or applying an existing innovation in a new setting.

Levels of analysis A term denoting a study's focus on different societal groupings. The usual groupings in relation to innovation are individual, team, organizational, industrial, and societal.

Systems theory A holistic approach to understanding elements and their interrelationships. This method contrasts with other world views by positing that a given element can only be understood by examining the other factors that the element interacts with, and its larger environment.

Defining Innovation

Innovation, as with creativity, is a driving force of the twenty-first century. Increasingly the world economy is shaped and improved by individual and organizational innovations. With material production and service being continually reshaped by competitive forces, there is a constant need for new business methods and innovations. And the pressure for innovation extends beyond the business sphere into all arenas. New innovations are being used to improve social issues, medical technology, environmental problems, and many other aspects of modern life. The world is placing an increasing emphasis on understanding and promoting innovation. An indication of this importance is that by late 2009 there were over 11000 books and 180000 articles with innovation in their titles: publications from across all academic disciplines. However, this plurality of interest means that developing a consensus innovation definition is difficult, with each area (and often each writer) using a slightly different meaning.

However, a core innovation meaning has emerged: it is the purposeful realization of applied creativity. As such, innovation is a special type of creativity, and it is also the recognition of how to implement a creative idea to solve a concrete problem. Innovation is both contained within the larger construct of creativity and afforded a special place in the study of creativity as an entity that extends beyond creativity. Nevertheless, the dividing line between creativity and innovation will always be fuzzy – drawing a firm boundary between the two is difficult in any given situation. In order to reduce this ambiguity, the remainder of this section will provide an expanded examination of innovation's meaning and characteristics.

Innovation Characteristics

The major characteristic that gives innovation its unique characteristic in the field of creativity is that innovation is purposeful: the innovation fulfills a specific need. Where creativity can occur spontaneously and simply for the joy of being creative,

innovation achieves some end or solves some problem. Therefore, the first criteria in determining if a creative act can also be classified as an innovation is if it fulfills a need or improves a situation beyond the need to be creative. As such, innovation can only truly be recognized retroactively – a creative act that attempts to fulfill a need but does not do so is not an innovation. Also, innovation may occur either through a deliberate act or through serendipity. That is to say that the creative act may be undertaken to solve a specific problem beforehand, or it may be later recognized that the creative idea can be used to answer some existing dilemma. In either case an innovation occurs when the creative act is able to solve some problem because it can be used to fulfill a need.

An example of both characteristics occurred with Pfizer. Chemists were working with a chemical compound (Sildenafil) to treat angina. This treatment proved to be ineffective – thus it was not an innovation. However, it was discovered that this chemical was effective in treating male erectile dysfunction, and very successfully marketed as Viagra. Thus, the unexpected use of the drug lead to it becoming an innovation.

The second innovation characteristic is one that moves it beyond creativity: innovation is both the development of new ideas and the adoption of new ideas. Creativity is usually only considered to occur when a new idea is developed. This idea may (and usually is) based on existing ideas, but the idea must in some way be unique. However, innovation can occur when someone adopts an existing idea that is new to the person, organization, or society. Thus, a surgical technique's first use within a hospital is an innovation for that hospital, even if the technique has been used (even widely used) in other hospitals. It may seem that at some point such adoption must stop being considered an innovation – if you are the last person on earth to use sticky notes to keep reminders on, it hardly seems that doing so is an innovation. But such is not the case. When a person or organization applies an idea to a problem for the first time, innovation occurs for that entity. The idea adoption process and the outcomes from adopting the idea all remain virtually the same for the last adopter to implement the idea as the first adopter to implement the idea.

Thus for each adopter it is an innovation. Taking the narrower view that innovation only occurs the first time (or even the first few times) an idea is applied to a problem seems to be artificially and unnecessarily restrictive. With this characteristic, innovation incorporates the concepts of everyday creativity and garden variety creativity – where creativity is not confined to new, unique, and exceptional ideas.

Another reason for including existing idea adoption in innovation's definition is that it recognizes how innovation diffuses through the wider environment. This recognition plays two roles in understanding innovation. The first role is to better our discernment of how innovations are transmitted. Innovations travel through a network of adopters and observers. Without such a network, innovation cannot occur. (This idea will be expanded upon again later in this article.) The second role is to expand our understanding of how innovation can be viewed. It goes beyond the person (or persons) who developed the initial creative idea. It includes those who recognize the idea can be used to fulfill their own needs. This characteristic goes back to innovation's core definition of applying a creative idea to solve a problem. While duplicating an existing idea may not be creative, applying it to a problem you face (even if others have also applied it to the same problem that they face) can be considered to be an innovation. So switching to fluorescent light-bulbs in your house because you saw the energy savings from a neighbor's change would be considered an innovation.

Innovation Types

This innovation aspect raises the idea of different innovation types. One innovation type – the rarest – is an innovation completely new to the world: the creative idea had not been applied to the given issue in any way. However, more commonly, innovations are new to a specific group, but not completely new. In this situation others have previously applied the innovation, but the innovation can be considered to be new to another group. Such innovations can be when technology is transferred from one nation to another (as with Asian nations adopting US developed chip fabrication processes), to a new industry (the adoption of computer financial management from the banking sector to all other industries) or new to an organization or work group (such as when GM adopted Japanese quality management methods). All of these applications would be innovative for the new set of adopters, though the innovation could be long standing to other adopters.

As alluded to in the previous paragraph, innovation occurs at different levels of societal groupings; when describing or defining innovation, the level at which it occurs must be considered in the definition. The most commonly studied groupings in terms of innovation are the individual, team, organizational, industry, and societal levels. While there are differences in how innovation is developed, transmitted, adopted, and implemented at each of these levels, there are also many meaningful similarities across these levels. Therefore, it is useful to take a systems approach to innovation so that cross-level or homologous similarities can be discovered and understood by looking for repeating innovation patterns at each level. Along this multilevel approach, it is also important to understand that innovation is a system process rather than a stand-alone phenomenon.

By definition, innovation changes its surrounding environment (if only to solve the problem it is applied to). In changing the environment an innovation will spur new innovations: innovation is a process. Such environmental spurs can come from a change in an organization's own needs after the innovation, or from an organization's innovation creating a need for change in other organizations. A systems view of innovation gives insights into innovation's feedback loop property. Unfortunately, such a systems approach has largely been neglected in innovation writing, but more recent work has begun to explore the larger systems nature of innovation development and dissemination.

Innovation Defined

Based on this discussion, innovation can be defined by recognizing the following characteristics. It is the realization of a creative idea being applied to an existing problem. This application may be either of a new idea or the adoption of an existing idea. Innovation can be either completely new or new to the adopting entity. There are different societal groupings or levels at which innovation can occur, and there are similarities and differences in the adoption process across these levels. And finally, innovation must be viewed as a systems process where the creative idea is shaped by the environment, and the environment is changed by the innovation.

With this innovation definition established, the rest of the article will provide information on what factors affect innovation at different levels, the major innovation outcomes, more information on the systems approach to innovation, and a conclusion that will provide suggestions on our understanding of innovation's future.

Innovation Factors

To better understand innovation, it is useful to examine the factors that can promote or hinder innovation. While the phenomenon of innovation is still not completely understood, at this point there is much consensus about what factors should be studied, and even how these variables are expected to affect innovation. As stated earlier, most innovation factors fall into one of four categories based on its grouping focus or level of analysis. These levels are individual, team, organizational, industrial, and societal.

Levels of Innovation

In addition to studying a level by itself, there is also interest in how factors at one level affects innovation at another level. The study of factors in this manner can be either through an atomistic or hierarchical perspective. Under the atomistic perspective, factors are considered to be the building blocks of events at a higher levels of analysis. Thus, individual innovation propensity would be studied in terms of how it affects team innovation. The hierarchical perspective (the more common perspective) instead examines how a higher level's characteristics influences innovation at a lower level. Thus an organization's resources would affect a team's innovation output.

It is important to approach innovation at multiple levels for two reasons. First, there is good evidence that some innovation factors operate differently at different levels of analysis. Therefore, one should not simply apply (successful) innovation methods from the team level to an organizational or individual level. On the other hand, there are also many similarities between the innovation process at multiple levels. For example, available resources and communication between entities is necessary for successful innovation at all levels. By noting these similarities, one can become more aware of the innovation process, and develop new means to enhance innovation.

Individual Level Factors

While the individual perspective provides valuable insights into the innovation process, innovation is less of an individual phenomenon than creativity. Correspondingly, less research has been done at this level than the other levels. Innovation is an interactive phenomenon: it usually requires more than one person to occur. Thus the individual level seems to have had less interest for the researcher who studies innovation and the practitioner who must nurture innovation.

The individual level, though less well studied, is the base from which innovation arises. It is thus both the foundation for the atomistic perspective, and does not lend itself to a larger hierarchical analysis. From this level, individual factors include both elements that are inherent in the person and elements from the surrounding environment that affect a person's innovation. Individual factors that have been found to be related to individual innovation include cognitive ability, personality, mood states, motivation, and job characteristics.

Individual core characteristics and innovation

An individual's cognitive ability provides the foundation for his or her innovative capabilities. Such cognitive abilities include intelligence, perseverance, creative thinking ability, and even pattern recognition. Cognitive ability refers to the functioning usually considered to be a person's mental faculties. In general, the higher an individual's cognitive abilities, the more able that person is to develop innovations and implement innovations from other sources. Leonardo da Vinci and Michaelangelo are perhaps the exemplars of strong cognitive abilities being linked to great innovations.

People with certain personality types have also been found to be more innovative. Those with a more creative personality tend to be more innovative as well. Characteristics that predispose one to innovation include openness to new ideas, perseverance, self-confidence, tolerance of ambiguity, independence, and originality. There are also personality traits that reduce a person's propensity for innovation. These include authoritarianism and being rules oriented. Personality, like cognitive ability, is thought to be a relatively stable aspect of a person, and thus not very amenable to alteration. While there are ways to improve both aspects, intervention techniques are usually aimed at other individual level characteristics.

Individual state and job characteristics and innovation

Such characteristics include mood states, motivation, and job characteristics. These characteristics are highly interrelated in terms of innovation, and best discussed together. Mood states

are transient feelings a person has about his or her surroundings and circumstances. (While such mood states can persist for extended periods of time, they are far less fixed than an individual's personality.) More positive mood states are associated with higher levels of innovation. Motivations are the rewards that drive a person to act. For example, workers are more likely to be innovative if there is a quarterly award for innovative practices. In addition to such external rewards, people that have an internal motivation for success and have a high level of personal initiative are more likely to be innovative. Job characteristics are the work features and a person's perceptions of those work features that affect a worker. Job characteristics that are associated with higher innovation are high autonomy, support for innovation, moderate job demands, low job dissatisfaction, good communication channels, and leadership support and guidance.

The last factor, leadership support and guidance, needs to be discussed further. This individual level aspect is also a bridge between the individual level and the team level. While a leader's support for innovation will impact an individual's innovation, it will also have a similar effect on other team member's innovation, thus creating similarities between team members. The leader also acts as a bridge between team members and the larger system in which the individual and team are embedded. Such a function occurs when a leader directs a team to focus on developing strategically mandated projects, and when the leader requests needed resources from higher management. As such, leadership acts across the individual and team level.

Team Level Factors

In contrast to the individual level, the team level seems to be one of the more natural groupings for examining innovation. The richness inherent in this grouping occurs because innovations most often arise at this level – with teams being used to develop creative outflows into innovation specifics. As stated earlier, innovation most often occurs through the interactions between individuals rather than as an individual phenomenon. The factors that seem to be most relevant for innovation at the team level include team processes, climate, structure, input variables, member characteristics, and team leadership.

Team process variables and innovation

Team process variables have been found to have the strongest link to innovation. Teams that possess more appropriate processes show much higher innovation rates than those lacking such processes. Many of these processes are similar to the individual personality characteristics at the individual level. These processes include having support for innovation among team members, and being task oriented. Task orientation acts to focus worker creativity onto appropriate tasks, while team support acts through developing norms as well as a focusing role.

Team climate and innovation

Team climate – analogous to job characteristics or mood state at the individual level – is also positively related to innovation. The more positive a team's climate, the greater the likelihood for development and adoption of innovation. However, team climate goes beyond members feeling that the team is a good

work group to be in. Climate also incorporates how open the team is to new ideas, tolerance for conflict, innovation norms, and participation expectations. In short, team climate is the set of norms for team member work behaviors. When GM initially opened the Saturn auto manufacturing plant, much work was done to ensure positive team climates among the various work groups. This initial set-up proved successful in that Saturn vehicles consistently ranked high in quality and customer satisfaction – outcomes that can be partially attributed to work team supported innovation.

Team structure and innovation

Team structure is the specific flow and interactions that occur between team members. In general, greater flow and interactions between team members fosters increased innovation. It should be understood that team structure plays a greater role in the team innovation process than this simple statement makes apparent. Team structure shapes the types and methods of innovation that occurs in a team. It tends to remain stable despite turnover in team members. Team structure can be viewed as the skeleton on which other team processes are built. In order to substantially change innovative process within a team, great care must be made to change the team structure. The Firefox browser's success can be partially attributed to such a change. The browser improved markedly – both in terms of overall quality and new innovative features – only after team structure changed from a more top down, centrally controlled model at Netscape to the decentralized, developer and user controlled model now in place.

Team input variables and innovation

Team input variables are also important for team innovation, though these variables do not seem to be as strong as process variables. Such variables include available resources, information, and exposure to external ideas. While all of these factors are important to innovation, teams that have more positive levels of the preceding factors will tend to compensate for lower input variables, while it will be difficult to make up for a deficit in the other factors by simply increasing inputs. Many organizations have made the mistake of increasing inputs but not changing team process, climate, or structure. Usually, innovation increases will not be sufficient to offset the extra resources applied in the attempt to improve outcomes.

Other team characteristics and innovation

Other important factors include team member characteristics and team leadership. Team member characteristics are much the same as already covered under individual factors; with teams composed of more innovative team members having increased team innovation. In addition, there are benefits to be had from increased team diversity, and when members with minority positions are willing and able to voice their dissent. This process can be seen when teams select a Devil's Advocate to purposefully challenge dominant positions. In this situation, everyone must be more creative to support their positions, group think is less likely (which also promotes innovation), and new ideas can occur from the enforced examination of all ideas. Team leadership operates through two means. Leaders act to motivate and inspire team members, and leaders with a more participative style that are open to

team member ideas tend to have more innovative teams. Team leaders also provide a communication channel, access to outside resources, and appropriate direction for applying creativity to organizationally relevant issues. As such, leaders provide a linking pin role between the team and the organization in which the team forms a part of.

Organizational Level Factors

Organizational factors are among the most studied innovation elements. Part of the reason for this plethora of information is that organizational level innovations are the most visible. However, there is also a strong argument for this level being truly the most active of innovation levels. Going back to the article's innovation definition including adoption as well as development, one can see that organizations have many peers where innovation observations can be made, and then decisions about which ones to adopt can be judged against peer success. Regardless of the reasons, many organizational elements have been identified that are related to an organization's innovation, and these factors often include innovation adoption issues.

Highly related organizational characteristic

Some of the strongest organizational characteristics that improve innovation are increased specialization, external communication, functional differentiation, and technical knowledge resources. As can be seen, many of these factors are similar to team and individual level factors that promote innovation with knowledge, communication, and idea diversity appearing in some form at all levels. Similarly, centralization is one of the strongest organizational inhibitors of innovation. This characteristic also shows similarities to how authoritarian leadership can inhibit innovation at the team level, and rigidity of thinking can diminish it at the individual level. A common thread among these characteristics appears to be that the influx of new ideas coupled with the ability and opportunity to act on them promotes innovation at all levels. Such seems to have been the case with Japanese manufacturing firms after World War II. In this situation, the firms readily adopted new manufacturing ideas, and worked to train and empower employees to implement these ideas in novel ways to recover from wartime devastation.

Moderately related organizational characteristic

Organizational level characteristics that have shown more moderate relationships with innovation include administrative intensity (the amount of personnel devoted to accomplishing administrative work relative to the total workforce), and managerial attitude toward change. Perhaps most surprising is that professionalism, slack resources, and internal communication have generally been found to have only weak relationships with organizational innovation. Such findings are especially unexpected in terms of slack resources and internal communication. Prior thought – and findings at other levels of analysis – had generally indicated that increased resources and communication provided a good basis for increased innovation. While there is a positive relationship at the organizational level, the strength of these relationships is less than what is expected.

Other organizational characteristics

Other organizational factors that affect innovation include structure (with more flexible structures producing more innovation), strategy (with strategic alignment being important for successful innovation), market orientation (with more market oriented organizations being more likely to develop and adopt new innovations), resources devoted to innovation (in contrast to general slack resources), and culture (with more organic cultures being more innovative). Organizational factors that have been found to be unrelated to innovation include formalization, top managerial tenure, and vertical differentiation.

Organizational demographic variables and innovation

Firm size has been found to be related to innovation adoption. And since this organizational aspect has been discussed so vigorously, more attention needs to be devoted to it in this article. A long-standing debate has been if firms become more or less innovative with increased size. The argument for a positive relationship has been that larger firms have increasing resources to devote to innovation, and also face increased competition that requires more innovations. The counter argument is that increased size leads to greater wasted resources and increased administrative barriers to innovation adoption and implementation. While this issue is complex and fraught with many exceptions, in general, studies have shown that larger firms are more likely to generate more innovations. Apple, IBM, and Google all show this phenomenon, with each company being responsible for a vast number of innovations in the IT sector.

Larger firms are especially likely to adopt IT innovations, possibly because managers see IT technology as one way to cope with the increased administrative complexity brought about by increased firm size. Many organizations adopted the practice of having managers use pagers to contact them when needed regardless of their location. This practice evolved into using cell phones and e-mail for distributed communication methods. While these practices have created problems with work-family life balances, they have also been useful for increasing manager efficiency and accessibility.

An organization's life-cycle stage can also play an important role in how innovation is encouraged. Organizations in the earlier life-cycle stages are more open to a wide variety of innovative types, but generally have fewer resources to encourage such innovations. Organizations in the later life-cycle stages tend to encourage a narrower set of innovation types, but also have more resources available to devote to the implementation of these creative ideas.

Several other organizational characteristics have also been found to be related to innovation. Higher levels of the following organizational demographic characteristics have been found to be positively associated with greater innovation: firm age, complexity, capabilities, specialization, formalization, organizational resources, and interfunctional coordination. In addition, there are management characteristics that are positively associated with innovation: greater management training, more managers with professional degrees, and having an innovation champion. Organizational culture and orientation characteristics that have been found to specifically enhance innovation include the following: diversification (having workers with many different backgrounds and varied

workplace projects), clan culture (characterized by tight knit work relationships and high levels of positive workplace interactions), customer orientation, competitor orientation, and openness to change. Also, successful past innovations tend to promote future innovations, while network capability and team communication promote the diffusion and adoption of innovation.

Organizational moderator variables and innovation

Several important moderators have emerged that need to be considered. The type of organization has been shown to be a strong moderator of organizational innovation. These moderators do not simply alter the degree of innovation in an organization, but change the relationship between organizational characteristics and innovation. The most important organizational classification types include manufacturing versus service organization, and for-profit versus nonprofit organization.

In manufacturing organizations, innovation is enhanced through work standardization while increased direct supervision decreases innovation. In service firms, there is no link between these two variables and innovation. Similarly, formalization and centralization enhance innovation in for-profit organizations, but seem to have no effect in nonprofit organizations.

There is also evidence that organizational culture moderates the relationship between other organizational characteristics and innovation development and adoption. This moderator effect is in addition to the direct effect that an organization's culture can have on innovation. However, there is still much debate and study needed to fully realize how culture moderates these relationships. Still, highly creative organizations often take extra steps to maintain a creative culture. For example, the *Mad Magazine* publisher and editor William Gaines once took his entire staff to Puerto Rico to convince their one subscriber there to renew his subscription. While this trip was unlikely to have been directly cost effective, it was a way to keep up an atmosphere of creativity and innovation among his workers.

An innovation's characteristics also has an effect on how likely an organization is to adopt the innovation. Innovations that are more compatible with an organization's mission or existing product line are more likely to be adopted. Similarly, innovations that are expected to provide the organization with a relative advantage have a higher chance of adoption. Conversely, complex innovations are less likely to be adopted.

There are also many factors that, often unexpectedly, are not related to adoption rates. These factors include cost, trialability (how well an innovation can be used on a limited basis before full adoption), observability (how completely an innovation can be viewed before adoption), communicability (how easily an innovation can be described before adoption), divisibility (the ability to try small or limited parts of an innovation), profitability, and social approval (how well the innovation's adoption will be perceived by organizational members and external stakeholders).

Industry Level Factors

While there is obviously industry-wide development and adoption of new innovations, factors at this level have been less well studied than at the organizational or team levels. However,

there are some useful findings about what type of industries are more likely to use and rely on innovation for their operations. Factors that have emerged from these findings include industrial age, the industry's technological dependence, required infrastructure investment, and the industry's technological turbulence. These factors will be briefly outlined in the following subsections.

Industry age

Industrial age seems to be negatively related to innovation. New innovations are most prevalent near the beginning of an industry's creation and growth. While this observation seems to be relatively stable across a broad array of existing industries, the causes for this phenomenon are still unclear. One possibility is that most major innovations are only possible during the early stage of an industry. As the industry matures, the opportunities for discovering new innovations decreases. Similarly, as industries mature, existing organizations may invest more in infrastructure, and find it increasingly difficult to adopt new innovations when they become available. It is also possible that a feedback loop is at play. As fewer organizations adopt new innovations, there becomes less competitive pressure for other organizations to be innovative. As such, there would be an increasing decline in overall innovation.

Technological dependence

The more technologically dependent an industry is, the more likely that the industry will be more innovative. While there is a bit of circular reasoning in this observation (technologically dependent industries are more innovative, and industries whose firm's competitive success depends on innovation are more technologically dependent), the statement has a strong intuitive appeal. When industries grow and thrive based on their technological capabilities, firms in the industry must strive to find new ways to innovate. What may not be as obvious is that success can come from sharing innovations between competitors more than keeping these innovations secret. An example of this phenomenon is the computer industry which makes many technological advances available to all members. This sharing of innovation then allows for greater interoperability and standardization between different IT aspects, thus increasing the utility, demand, and growth of all components.

Infrastructure investment

Required infrastructure investment within an industry can be either positively or negatively related to industry innovation. Higher levels of required investment can hamper innovation by creating greater barriers to entry and change within the industry. Such barriers can make innovation more difficult, and thus favor organizations that do not innovate through being able to redirect their resources to other organizational operation areas. However, these required high investments can also lead to industry members developing innovations to lower the needed infrastructure costs, and allowing the early innovation adopters to reap high initial returns. Such events have happened during the 1970s when mini-mills were introduced by Japanese steel companies, and in the printing industry today which is outsourcing much of its physical printing to China at lowered cost.

Environmental turbulence

Organizational level innovation also has a weaker effect on firm performance in technologically turbulent environments than in calmer environments. While this observation could also appear under the innovation outcomes section, it is important to discuss it in this section for the possibilities it brings up. Turbulent environments may suppress this relationship because innovations have less chance to be successful when the environment is uncertain. It can be unclear how well an innovation will solve a problem when one is uncertain of what the problems are. However, turbulent environments may also force all competitors to be more innovative to cope. In turn, this higher level of innovation continually changes the industry's environment, thus reinforcing the environmental turbulence – an example of the feedback loop inherent in the innovation process.

Societal/Cultural Level Factors

At the highest level of analysis are societal or cultural factors that influence innovation. Less work, and thus diminished understanding, exists for factors at this level. This paucity of research might arise from the difficulty of comparing innovation factors across nations, as would be necessary for most research at this level. However, evidence does show that higher levels of competition, environmental turbulence, and urbanization all improve innovation. Similarly, higher unionization levels in a society has been found to reduce innovation. The number of patents granted within a society seem to have weak or mixed effects on innovation. Patents do not seem to be useful in predicting cross-national innovation, but this effect may be moderated by industry. Within the pharmaceutical industry the number of existing patents have been found to be positively related to innovation. In other industries patents seem to hinder innovation. The reason for this variance is unclear, but it appears that other industries use patents to create idea monopolies and barriers to innovation exchange. The pharmaceutical industry seems to have developed a system where patents provide clear information on drug creation so other firms can build new research on this work.

Fortunately, national culture factors are becoming more prominently studied, and there appears to be cultural differences that strongly affect innovation. Higher individualism, lower power distance (a view that there should be a certain level of equality between people in different work positions), and lower uncertainty avoidance (a greater willingness to take risks) are related to increased organizational innovation. The area of innovation transfer has also been studied internationally, though specific and stable findings about these factors has yet to emerge.

Innovation's Effects

Innovation is an interesting phenomenon in its own right, but most often the purpose of studying innovation is to try and improve some organizationally or societally desirable outcome. As such, there is much interest in the effect of higher levels of innovation. Most people agree that increased innovation is a desirable state of affairs at all levels, and for most all

affected parties. In some ways, this belief is almost a tautology. By definition innovation is an applied solution to some problem, therefore greater innovation should lead to improved outcomes. However, this belief has been confirmed by observations. While there exists much work on how innovation affects a broad range of life factors – such as quality of life, environmental shaping, and societal development – the most consistent findings have been in the area of organizational performance. As such, this section will focus on this outcome.

Performance and Innovation

Performance is perhaps the most highly studied innovation outcome, and findings have shown a strong link between the two across a wide swath of performance measures. At the firm level, higher levels of innovation increase financial performance, stock prices (for publicly traded corporations), and the perception of organizational performance. There is also evidence that innovation has a long lasting impact on firm performance, with greater innovation today leading to increased future performance.

This relationship is stronger when the innovations are more relevant to firm strategy. There may also be an increasing need for organizations to focus on product innovation rather than service innovation, as there seems to be a trend in diminishing returns between new service innovation and better firm performance. This trend may be because there is an increasing ease of other organizations observing and adopting similar service innovations, while there are legal and sometimes physical barriers to prevent such adoptions of new product innovations. There also seems to be a decreasing link between new-to-firm innovations and organizational performance. However, the link between new-to-market innovations still seems to be strong. This trend indicates that there may be increasing benefits for organizations to invest in research and development in attempts to bring out innovations ahead of competitors.

Innovation as a Systems Process

As has been discussed throughout this article, innovation depends on a larger system to occur and be transmitted to other entities. Therefore, innovation can only be fully understood in a systems context. Even more than creativity, innovation requires a network of elements to be successful, and these elements must also be included as part of the innovation process. While much progress has been made to place innovation in a systems context, most people continue to view innovation and innovation factors as stand-alone entities. Fortunately, a consensus is emerging concerning what elements should be included in our understanding of an innovation systems view.

The Environment–Innovation Interrelationship

The first part of this systems view is that an innovation and its environment are inextricably related. The environment will provide the impetus for an innovation, resources for developing innovations, and limit what innovations are possible at a

given time. In turn, innovations can change their environment through such means as altering the competitive landscape, shifting resource allocation and availability, and creating new innovation opportunities. Another generally agreed upon aspect of this system view is that innovation relies on some form of transmission channel in order to bring in new ideas, and transmit innovations to other system members.

Actor Network Theory and Innovation

One of the most advanced descriptions of innovation as a systems process has been developed by Bruno Latour in his actor network theory (or ANT for short). This theory was developed based on his observations of French science researchers and how they conducted their work. From his observations, he realized that innovation was embedded within a network of human and nonhuman participants that all must be considered to be part of an indivisible whole. He also posits that most system theories unnecessarily give human actors precedence in their system descriptions, and will under-rate the importance of nonhuman elements. For instance, scientific journals are often ignored in the examination of the innovation process. However, such journals are necessary for the researchers to both obtain information for their creative work, and to transmit their innovation to other parties.

Latour asserts that – in such a case – not only are journals necessary elements in the system, but the researchers would not be researchers without such mechanisms. All elements, therefore, must be considered simultaneously in the ANT framework. While the practical implications of the ANT system model have not fully been delineated, it holds great promise for better understanding how the innovation process works.

The Innovation Systems Model: Our Current Understanding

The development of a full innovation systems model is still in the early stages, but there has been more consensus on how an innovation process model can be viewed. The following is a brief outline of this model.

1. An environmental impetus for an innovation occurs. This impetus can be a change in the surrounding environment that presents a problem or opportunity, or simply the recognition of a gap between existing and desired conditions.
2. This impetus must find creative receptivity so that some actor within the system can become aware of the need and possibility of a creative development. There may also be a garbage can effect where an impetus triggers the use of an existing creative spark to fulfill the need.
3. The creative idea must be developed into an innovation, and this development has to be supported by the environment through available resources including support and materials.
4. The innovation must then be accepted by appropriate parties within the system (though innovations may lie dormant for extended periods of time).
5. The innovation will be diffused through a network, and adopted by appropriate parties. The party that originally

developed the innovation may see advantages to either keeping the innovation exclusive or allowing other parties to adopt the innovation. In turn, the other parties may seek to incorporate the innovation, neutralize the original parties ability to implement the innovation, or counter the innovation through some other innovation.

6. The new innovation will alter its environment, thus leading to the need for a new generation of innovations (either in response to environmental changes, or by freeing up resources to develop new innovations).

Conclusions

This entry has presented an overview of our current understanding of innovation, the innovation process, factors that promote or hinder innovation, and how innovations affect their environment. Innovation is a specific type of creativity: creativity that is applied to solving some given problem. Also, innovation cannot be viewed as an independent event. It is part of a larger system process that creates a feedback loop and the necessity of new generative innovations. Another important aspect to understanding innovation is that it occurs at different levels throughout society. Innovation at each of these levels has similarities and unique characteristics, but understanding innovative output and processes must take into consideration the level at which the innovation occurs.

With this recap, what can be understood about innovation in the twenty-first century? From this review there appears to be a few characteristics of innovation that are common at all levels. To promote innovation at all levels there must be resources made available specifically for developing innovation, innovation must be encouraged by the wider system, effective communication is necessary between appropriate parties, and there needs to be a strong leadership role to nurture innovation and provide a guiding vision to focus the innovation. Barriers to innovation at all levels appear to be inflexibility and a fear of change.

For organizations to successfully promote and develop innovations, there will have to be an alignment between the organization's goals and mission and its attempts to implement innovations. Such linkage has to be accomplished through individuals, and this requirement means a well developed and articulated human resources strategy and plan. While it can be easy to focus on the hardware aspect of innovative advancement, the human side is the true driver of the phenomenon.

There also seems to be a potential shift in the national sources of innovation. For most of the modern era, the western world has driven most large innovations with new forms of society, government, organizations, and industrial advancements. However, with the opening of the twenty-first century, there seems to be a shifting of innovation to the eastern world. With nations like China, Taiwan, and Japan devoting much of their national resources to education institutions and corporate research, many of the factors that promote innovation are being put in place in these nations. In contrast, the western nations seem to be more reluctant to place long-term investment in such projects. At this point it is unclear what the long-term behaviors of all parties

will be – the western world still has far more resources that can be placed into innovation promoting activities. Increased diversity in ideas can only be beneficial for all parties in terms of increasing innovation.

Perhaps the most basic observation is that innovation will continue to drive our civilization's growth and advancement for the foreseeable future, and the rate of innovation is expected to continue increasing. With this observation, however, it must be pointed out that not all innovations are beneficial for society, and that most all major innovations have unforeseen consequences that can create seriously detrimental outcomes. The innovation of using oil products as a fuel has allowed humanity to make tremendous strides forward. It would not be an exaggeration to say that this innovation has advanced our civilization more than most any other application of a creative idea. However, as this innovation has become more widespread, we are realizing that it also has serious negative effects on our environment, and that new innovations are necessary to counter these negative effects. What is less clear is what long-term effects these new innovations will have.

With this observation in mind, there is a need to place greater emphasis on both developing methods for examining possible consequences of innovations and the ethics of implementing innovations. While no perfect solution exists for determining unintended consequences from innovations, scenario planning as developed by Shell Oil provides a useful tool for this purpose. Similarly, Donella Meadows' Twelve Leverage Points model provides another way to predict the scope of effect an innovation might have. By using these tools we might be able to better understand the consequences of an innovation and determine what the ethical boundaries are of using or not using it.

See also: Adaptation, Adaptiveness, and Creativity; Cognitive Style and Creativity; Creative Environments, Conditions, and Settings; Cross-Cultural Differences in Creativity; Everyday Creativity; Group Creativity; Leadership; Michelangelo 1475–1564; Moral Issues in Creativity; Problem Finding; Rewards and Creativity; Systems Approach; Teams; Max Wertheimer 1880–1943.

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- http://www.developerdotstar.com/mag/articles/places_intervene_system.html – Donella Meadows' leverage points.
- <http://www.lancs.ac.uk/fass/centres/css/ant/antres.htm> – Actor-Network Theory.
- <http://web.archive.org/web/20040214135427/http%3A/www.comp.lancs.ac.uk/sociology/soc054jl.html> – Actor-Network Theory.
- <http://www.bruno-latour.fr/> – Actor-Network Theory.

Insight

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Glossary

Illumination Conscious realization of how to solve a problem or how to understand the problem properly; usually quite sudden and emotional.

Incubation A stage of problem solving during which the conscious mind does not work on the problem; used to be accounted for in terms of implicit processing.

Problem A situation characterized by one's inability to find a way between the initial states of affairs (i.e., data) and the

desired state of affairs (i.e., goal, solution); one knows what is needed but does not know how to get it.

Problem representation The way people understand the main features of the problem, particularly what the difficulty comes from, and what the obstacles are to achieve the goal.

Restructuring Conversion of the previous problem representation into a new one.

Insight is a sudden realization of the essence of a complex, paradoxical, or not well-understood situation, particularly the essence of a problem at hand. Insight is not synonymous with working out a solution to the problem; rather, it consists in understanding the gist of the problem through discovering its hidden structure. In problem solving, insight usually occurs after the preparatory stage, often following an 'incubational break,' and results in deep understanding why the problem is 'problematic.' In other words, insight produces realization of what the difficulty comes from, what the obstacles are to a good solution, and why the previous attempts to solve the problem were futile. Insights like that may be false and misleading, if based on inappropriate or incomplete data, but nevertheless they produce the unique (sometimes deceptive) feeling of understanding the essence of the problem. Besides problem solving, insight occurs in learning, where it produces deep understanding of a difficult subject matter, and in reception of creativity, where it leads to the realization of what is the message of the creative artwork. A particular example of insightful reception of one's creativity is the act of understanding a joke. According to Arthur Koestler, every act of creation includes an element of beauty (ah!), an element of wisdom (aha!), and an element of humor (haha!). Although in particular cases these elements occur in specific proportions, it is always possible to investigate production and understanding of humor instead of studying the whole creativity. Analogically, it is possible to examine insightful problem solving in laboratory settings, with the use of relatively simple tasks, to replace studying deep insights in science or technology, providing that such simple tasks are good models of serious and difficult problems taking place in mature creativity.

The Nature of Insight

The Gestalt psychologists introduced the term insight at the beginning of the twentieth century. It was put forward in opposition to the trial-and-error account of learning and problem solving, a stance advocated by the behaviorists. According to Wolfgang Köhler, Kurt Koffka, and Max Wertheimer,

problem solving should not be described as a process of incremental increase of habit strength because people (and great apes as well) sometimes work on problems that are impossible to solve through continuous acquisition of learned skills. Such problems supposedly require fundamental change in the way they are perceived. Restructuring of problem perception occurs on the basis of already acquired knowledge but requires additional new elements and – this is particularly important – new arrangement of these elements. The problem before the solution is a 'bad' (i.e., incomplete or inelegant) figure, whereas after the solution it becomes a 'good' figure. In other words, problem solving is a process of conversion of a 'bad' figure into a 'good' figure through adding some lacking elements, along with rearrangement of all the elements of the problem (both 'old' and 'new') into a plausible structure.

Max Wertheimer described a little girl who was taught to estimate the area of a rectangle by counting the number of small squares into which the rectangle was divided. This counting-the-squares method was pretty successful in every instance of a rectangle but appeared inadequate in the case of a parallelogram. The girl was unable to find the area of a parallelogram until she realized a new possibility. She asked for scissors, immediately cut off the triangular part of the parallelogram, and put it at the appropriate place on the other side of the figure. In this way, she obtained a rectangle, whose area was easy to estimate with the already acquired method of square counting. This example epitomizes all-important aspects of insight: The 'old' solution does not work anymore. The impasse is therefore inevitable. After some break, a new solution appears, which is quite unexpected. The new solution consists in the use of old knowledge completed with new elements. And, most importantly, the new solution is based on the essential change of the problem perception.

Laboratory studies of insight cannot rely on realistic difficult tasks, like scientific problems; therefore, some relatively simple but tricky tasks are usually explored. For instance, a task may consist in deciphering the meaning of an expression, such as 'poPPd.' The expected answer to this rebus, 'two peas in a pod,' requires not only perfect knowledge of idiomatic English but also specific mindset and – maybe – an ability to read the

intentions of the experimenter. Insight tasks may be nonverbal as well, such as a series of various 'matchstick problems.' For example, a person may be asked to compose four unilateral triangles out of six matchsticks; the solution seems impossible until one realizes that he/she is supposed to build a pyramid. Or, a person may be asked to convert an equation expressed in Roman numerals, for example, $IV=III-I$, into the correct version using just one stick, that is, $IV-III=I$. Such tasks, though appealing to one's mental flexibility and the ability to overcome fixed mindsets, require some specific skills, like spatial imagination (pyramid) or knowledge of Roman numerals (equation). If so many factors count, validity (i.e., what is actually measured) and reliability (i.e., how well is it measured) of such tasks appears as serious methodological issues.

Stellan Ohlsson introduced a task that proved to be quite popular and useful in the studies on insight (Figure 1). It is a much more advanced and difficult version of the problem that was solved by the little girl, described by Max Wertheimer. The task is to find the sum of the areas of square ABCD and parallelogram EBGD, given that $AB=a$, and $AG=b$. We know very well that the area of a square is obtained by multiplication of the length of its two edges, which is easy. We also may remember that the area of a parallelogram is obtained through multiplication of the length of its base by the length of its height, but the latter value is not provided (the former is possible to deduce). However, the solution is immediately worked out as soon as one realizes that the needed sum of areas is obtained through moving the triangle DCE upwards (or the triangle ABG downwards), so as to compose two big triangles, and eventually one big rectangle, whose square is easily computed as a times b . Although this task requires basic mathematics, its difficulty results from the necessity in perceiving it in a new and unconventional way rather than from complex mathematical reasoning.

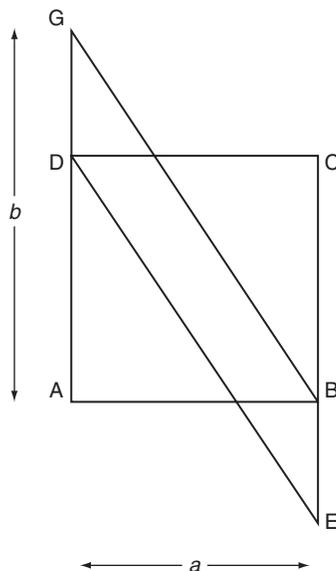


Figure 1 Given that the line $AB=a$ and the line $AG=b$, find the sum of areas of square ABCD and parallelogram EBGD (Ohlsson, 1984).

The Features of Insight

Suddenness

Insight is usually experienced as sudden and unexpected. Eminent creators, on the basis of their introspective analyses of the creative processes, often report these feelings. Introspection lacks objectivity, but if the phenomena under consideration are subjective by nature, it must not be ignored as a source of relevant data. The empirical psychology argues that similar phenomena take place in controlled experimental settings, too. Psychologists also try to answer the question why insight is experienced as sudden and unpredictable.

Investigations on suddenness are based on the technique called 'feeling of knowing.' People are presented with an intellectual problem and asked to judge their subjective feeling of being close to the solution. They may use a 1–10 point scale where '1' means 'I'm at the starting point' and '10' means, 'I know how to solve it.' It usually appears that this subjective feeling of knowing rises only 10–20 seconds before emergence of the actual solution. People are quite unable to discern any symptoms of the upcoming solution during the earlier stages of the process of thinking. It also appears that the feeling of knowing may rise quite evenly in the case of regular algebraic problems but not in the case of insight problems. The latter usually produce irregular curves of changes of the feeling of knowing (i.e., with many ups and downs). If the problem solver is eventually successful, the curve rises steeply during a few final judgments but not earlier. This pattern of relationships suggests that insightful problem solving typically results in a solution that is unpredictable for the problem solver, and the process of looking for solution is interpreted as 'catastrophic' or lacking continuity.

Malcolm Westcott demonstrated the phenomenon of discontinuity in the studies on 'intuitive leaps.' Participants were presented with a series of numbers ordered according to some principle, for example, 4–5–3–6–2–7–1–?. Their task was to decide which number is supposed to replace the question mark if the underlying principle is valid. Some people were ready to make a decision only after two or three elements of the series, whereas others needed more time for that. The former apparently made their choices on the basis of quick, spontaneous speculations, rather than elaborated deductions. In follow-up studies participants were encouraged to guess the elements of series as soon as possible. It appeared that those who were inclined to make such 'leaps' scored higher on the independently administered battery of insight problems. Therefore, such 'intuitive leaps' may be interpreted not only as an illustration of discontinuity in problem solving but also as a model of intuitive processes in high-level creativity.

Where does the subjective feeling of suddenness of insight comes from? According to Graham Wallas, the author of the 'theory of incubation,' suddenness of insight results from the unconscious nature of creative processes. If a creative idea is 'incubated' in the unconscious parts of the mind, its eventual appearance must be unpredictable and entirely unexpected for the consciousness. This theory, although very popular and influential, was questioned by the proponents of the so-called 'nothing special' approach. According to Robert Weisberg, creative processes do not differ in kind from less creative functions

of the mind. Particularly, they have nothing to do with unconscious 'incubation,' because they rely on the incremental process of accumulation of knowledge. The creative process supposedly consists of consecutive trial and errors, being usually very long, full of pauses, and tiresome. If a particular trial appears successful, a person may have an impression of unexpectedness of the creative idea. But this is just an illusion, coming from large number of previous unproductive attempts.

Incubational Break

Even though the theory of unconscious incubation is questioned for a lack of empirical evidence, there are good reasons to ask about possible benefits of breaks in the creative process. The occurrence of such breaks is unquestionable. For instance, Catherine Patrick observed painters during their work and concluded that the process of drawing a picture is discontinuous in nature. The artists usually start with an initial idea, which is seemingly abandoned and replaced by alternative options. However, the original idea tends to reappear from time to time, and the whole process of creation makes the impression of being abundant with breaks and pauses.

Five hypotheses have been formulated to explain the effect of incubational break.

1. The hypothesis of unconscious activity of the mind, although formulated more than 100 years ago, still has its proponents. If this stance makes any sense, an incubational break must be long enough in order to allow the unconscious mind to work out a tenable solution.
2. It is claimed that a break allows renewal of energetic resources because creative work may be prolonged and exhaustive (so-called 'fatigue-dissipation hypothesis'). This viewpoint is somewhat opposite to the unconscious thinking hypothesis, as it amounts to the conclusion that nothing particular happens during the break.
3. A break supposedly allows redirection of attention from futile ideas and misleading aspects of the problem perception to some new and more promising pieces of information. According to this explanation, people must change their activity during the break, possibly to something completely unrelated to the original problem, because otherwise the effect of attention redirection cannot be obtained.
4. A break probably leads to elimination of ineffective mindsets, false assumptions, and other symptoms of mental rigidity. If this hypothesis makes sense, it should not be important what type of activity takes places during the incubational break because its beneficial effects result from mere flow of time.
5. It is claimed that something particular must happen during the break, namely, a new piece of information is perceived which serves as a source of inspiration and therefore leads to a new and productive idea. For instance, a person reads relevant literature or discusses the problem with other people, and thanks to such events, assimilates new and productive pieces of knowledge. Sometimes the process of assimilation is subtle enough to prevent any conscious realization of the actual sources of inspiration. For instance, a person perceives an analogical solution in some area that is distant and seemingly irrelevant to their problem.

In such cases, inspiration works without conscious realization of the source of a new idea, although one's mind must be prepared for assimilation of relevant information.

Some of the above-sketched hypotheses have been verified experimentally. For instance, Roy Dreistadt demonstrated that short (eight minute) incubational breaks alone did not improve performance on an insight problem solving test but helped to assimilate pictorial analogies that were dispersed in the lab and served as 'hints' to the participants. People who saw these hints but had no opportunity to take a break obtained lower scores. These results favor the fifth hypothesis, according to which the break does not work as such but serves as an opportunity to assimilate some new relevant information. More recently, Eliaz Segal asked students participating in his study to solve the problem of the parallelogram (Figure 1). Participants were given a short (four minute) or a long (12 minute) break, during which they solved crosswords (a demanding activity) or leafed through newspapers (a nondemanding activity). There was also a group with no break allowed. It appeared that the break resulted in increased proportion of correct answers but its duration did not matter. It was also demonstrated that the demanding activity during the break was more beneficial than the less demanding one. It is therefore possible to conclude that:

1. incubational breaks work;
2. the unconscious activity of mind probably does not take place (duration of breaks is irrelevant); and
3. breaks allow redirection of attention from irrelevant aspects of the problem to the relevant ones (demanding activity is beneficial).

Restructuring

The notion of restructuring is crucially important for the original Gestalt account of insight. However, the Gestalt psychologists did not develop any mature theory of restructuring, sometimes over-relying on metaphors like 'replacement of figure with background' or 'seeing the problem from another perspective.' More elaborated models of restructuring have been worked out by cognitive psychologists and cognitive scientists in the last three decades.

According to Stellan Ohlsson, people typically attempt to solve problems through retrieving relevant knowledge from their long-term memory, while elements of the mental representation of the problem serve as retrieval cues. In 'normal problem solving' such a strategy may turn out to be successful but if a problem is tricky or unusual, a person runs into an impasse. In order to break the impasse, a person needs to restructure their mental representation of the problem. Instead of trying to find a way between the initial state of affairs (i.e., the problem) and the attempted goal state (i.e., a solution), one aims at constructing a new problem space, where both the initial state and the goal state are either changed substantially or replaced by entirely new structures. In consequence, restructuring means that a new problem arises in one's mind, with new initial data, new goals, and new constraints. When such a change is completed, the transformed mental representation of

the problem works as a fresh source of retrieval cues, thanks to which some relevant data, already stored in the long-term memory, can be used in a productive way.

Ohlsson improved the Gestalt theory through identifying three separate types of restructuring: elaboration, reencoding, and constraint relaxation. Elaboration consists in adding new elements to the original mental representation, so as to make it complete. For instance, the problem of the parallelogram (Figure 1) is easily solved if one adds new elements to its original representation, namely, two big triangles ABG and DCE. The original representation involves the square and the parallelogram, whereas the transformed representation consists of just two triangles. Reencoding amounts to sticking a new label to some old elements of the problem, which usually require that these elements be included into another category. For example, the rebus 'poPPd' ('two peas in a pod') is solved only if one includes two capital letters (PP) into one category, and three lowercase letters (pod) into another category. In other words, the solution requires that the already encoded elements be encoded again in this entirely new way, because particular letters must be treated as independent words instead of parts of words. The third mechanism, constraints relaxation, consists in abandoning, or at least lessening, some impediments, rules, or obstacles that previously seemed unconditional. For example, if the task is to compose four unilateral triangles with the use of six matchsticks, one has to abandon the tacit and false assumption that all triangles must be located on the same plane. Only after such relaxation is accomplished, one is able to build a pyramid of six matchsticks.

The Cognitive Mechanisms of Insight

Selectivity

Janet Davidson and Robert J. Sternberg proposed the selectivity theory of insight. According to the authors, insightful problem solving does not differ in kind from 'regular problem solving.' What makes a difference amounts to selectivity with which otherwise regular mental processes are executed. There are three types of selectivity that the authors believe are important for insight: selective encoding, selective comparison, and selective combination.

Selective encoding consists in taking into account some pieces of information that, though present in the perceptual field, were hitherto ignored as irrelevant. Alternatively, selective encoding may consist in ignoring some elements of the problem as irrelevant, although they tended to be treated as rather important. These two aspects of selectivity take place mostly in perception but may also occur in remembering and concept formation. Louis Pasteur's discovery is a good example of selective encoding. Pasteur noticed that grapes with broken skin quickly staled, whereas grapes with whole skin preserved their freshness for a long time. These facts were well known to everyone but only Pasteur understood that broken skin is a gateway open for microbes. In consequence, he was able to formulate the germ theory of fermentation.

Selective comparison amounts to discovery of relations between new facts and previously acquired pieces of knowledge. Thanks to such comparisons people can achieve new solutions through analogical transfer of knowledge. They use

already acquired knowledge to work out novel ideas, which are 'borrowed' from other schemas, or even other domains. Davidson and Sternberg illustrated this phenomenon with an anecdote about Archimedes, who had to find out if the king's crown was made of genuine gold. He knew the specific weight of gold but was unable to determine the irregular crown's volume. Fortunately, he noticed that the human body, which is also irregular in shape, elevated water if sunk in a bathtub. As soon as he discerned the analogy between the irregular human body and the irregular crown, he knew the solution: immerse the crown into water, measure the volume of water pressed up by the crown, which is equal to the volume of the crown, calculate the expected weight of the crown if it was gold, and – finally – compare the expected and the actual weight of the crown. Although anecdotal, this story epitomizes numerous examples of analogical transfer in science and technology.

Selective combination is a process through which people connect dispersed, seemingly unrelated pieces of knowledge into sensible, meaningful structures. Construction of scientific theories often matches this pattern. For example, Charles Darwin sketched the theory of evolution through connecting numerous facts from botany, paleontology, ornithology, and other domains of natural sciences. He provided an explanatory pattern thanks to which all these facts appeared understandable and meaningful. Sometimes selective combination leads to transformation of the old theory rather than construction of a new one but in every case this process requires that seemingly unconnected facts and observations be composed into a new and elegant configuration.

Simplification

Creativity is often impeded by the fact that problems that require new and productive approaches are incredibly complex in nature. The amount of data that have to be taken into account in order to construct a cognitive representation of the problem may give the impression of being too large for the human mind, particularly in science and technology but also in some domains of artistic creativity. Great creators undoubtedly possess enormous cognitive skills but nevertheless the complexity of problems they have to deal with does not seem compatible with the capabilities of any human mind. The disparity between what has to be done and human mental capabilities seems particularly severe in reference to working memory. This module is specialized in current information processing, so-called mental combinatorics, and it is severely limited in capacity. It is estimated that working memory can keep only about four separate chunks of information simultaneously. Four pieces of information may not be enough for economical shopping, not to mention insightful problem solving.

Herbert Simon was aware of the problem of disparity; therefore, he developed a theory of scientific insight whose main message amounts to the thesis that scientific problems must be substantially simplified in order to be solvable at all. Simplification is possible thanks to two independent processes: familiarization and selective forgetting. Familiarization is a long process of getting acquainted with all-important aspects of the problem. The situation is analyzed from many different perspectives. Also, many different ideas emerge how

to solve the problem, but all of them turn up to be false or incomplete. During this lengthy and 'intimate' contact with the problem, its structure is constantly changing. In particular, a person is able to perceive the problem from a very high level of abstraction, or – if necessary – with subtlety typical of perception at the lowest possible level of abstraction. In other words, the problem may look either simple or complicated, depending on the level of abstraction. In addition, during familiarization the elements of the problem are packed into 'mental parcels,' that is, they are composed in chunks defined on the basis of either content or association with other elements. In consequence, the problem gets more and more simplified although it is not deprived of important, building elements.

Simultaneously, selective forgetting allows the disposal of those elements of the problem that are not important, or even misleading. In every scientific problem, there are many pieces of data that are superfluous, redundant, or meaningless. It would be very advisable to get rid of them as soon as possible, if only one could tell which elements are actually misleading. Fortunately, the long process of deliberation about the problem makes such decisions easier, because what seems important at the beginning may lose importance later on, and *vice versa*. The mechanism of selective forgetting is especially beneficial from this point of view because it eliminates unnecessary elements of the problem quite automatically. We just do not remember some pieces of knowledge anymore, so we do not have to decide at the conscious level what is relevant and what is not.

Familiarization and selective forgetting may take a very long time but as soon as the problem is simplified enough, the solution appears as if unexpectedly. According to Herbert Simon's theory, unexpectedness is just a side effect of simplification of the problem structure, which is possible thanks to two independent but mutually supportive processes: familiarization and selective forgetting.

Assimilation

Assimilation is a process through which new elements are introduced into the cognitive representation of the problem. New pieces of knowledge are absorbed from the environment thanks to the ability of the properly prepared mind to exploit helpful external cues.

Colleen Seifert and her colleagues proposed a theory of insight based on the notion of opportunistic assimilation. According to this stance, the creative process starts with 'confrontation with the problem,' that is, with numerous attempts to understand the problem and to find a plausible solution. Striving for a new and valuable outcome is likely to result in a number of failed attempts so any serious creative work requires long-term commitment and strong motivation. When the impasse occurs, the human mind uses so-called failure indices in order to mark components of the unsolved problem in the long-term memory store. Thanks to these failure indices, the human mind remembers its fiascos: it is quite easy to remember that one was not successful and to retrieve required elements of the unsolved problem. The failure indices make one's mind rather vigilant, or 'hyper attentive,' to pieces of information that might be helpful in working out a solution.

The confrontation with the problem, the following impasse, and setting up failure indices, supposedly take place in the preparation phase of creativity. Then, the incubation period follows, which is characterized by a lack of any observable problem solving activity. This phase is very important, though, not because of hypothetical unconscious mental activity but because of increased tendency of the well-prepared mind to absorb relevant data from the environment. Siefert et al. do not agree with Simon's hypothesis about selective forgetting, nor with the argument that an incubational break alone is sufficient for success. Rather, they argue that the previously prepared mind is very sensitive to those elements of external stimulation that may be a source of relevant information. The mind takes a chance provided by the environment. External cues appear accidentally but their being utilized is the effect of the formerly performed job of confrontation with the problem, establishing failure indices, and making the mind well prepared for taking an opportunity to exploit relevant environmental cues. The experience of illumination, being a culmination of the creative process, results from unexpected 'opportunistic assimilation' of external cues that happen to be crucially important for finding a solution to the previously unsolved problem.

Conclusions

Insight is undoubtedly a pivotal moment of the creative process, so understanding insight results in better understanding creativity. The scientific study of insight brought about interesting theories, as well as valuable empirical evidence. However, there seems to exist a serious disparity between real-life insights, for example, in science and technology, and so-called insight tasks widely employed in laboratory studies. Future advances in the theory of insight seem to depend on the researchers' ability to unify the experimental laboratory studies with *in vivo* observation of genuine creative processes.

See also: Remote Associates; Max Wertheimer 1880–1943.

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Intelligence (as Related to Creativity)

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How are intelligence and creativity related? The question is important because, in our schools, we seem to value intelligence over creativity, but in life, creativity is at least as important because it involves adapting to the novel situations that can lead people either to great success or stunning failure. Not only is the relationship important for theoretical reasons, it also has tremendous applied value in the schools, workforce, and our every day lives.

The roots of creativity as a scientific discipline are planted in the intelligence literature. Many of the earlier scholars (such as Francis Galton, Lewis Terman, Alfred Binet, and Charles Spearman) who considered and discussed creativity were more primarily focused on intelligence. Indeed, it was an intelligence researcher, J. P. Guilford, who first publicly recognized the need for an independent study of creativity.

Guilford placed creativity into a larger framework of intelligence in his Structure of Intellect model. He attempted to organize all of human cognition along three dimensions. The first dimension was called 'operations,' and simply meant the mental processes needed to complete almost any kind of task, such as cognition. The second dimension, 'content,' referred to the general subject matter, such as words. The third dimension, 'product,' represented the actual products that might result from different kinds of thinking in different kinds of subject matters, such as writing. With five operations, four contents, and six products, Guilford's model had 120 different possible mental abilities. Indeed, he later expanded the model to include 180 different abilities, although the 120 abilities model is the one more often studied.

One of Guilford's operations (or thought processes) was divergent thinking – analyzing one's response to questions with no obvious, singular answer. Such questions might include "What would happen if we didn't need sleep?" This work, followed up by other researchers (most notably E. Paul Torrance), has often been used as a measure of creativity. Two of the most common ways of scoring these tests are fluency (the total number of responses given) and originality (how unique are the responses).

Theories of Intelligence which Encompass Creativity

Guilford placed creativity within the context of an intellectual framework. In doing so, he was the first of many to consider creativity to be part of intelligence. Some theories of intelligence include creativity as a subcomponent. Undoubtedly, the theory of intelligence that is most often applied to IQ tests is the CHC (Cattell–Horn–Carroll) theory, a combination of two earlier theories. The Cattell–Horn theory initially proposed two types of intelligence, crystallized (Gc) and fluid (Gf). Gc is what a person knows and has learned, whereas Gf is how a

person handles a new and different situation (i.e., problem solving). Horn expanded the theory to include more dimensions (known as Broad Abilities). Carroll's theory proposed a hierarchy of intellectual abilities. At the top of the hierarchy is general ability; in the middle of the hierarchy are various broad abilities (including learning and memory processes and the effortless production of many ideas). At the bottom of the hierarchy are many narrow, specific abilities such as spelling ability and reasoning speed.

The combined CHC theory incorporates both the concept of a general intelligence (all of the different aspects of intelligence are considered to be related to a common 'g', although this aspect is not often emphasized) and the concept of many different aspects of intelligence. Ten different broad factors of intelligence are proposed. These include Gf and Gc from the initial Cattell–Horn theory. They also include Gq (quantitative knowledge, typically math-related), Grw (reading and writing), Gsm (short-term memory), Gv (visual processing), Ga (auditory processing), Glr (long-term storage and retrieval), Gs (processing speed), and Gt (decision speed/reaction time). Of these 10, only 7 are directly measured by today's intelligence tests: Gq and Grw are in the domain of academic achievement, and, therefore, are measured by achievement tests, and Gt is not measured by any major standardized test. Intelligence tests may indirectly measure some of these other skills, however. For example, intelligence tests indirectly measure achievements in various areas. The Stanford–Binet 5 and the Woodcock–Johnson–Revised were the first intelligence tests to be built on Gf–Gc theory. Today, nearly every major intelligence test is founded either explicitly or implicitly on the current version of the theory, namely, CHC.

Although in the early stages of the Cattell–Horn Gf–Gc theory, Gf (fluid intelligence) was hypothesized to be strongly linked to creativity, such a relationship is no longer explicitly part of the CHC theory. The current model, based on factor analytic studies by Carroll and others, includes originality/creativity as a component of long term storage and retrieval (Glr). The most recent presentations of CHC theory argue that some Glr narrow abilities impact such creativity-relevant abilities as divergent production, ideational fluency, or associative fluency. In the detailed description of the model, connection is the only mention of creativity, originality, or divergent thinking. Fluid intelligence (Gf) is discussed in terms of its relationship to problem-solving and coping with novel problems (both considered to be highly related to creativity), yet the emphasis is on Glr.

Martindale proposed a differential relationship between Gs (processing speed) and creativity. According to Martindale's theory, people who are creative are selective with their speed of information processing. Early in the creative problem-solving stage, they widen their breadth of attention, allowing

a larger amount of information to be processed (and thereby lowering their speediness). Later, when the problem is better understood, their attention span is shortened and their reaction time is quicker. This theory is reminiscent of Sternberg's distinction between global and local planning: According to Sternberg, brighter people spend more time in initial global planning so that later they do not have to spend as much time in local planning.

Some have argued that the current CHC model short-changes creativity. Placing all references to creativity and originality under *g* seems quite narrow. The ability to draw selectively on past experiences is essential for creating something new. But the connection between fluid intelligence and creativity is minimized in new conceptions of the model. A theory of intelligence that has recently been applied to school admissions is Sternberg's theory of successful intelligence. This theory comprises three 'subtheories': a *componential subtheory*, which relates intelligence to the internal world of the individual; an *experiential subtheory*, which relates intelligence to both the external and the internal worlds of the individual; and a *contextual subtheory*, which relates intelligence to the external world of the individual. The componential subtheory specifies the mental mechanisms responsible for planning, carrying out, and evaluating intelligent behavior. The experiential subtheory expands on this definition by focusing on those important behaviors that involves either adjustment to relative novelty, automatization of information processing, or both. The contextual subtheory defines intelligent behavior as involving purposeful adaptation to, selection of, and shaping of real-world environments relevant to one's life.

The experiential subtheory is directly related to creativity. Sternberg's application assessments of creativity to admissions data increased prediction of college success beyond that obtained with standard admissions tests; in addition, ethnic-group differences were significantly reduced. Gardner's well-known theory of multiple intelligences does not specifically address creativity. However, his eight intelligences (interpersonal, intrapersonal, spatial, naturalistic, linguistic, logical-mathematical, bodily-kinesthetic, and musical) certainly seem to apply to creativity. Gardner has used case studies of eminent creative individuals to argue that creative people can shine as a function of embodying different intelligences. For example, he selected Freud as an example of intrapersonal intelligence; Einstein to represent logical-mathematical intelligence; Picasso, spatial intelligence; Stravinsky, musical intelligence; T. S. Eliot, linguistic intelligence; Martha Graham, bodily-kinesthetic intelligence; and Gandhi, intrapersonal intelligence (naturalistic intelligence had not been added at this time).

Another theory of intelligence that incorporates creativity is Luria's neuropsychological model. Like the CHC model, Luria's model is frequently applied to intelligence tests. This model has three functional units; the first unit is responsible for focused and sustained attention. The second functional unit receives and stores information with both simultaneous and successive (or sequential) processing. Simultaneous processing involves integrating chunks of information together, largely in parallel; chunks are synthesized together simultaneously, much as one might appreciate a painting all at once. Successive processing is interpreting chunks of information

separately, in sequential fashion, much as when one listens to a news broadcast reporting successive stories.

The third functional unit is responsible for planning, decision-making, and self-monitoring behavior. It is this last ability, planning, that has been hypothesized to be related to creativity. For example, studies have found that planning-oriented cognitive styles were strongly linked to creative productivity. Also, people who spent time planning and replanning a project were more productive and more creative.

Theories of Creativity that Encompass Intelligence Systems Theories

In recent years, there has been an emphasis on creativity theories that incorporate factors that are interrelated. Some of these theories emphasize issues such as the environment or evolution and are less relevant here. Other theories emphasize a confluence of different elements and include intellectual and cognitive abilities in the equation. One such theory is Sternberg and Lubart's 'investment' theory of creativity, in which the key to being creative is to buy low and sell high in the world of ideas. In this model, a creative person is like a talented Wall Street investor. A successful creator will generate ideas that may be initially unpopular or underappreciated (as in buying stocks with low price-earnings ratios), yet will persist and convince others of the ideas' merits. The creator will then know when to move on to pursue other ideas (as in selling high, when one divests oneself of stocks).

According to this model, six main elements contribute to creativity: intelligence, knowledge, thinking styles, personality, motivation, and the environment. Intelligence contributes using three elements drawn from Sternberg's triarchic theory (later expanded into the theory of successful intelligence).

The first element is synthetic ability, which is the ability to generate ideas that are novel, high in quality, and high in task appropriateness. Because creativity is viewed as an interaction between a person, a task, and an environment, what is novel, high in quality, or task appropriate may vary from one person, task, or environment to another. Central to this ability is being able to redefine problems. Creative people may take problems that other people see, or they themselves may previously have seen, in one way, and redefine the problems in a different way. This synthetic ability includes three knowledge-acquisition components. The first, selective encoding, involves distinguishing relevant from irrelevant information. Selective combination, the second, involves combining bits of relevant information in novel ways. Finally, selective comparison involves relating new information to old information in a novel way.

The second element, practical ability, is needed to communicate creative ideas to other people (i.e., 'selling' an idea). Good ideas do not always sell themselves – the creative person needs to devise strategies for and expend effort in selling those ideas.

The third component, analytical ability, is often measured by traditional intelligence tests. Yet this component is also related to creativity, as a successful creator must be able to judge the value of his or her own ideas and decide which ones to pursue. Such analytical ability can be used to evaluate

the strengths and weaknesses of the idea and determine the best steps to improve upon the idea. People who are high in synthetic ability but low in analytical ability may need someone else to evaluate and judge their work for them. People who are able incisively to evaluate their own work may be said to be high in metacognition (which is related to planning, a key component of Luria's model).

There has been some empirical work on the role of meta-cognitive abilities in creativity. Some studies have found that people who tended to produce more original responses also were better at rating their most original responses to a divergent-thinking task. In one study, people were asked to pick their best responses to a similar divergent-thinking task, and then examined whether they were more likely to choose responses that outside raters considered creative. Research found that people were able to discern their more creative responses – and that people who were more open to experience were more likely to choose accurately.

A theory of giftedness that could be argued to be a Systems theory is Renzulli's Three-Ring Model, which proposes that giftedness is at the intersection among above-average intelligence (measured traditionally), creativity, and task commitment. The circles representing creativity and intelligence overlap. Renzulli distinguishes between two types of giftedness – schoolhouse (i.e., what would be measured by an ability or achievement test) and creative-production. Examples of his components of creativity include Guilford's divergent thinking components (fluency, flexibility, and originality), and being open to new experiences, curious, willing to take risks, and sensitive to aesthetic characteristics.

Another theory that views creativity as a mix of different abilities is Amabile's componential model of creativity. She argued that three variables were needed for creativity to occur: domain-relevant skills, creativity-relevant skills, and task motivation. Domain-relevant skills include knowledge, technical skills, and specialized talent (i.e., a creative mathematician should know basic algebra and geometry). Creativity-relevant skills are personal factors that are associated with creativity. These skills include tolerance for ambiguity, self-discipline, and risk-taking. Finally, Amabile singles out your motivation toward the task at hand. Intelligence would primarily occur at the domain-relevant skill level.

Cognitive Theories of Creativity

The other group of theories that includes intellectual abilities as a key component is the set of cognitive theories of creativity. Guilford, as discussed earlier, pioneered these ideas, and his convergent versus divergent thinking dichotomy is still a key idea in creativity. Even before Guilford, however, Wallas proposed a model of the cognitive creative process. According to his five-stage model, you first use *preparation* to begin work on a problem. Next, there is *incubation*, in which you may work on other things while your mind thinks about the problem. In *intimation*, you realize you are about to have a breakthrough (this phase is sometimes dropped from the model), and then you actually have the insight in the *illumination* phase. Finally, with *verification*, you actually test, develop, and use your ideas.

More recently, the Genevieve model has two phases, generative and explorative, that are comparable to Guilford's

convergent and divergent thinking distinction. In the generative phase, someone constructs a preinventive structure, or a mental representation of a possible creative solution. For example, Elias Howe was working on his invention of the modern sewing machine. He could not quite get the needle correctly designed. Howe had an odd dream in which he was chased by savages who threw spears at him. The spears had a circle loop at the end – and Howe realized that adding the circle (or an 'eye') to the end of the needle was the solution he needed. The image of a spear with a circle at the end – the image that preceded Howe's insight – would be an example of one of these preinventive structures. They do not need to be as dramatic or sudden as the realization based on Howe's dream. Indeed, the generation of preinventive structures is only one part of the creative process, according to the Genevieve model. The thinker must then explore these different preinventive structures within the constraints of the final goal. There may be several cycles before a creative work is produced.

Although the model focuses on the creative process, most tests of the model have actually measured the creative product. In an experiment testing the model, people were shown parts of objects (such as a circle or a cube). They were then asked to combine these parts together to produce a practical object or device. The creativity (and practicality) of the items was then assessed. Interestingly, people produced more creative objects when they were told which parts had to be combined than when they could pick the parts to be combined.

Other theories have also focused on cognitive-oriented components of the creative process. Michael Mumford and his colleagues have argued for an eight-part model, focusing on problem construction, information encoding, category selection, category combination and reorganization, idea generation, idea evaluation, implementation planning, and solution monitoring. Mednick proposed the idea that creativity occurs when different elements are associated together to form new combinations. Creative individuals are assumed to be able to make meaningful, useful associations between disparate concepts and ideas to a greater extent than a relatively uncreative individual. The Remote Associates Test was developed based on this idea.

Theories on How Intelligence and Creativity Are Related

The threshold theory argues that intelligence is a necessary but not a sufficient condition of creativity. According to this view, creativity and intelligence are positively correlated up until an IQ of approximately 120; in people with higher IQs, the two constructs are said to show little relationship. The interference hypothesis suggests that very high levels of intelligence may interfere with creativity.

Empirical Work on Intelligence and Creativity

Most studies that investigate creativity and intelligence use divergent-thinking tests (such as the TTCT) or other related paper-and-pencil tests also scored for fluency, originality, or other divergent thinking-related methods of scoring. The studies have generally found that creativity is significantly associated

with psychometric measures of intelligence (especially verbally oriented measures, regardless of the type of creativity measured). This relationship is typically not a particularly strong one, although some have argued that the relationship between the latent constructs of creativity and intelligence is underestimated because the analyses only look at observable scores (i.e., performance on an intelligence test). If it were possible to get a 'true' measure of the constructs, there might be a higher relationship.

More recently, however, the threshold theory has come under fire. Some have found that the nature of the relationship was dependent on the measures used and the populations tested. Others looked at measures of fluid intelligence and creativity (as measured through divergent thinking tests) and found modest correlations across all levels of intellectual abilities. A longitudinal study of gifted (top 1%) 13 year olds revealed that differences in SAT scores – even within such an elite group – predicted creative accomplishments 20 years later. A meta-analysis of 21 studies discovered virtually no support for the threshold theory, with small positive correlations found at all levels of ability between measures of intelligence and creativity.

It is notable, however, that nearly all of these studies do not use traditional, individually administered intelligence tests. In the meta-analysis, many of the studies were more than 30 years old and, therefore, were conducted using intelligence tests that do not reflect current theories of intelligence. In addition, most of the studies used group intelligence tests. Although group intelligence tests serve a strong purpose in research studies, they are not used by most school psychologists for psychoeducational assessment.

One of the few research studies to use an individually administered, modern IQ test used the Kaufman Adolescent and Adult Intelligence Scale and a creative invention task (in which people would use shapes to create a possible object, and then name and describe their invention). They delved deeper into the intelligence–creativity relationship by specifically examining the relationship between Gf (novel problem solving) and Gc (acquired knowledge) and a measure of actual creative innovation. Gc showed the same moderate and positive relationship to creativity as past studies, mentioned previously; in contrast, Gf showed the opposite pattern. Measured intelligence and creativity were significantly correlated for the high IQ group, but they were not significantly correlated for people with average IQs. This finding implies that students who receive high Gf scores may be more likely to be creative than students who receive high Gc scores.

This study also addresses a second major weakness in this line of research: the over-reliance on divergent thinking measures as the sole assessment of creativity. Few studies have been conducted that include measures of creative personality, creative products, and creative processes (other than divergent thinking). Given the distinct characteristics of assessments in these areas, highlighted throughout this book, the threshold theory may be best viewed as largely untested.

Conclusion

Intelligence is strongly valued in schools, and there are extensive and popular measures that are often used. There are usually hundreds of empirical studies about each intelligence test. Creativity may be theoretically desired in school, but is often considered less important; some teachers may even dislike creative students. Creativity assessment is murkier than intellectual assessment. The Torrance Tests remain the most-used creativity tests despite extensive critiques.

Few studies contradict the idea that creative people tend to be fairly smart, and that smart people are usually somewhat creative. But some of the tested-and-true ideas about the specific relationship are still unclear. If the threshold theory is correct, then there may be a certain point at which being smart stops helping creativity; recent psychometric studies, however, call the existence of the threshold effect into question.

Both intelligence and creativity are essential component of learning and problem solving in everyday life. Virtually any problem, by the virtue of definition, imposes on its solver some ambiguity that needs to be overcome in order to find the solution. Some theories consider creativity to be subsumed into intelligence and others view intelligence as a core component of creativity. The need of both cognitive constructs in life, however, is undisputed.

See also: Divergent Thinking; Dreams and Creativity; Everyday Creativity; Multiple Intelligences; Problem Finding; Remote Associates.

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Interest Inventories

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Glossary

Characteristics approach A method of identifying potentially gifted individuals based on how similar their interests, behaviors, and personality traits are to those of highly creative people rather than identifying them based on their previous creative achievement.

Holland codes A set of six different categories of interest based on J. L. Holland's personality research. The categories include: realistic, investigative, artistic, social, enterprising, and conventional.

Interest inventories Assessment tools that determine an individual's likes and dislikes for activities, objects,

and persons. The inventory may determine level of interest either interpersonally (compared to the interests displayed by other individuals or groups) or intrapersonally (compared to interest in other types of activities within the same individual).

Reliability The consistency of a measurement; the extent to which a construct remains stable across time and across raters.

Validity The extent to which an assessment measures what it is purported to measure; the degree to which an assessment correlates with an established measure of the construct it is supposed to be measuring.

Introduction

Interest inventories are assessment tools that determine an individual's likes and dislikes toward a variety of activities, objects, or people. Inventories may determine level of interest either interpersonally (compared to the interests displayed by other individuals or groups) or intrapersonally (compared to level of interest in other activities within the same individual) or both. Interest inventories are often used to predict present or future success and satisfaction within a specific domain of endeavor. Inventories that use *interpersonal* comparisons assume that individuals whose interests match those of a specified group will be more likely to find satisfaction in activities and careers endorsed by that group. Inventories that use *intra-personal* comparisons assume that interest in an activity or endeavor motivates the individual to pursue that interest, and may consequently equate to better performance in the specified activity. In other words, a person's interest is indicative of his or her potential in that area.

Three types of interest inventories are related to creative endeavors. The most prominent group of inventories is geared toward the assessment of possible career trajectories for adolescents and adults. These vocation-based interest inventories compute the individual's interests across different categories of activity, including creative activities, each related to a broad range of potential careers. A second smaller set of inventories measures interest in creative activities in children. These inventories are primarily geared toward identifying individuals who may show promise in creative fields such as visual art, creative writing, music, drama, and science. High scores on these measures may be used as selection criteria for programs for gifted children. A third type of inventory assesses creative interest as a measure of overall creativity for psychological research purposes. These inventories vary in their structure and method of delivery and may include items that assess creative achievement along with interest-based items.

While the three types of inventories are grouped according to the purpose for which they were developed, their functions

overlap and are not mutually exclusive; both vocational and educational inventories may be used for research, and vice versa. Because vocation-based instruments are the most widely used form of interest inventories, they will be prominently discussed.

Vocation-Based Interest Inventories

Vocational interest inventories were developed as an applied psychology tool for the purpose of career counseling. The assumption behind the use of vocational interest measures is that occupational satisfaction and performance will be determined not only by aptitude and skill, but will also be enhanced when an individual's interests are in line with the requirements of the occupation. When the environment and the individual's interests coincide, work performance and work satisfaction will be maximized.

Vocational interest inventories have a variety of uses. Because they were designed for vocational counseling, they are widely administered in high school and college career counseling settings. Most vocational inventories are suitable for use with both adolescents and adults. These inventories are also used in career transition settings, such as transitioning out of the military into civilian careers. In addition, they may be used by employers as part of a psychological testing package for potential employees. Finally, interest inventories can be used by individuals to help them determine the type of leisure activities that may balance their work life.

History of Vocational Interest Inventories

Speculation into the usefulness of interest inventories appears to have originated with E.L. Thorndike early in the twentieth century. In 1912, he reported the results of a project in which he asked 100 college undergraduates to list their interests in elementary school, high school, and college, and then to list their abilities during the same periods. Thorndike concluded

from this project that (1) interests precede abilities and (2) interests and abilities are closely related.

The prototype for the interest inventory had its beginnings after World War I at the Carnegie Institute of Technology, where Clarence S. Loakum was developing psychological tests for army use. The first widely used inventory, the Strong Vocational Interest Blank (SVIB), was developed in 1927 by E. K. Strong, Jr., to help individuals exiting the military find suitable jobs. The development of the SVIB is historically important because it is the most widely used model and the oldest interest inventory in continuous use.

The original SVIB was an inventory of items that dealt with activities, objects, and types of people that might be encountered in everyday life. Respondents indicated whether they liked or disliked each item. The original items in the SVIB were culled from a set of 1000 that had been developed by Yoakum at Carnegie. These items were submitted to samples of approximately 10000 men in some 50 occupations, and items that differentiated groups were retained in the inventory. Results of Strong's research indicated that preference for a career type also extended to a preference for specific hobbies, school subjects, and social relationships. Scores from Strong's inventory were keyed on how closely the preferences of the individual respondent matched the preferences of the vocationally distinct samples. The original inventory was not based on any specific theoretical approach, and the early versions of the instrument were developed exclusively for men. Variants of Strong's original inventory, including the recently revised Strong Interest Inventory, are still in use.

Another major influence on vocational interest inventories was the development of the Holland classification system of person and environment. In 1959, psychologist John L. Holland published the first version of his person-environment theory of vocational personalities, based on 11 years of empirical investigation. This theory suggested that both individuals and work environments can be classified into six categories, designated as Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. The system of classifications, known as the Holland codes, was based on the assumption that career choice is an expression of personality (Figure 1). Thus, the six categories of personal and vocational interests represent dispositional traits of basic personality types. Holland believed that individuals who are aware of their preferred interest types can make better career choices.

Within the Holland system, the two categories of interests that are most relevant to creativity are the Artistic and the Investigative. The Artistic category includes interest in the arts, writing, music, design, and a variety of other creative endeavors. It also includes a preference for an unstructured work environment, flexible working hours, and flexible work location. The Investigative category includes interests in activities that involve observation, evaluation, and problem-solving, with relatively minimal interaction with other people. The Artistic and Investigative categories are indicative of interest in the arts and sciences respectively, and are generally taken to be measures of creative interests.

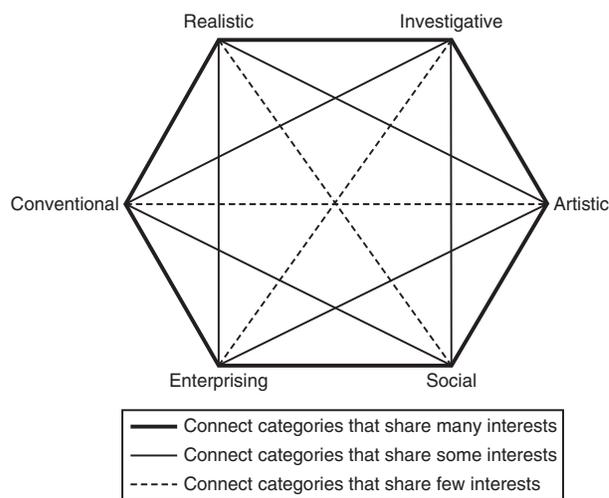


Figure 1 Holland's classification codes.

In contrast, the Realistic category of interests includes a preference for working with one's hands using tools, machines, or plants, and engaging in practical or physical tasks. It is associated with careers such as farming, transportation, and law enforcement. The Social category includes interest in working with people rather than things, as well as a desire to train, counsel, or cure others. It is associated with careers in education, applied medicine, counseling, and customer service. The Enterprising category includes interest in persuading, influencing, or directing others. It is associated with careers in sales, politics, entrepreneurship, and the law. Finally, the Conventional category of interests includes a preference for working with data rather than people or objects, and a desire for structure and working with details. It is associated with careers in accounting, business administration, banking, and finance.

Holland's research indicated that most people's interests do not fall exclusively into one category, but rather consist of blends of interests from several categories. Interests from one category will generally be dominant, with secondary interests falling within each of the remaining categories in descending order of preference. Correlations of types of interests across many samples of occupations also suggested that some interest categories are more highly correlated with each other than others. Holland arranged the six categories in a hexagon with types that tend to be more highly correlated arranged adjacent to each other. Thus, it is more likely that individuals whose primary interests are in the Artistic category will have secondary interests in either the Investigative or Social categories than in the Realistic category.

Holland's hexagon is widely employed in the vocational interest inventories available today. The Strong Interest Inventory (SII), for example, incorporates Holland's theory with Strong's original research on interests and occupations, and provides feedback to users on both the Holland codes and the occupations that are aligned with those codes.

Current Vocational Interest Inventories

Currently, there are more than 50 vocational interest inventories commercially available. Because these inventories

measure interests rather than skills or aptitudes, they are often delivered in conjunction with specific aptitude tests. **Table 1** lists examples of current vocation-based interest inventories.

The most widely used current interest inventories are those based on Strong's original 1927 instrument. The original version of the inventory has been revised by psychologists Jo-Ida Hansen and David Campbell, and several offshoots of the original Strong inventory are now available. Major changes to the original Strong inventory include the following: (a) occupations are now theoretically interpreted using the Holland codes, (b) separate inventories for males and females have been combined into a single assessment, (c) more occupations for vocational and semi-skilled workers with lower education levels have been added to the list of occupations described, and (d) inventories are now generally delivered and scored by computer rather than by hand, improving the speed and accuracy of the inventory.

A second set of vocational interest inventories that have been in use almost as long as the Strong inventories first appeared in 1934, and were developed by G. F. Kuder. The Kuder inventories differ from those developed by Strong in several ways. Unlike the Strong inventories, Kuder's original inventory was not empirically normed but was based on conceptually derived categories of interests. Rather than using the six-category Holland system as the basis of interests, Kuder conceived 10 broad interest areas: Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service, Clerical, and Outdoors. Scores on the broad interest areas can be converted to Holland system scores by combining the output scores for the Artistic, Literary, and Music scales (equivalent to Holland's Artistic category) and the scores for the Clerical and Computational scales (equivalent to Holland's Conventional category). Researchers have noted the similarity between the categories in the Holland and Kuder systems, despite the very different methods of development (empirically versus conceptually driven). That two such different methodologies have yielded such similar results attests to the face validity of the interest categories.

An additional type of interest inventory was introduced by Holland himself. Whereas other inventories of the time were designed to be administered and scored by trained

professionals, Holland's Self-Directed Search (SDS) was developed to be self-administered and self-scored. Users could sum their own responses to yield scores on each of the six themes of the Holland hexagon. They could then look up a table of occupations suited to their theme scores in the manual provided with the inventory.

Although the six categories of interest described by Holland continue to be widely accepted, the careers associated with each category have changed over time. Because some career choices become outdated (such as telegraph operator) and new careers possibilities are constantly developing due to technological advances (such as IT specialist), it is necessary to update vocational interest inventories on a regular basis. For example, in the Artistic category, new careers include work in computer graphics design, internet advertising, and interactive video. In the Investigative category, new careers include developing computer systems, research using brain imaging, and research in molecular genetics.

Validity and Reliability of Vocation-Based Interest Inventories

Most popular vocational interest inventories available today appear to have acceptable validity and test-retest reliability according to published studies.

Because one of the main purposes of interest inventories is to assist in career counseling, the predictive validity of the tests is important. While there is variability across instruments, the most popular inventories have shown good predictive validity. Studies of popular inventories indicate a concordance of 50–75% between current occupations and occupations predicted by interests inventories 12–19 years earlier.

A second purpose of interest inventories is to predict future job satisfaction. One premise of the inventories is that when individual interests are matched with occupational demands, career satisfaction should improve. Several studies have investigated job satisfaction in terms of interest-occupation compatibility as measured by interest inventories. The results have been mixed. While some studies show only small associations between job satisfaction and interest-occupation congruence, other studies show that congruence is an efficient predictor of job satisfaction when between-occupation sources of variance are controlled.

A number of studies have also examined validity and reliability for interest inventories across racial and ethnic groups. The SII has shown validity in Chinese groups and Icelandic college-age groups. There is evidence for validity in college-educated groups of African Americans, Latinos, Native American and Asian Americans as well. However, it is unclear whether the validity of the inventories would extend to minority groups with lower education levels.

Most research indicates that it is preferable to use interest inventories that have been developed specifically with the group to be tested in mind. To that end, several interest inventories have also been developed for specialized groups, including picture-based inventories for groups who are illiterate, developmentally disabled or who have limited familiarity with English.

A quantitative analysis of 66 longitudinal studies conducted by K. S. Douglas Low and colleagues in 2005 examined the

Table 1 Examples of vocation-based interest inventories

<i>Name of inventory</i>	<i>Author(s)</i>
ACT Interest Inventory (ACTII)	American College Testing Program
Campbell Interest and Skill Survey (CISS)	D. P. Campbell
Career Assessment Inventory (CAI)	C. B. Johansson
Jackson Vocational Interest Survey (JVIS)	D. N. Jackson
Kuder Occupational Interest Survey (KOIS)	G. F. Kuder, E. Diamond, and D. Zytowski
Strong Interest Inventory (SII)	E. K. Strong, Jr., D. P. Campbell, and J. Hansen
Self-Directed Search (SDS)	J. L. Holland
Vocational Interest Inventory (VII)	P. W. Lunneborg

stability of interests across time as measured by popular vocational interest inventories. This review found that vocational interests remain relatively stable over time, and in fact, show even greater stability than measures of personality traits between early adolescence and early adulthood. According to this review, stability of interests rises steadily from early adolescence, and peaks in early adulthood, declining somewhat between 29 and 40. Of the six categories of interests in the Holland classification system, Realistic and Artistic interests showed the greatest stability over time. When the interest classification system developed by Kuder was examined, Artistic interests again showed the greatest stability, followed by Mechanical, Musical, and Scientific interests. The bulk of the research indicates that areas of interest, whether described by the Holland and Kuder classification systems, are stable, trait-like features within individuals.

Gender Differences in Interests

Early interest inventories were developed for men only. Specific but separate scales were later developed for women under the assumption that there was little overlap between the occupations chosen by men and women. Even when instruments that combined tests for men and women were introduced, groups such as the American College Testing Program (ACT), argued that items within certain occupation scales were still heavily weighted toward one sex or the other. The ACT asserted that interest inventories could provide a means of exploring the world of possible occupations and thus should be instruments for social change and equality in addition to providing personal information on career choice. Such a role for interest inventories would mandate that they be scored similarly for both men and women. Other researchers, including Holland, believed that interests are partially the result of the different socialization of men and women and that standardizing the scale scores for both sexes would affect the validity of the inventories. In 1981, the ACT released a unisex version of its interest inventory, in which items that substantially differentiated the sexes were removed. A recent study indicated that women who take both the ACT test and one of several other inventories based on the Holland classification system are likely to receive very different scores on the interest scales. These findings have led to a debate in vocational psychology, with some researchers applauding the unisex model and others suggesting that the removal of sex-weighted items substantially dilutes the underlying category descriptions and blurs them to the point that they no longer convey meaningful information.

Traditionally, women have shown interest in careers that are geared toward working with other people, while men have shown more interest in working with data and things. The Holland hexagon can be roughly divided in half based on a preference for working with people (Social, Enterprising, and Artistic categories) or working with things (Realistic, Investigative, and Conventional categories). A meta-analysis conducted in 2009 by Rong Su, James Rounds, and Patrick Armstrong examined studies in which over 500 000 men and women had completed interest inventories. The results indicated that there continue to be substantial differences between the interests of men and women despite the opening of many previously male-dominated occupations to women. This analysis

indicated that women across many age cohorts tended to prefer interests in the Social, Artistic, and Enterprising categories, as predicted by former research, while men overwhelmingly preferred interests in the Realistic and Investigative categories. Further, men demonstrated substantially more interest in the so-called STEM fields (science, technology, engineering, and mathematics) than women. Although there was somewhat more interest in the STEM fields in younger rather than older women, the difference was not significant enough to indicate a major trend, suggesting that differences in interest – rather than ability or opportunity – may explain the lack of parity in these fields.

In summary, vocation-based interest inventories have been in existence since the early 1900s. Most of them are commercial in nature. The main premise of these inventories is that matching individual interests to the qualities of the work environment will result in greater job satisfaction and performance. This premise appears to be empirically supported. The most popular systems of categorizing interests show substantial overlap, suggesting that the categories have validity. Current issues in the ongoing development of interest inventories include the handling of gender differences in occupational interests, the development of inventories that serve specialized groups of individuals, and the updating of job descriptions and interest items to reflect the rapidly changing technology of the twenty-first century.

Education-Based Creative Interest Inventories

As with vocation-based interest inventories, education-based inventories have a variety of uses. Understanding a child's creative interests may assist teachers in determining the best ways to help an individual child learn new material. When students can be directed toward materials that stimulate their prepotent interests, they are likely to remain engaged in school. Identifying a child's interests at an early age may also help educators and parents to guide children toward activities and educational choices that will be more rewarding for the child.

Interest inventories may also assess creative interests in children for the purpose of early identification of possible career trajectories that are impacted by educational decisions. For example, identified interests may affect a student's choice of high schools, electives, and clubs and summer programs. Results of interest inventories may also be used for early identification of creative giftedness. In some cases, inventory scores may be used as a partial basis for selection to gifted child or extra-curricular school programs. One assumption of such inventories is that the child who is interested in creative endeavors will be intrinsically motivated to take advantage of the skills and opportunities afforded by special programs, and thus will be more likely to be successful in such programs.

Many of the interest inventories designed to test children are based on the 'characteristics approach' to assessment. The assumption of this approach is that creative people share common interests, behaviors, and personality traits. Therefore, determining how closely an individual's interests match those of most creative persons is a valid way to assess creativity. Many gifted programs of the 1950s and 1960s relied on teacher

Table 2 Examples of education-based interest inventories

<i>Name of inventory</i>	<i>Author(s)</i>	<i>Age range</i>
Creative Activities Checklist	M. Runco	Grades 4–8
Creative Perception Inventory	E. P. Torrance and J. Khatena	Grades 4–12
Group Inventory for Finding Interests	G. A. Davis and S. Rimm	Grades 6–12
The Interest-A-Lyzer	J. S. Renzulli	Grades 3–12
Preschool and Kindergarten Interest Descriptor	S. Rimm	Pre-k and k

evaluations or school achievement as selection criteria. Research indicated that this form of selection lacked validity and reliability, with many potentially creative students being omitted from the selection process. Therefore, a number of psychologists have advocated for using instruments that identify creative children based on their creative interests and behaviors as well as on their school performance.

Education-based interest inventories are delivered in several formats. Inventories geared toward very young children can be completed by an observer of the child, such as a teacher or parent. Inventories for elementary school children may be picture based to account for differences in reading levels. The assessments may consist of open-ended questions ('what is your favorite activity at school?'), forced choice items ('I prefer to work alone' versus 'I prefer to work in a group'), or Likert-type items that rate activities on a never-sometimes-always scale. While most inventories are available in paper-and-pencil format, many are now available as internet programs with automatic, immediately available scoring. **Table 2** lists examples of interest inventories designed primarily for educational use.

Research using education-based creative interest inventories has reported four significant findings: first, reliability of interest inventories increases with age. Thus, instruments that assess preschoolers are less reliable than those that assess middle schoolers or high schoolers. Second, children who later enter creative occupations display interest in creative activities, such as art, writing, and investigative pursuits, early in life. Third, children who later enter creative occupations also display a wider range of interests than children who later choose less creative occupations. Finally, education-based interest inventories display greater predictive validity when used in conjunction with at least one other form of creativity assessment.

Research-Based Creative Interest Inventories

In addition to inventories measuring creative interests in children and vocational interests in adolescents and adults, a set of inventories has also been developed for use in psychological research settings. These inventories are based on the premise that future creative behavior is best predicted by past creative behavior and interest. One of the most widely replicated findings in the field of creativity research is that highly creative individuals are intrinsically motivated. Intrinsic interest in creative activity appears to be the motivating force behind much creative work. Because creative interest is necessary for high creative performance, creative interest scores are often treated as a measure of creativity.

Description of Research-Based Creative Interest Inventories

Creative interest inventories used in research are self-report measures that generally consist of checklists of activities ('I like to invent things,' 'I like to write stories'). Self-report inventories have a number of advantages over other forms of creativity measurement. First, they are quick and easy to complete. Second, they avoid the time and expense of engaging expert raters. Finally, they are suitable for internet administration, and therefore avoid the necessity of testing participants in a lab setting. Unlike the vocational and education-based interest inventories, most of the research-based instruments are not commercial in nature.

Some of the creative interest inventories developed for research combine items concerning creative interest with items assessing creative achievement. For instance, a checklist developed by researcher Dennis Hocevar for use with college-age subjects, combines items that assess participation in creative activities (e.g., 'participated in a dance workshop') with items that assess actual achievements (e.g., 'received an award for acting'). Similarly, a measure developed by Holland and Robert Nichols combines items assessing creative interests (e.g., 'drawing cartoons') with achievement items (e.g., 'invented a patentable device'). **Table 3** lists several creative interest inventories developed for research.

Relationship of Creative Interest to Other Measures of Creativity

If creative interest inventories are indeed a valid method of assessing creativity, they should demonstrate moderate correlations with other assessments of creativity. Creativity is often measured by tests of creative achievement, divergent thinking, and creative personality. In fact, several studies indicate that scores on creative interest inventories are indeed related to creative achievement in high school and college students. Creative interests in childhood predict teacher ratings of creativity in high school. Creative interests in high school predict both teacher ratings and self-report lists of creative accomplishments in college. As was indicated in research using vocational interest inventories, investigations using research inventories confirms that creative interests tend to remain stable throughout childhood and early adulthood and to predict creative pursuits in college.

Divergent thinking is a type of cognition in which the contents of memory and perception are employed to generate a large variety and quantity of solutions from an open-ended source or starting point. The ability to think divergently has been associated with creative potential; tests of divergent

Table 3 Examples of research-based creative interest assessments

Name of inventory	Author(s)	Year
ALPHA-Biological Inventory	C. W. Taylor and R. L. Ellison	1972
Biographical Inventory – Creative	A. A. Anastasi and C. E. Schaefer	1969
Creative Behavior Inventory	D. Hocevar	1979
Lifetime Creativity Scale	R. Richards, D. Kinney, et al.	1988
Potential Achievement Scales	J. L. Holland and R. C. Nichols	1964

thinking have been used as a measure of trait creativity. In general, scores of creative interest inventories do not correlate highly with measures of divergent thinking, although both types of measures have validity as markers of creative achievement. Researchers suggest that divergent thinking ability and creative interests may tap into two different facets of the creative achievement construct that, while unrelated to each other, are both necessary for high creative achievement.

Other work has demonstrated a positive and significant correlation between scores on a creative interest inventory and expert ratings of creative drawings. Inventories have also been associated with the personality trait openness to experience, the trait most predictive of creativity.

Creative interest inventories are rarely used as the sole measure of creativity in research. However, when combined with checklists of creative achievements or with other creative assessments, they may be valid indicators of creative potential.

Conclusions

Interest inventories have been constructed for a variety of purposes. Vocation-based interest inventories comprise the largest category of such assessments, followed by education-based and research-based interest inventories. Vocation inventories compare an individual's interests to those of large samples of people across many different occupations. A large body of research indicates that most interests fall into six categories that can be described as Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. While interests in general are relatively stable across time, interests in the domains associated with artistic creativity are even more stable across the lifespan than most other types of interests. Stable differences in interests and careers choices also exist between the sexes. Women tend to endorse interests that include other people while men endorse interests that involve data and things. Careers

associated with creative and artistic interests are more common in women than in men.

Education-based interest inventories indicate that early childhood interests predict high school and college creative achievement as measured by teacher ratings. Creative interest inventories used in research are associated with creative achievement and creative personality measures, but only modestly associated with measures of divergent thinking. Because intrinsic motivation, or intrinsic interest in creative activities, is highly correlated with creative production, inventories that assess creative interests may be tapping into the motivational core of creative activity.

See also: Divergent Thinking; Motivation.

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Intuition

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What Is Intuition?

Intuition, in its most characteristic manifestation, occurs when a person apprehends a course of action, solution to a problem, idea, or feeling, in an immediate fashion (often in a pressure situation), without necessarily knowing from where or how the notion arose. (In this sense intuition is kindred to insight, and may be fostered by incubation – and both insight and incubation are separate topics of this encyclopedia.) However, in the case of intuition, it is logically possible that the apprehended knowledge was potentially available to the person, and stored within his or her neural makeup at all previous times. Because of the disparity between the often stimulating and rich experience of having an intuition and the relatively sparse and unsatisfying early attempts at scientific explanation of this phenomenon, many diverse and colourful views of intuition have emerged with ardent adherents to accompany each of them.

In arguably the sparsest view of intuition, people simply draw, without awareness, on their previously stored (but dormant) learning and knowledge in order to make a snap decision. This would be somewhat like the procedural knowledge of riding a bike. When we ride a bike, we don't think about all the things we have to do and know to ride, but the knowledge is there if we need to think about it.

At the opposite extreme is the view that intuition is exogenous to the individual. That is to say, that God, the universe, some other (perhaps even impersonal) force, or the situation itself imparts knowledge to a person in a discrete and mysterious way and the person can then use that knowledge to guide his or her behavior. This is actually the derivation of the word inspiration – a synonym of intuition when it is defined in this fashion. Intuition is generally regarded as a discrete, concise, and rapid acquisition of a piece of knowledge or feeling, whereas inspiration is usually prolonged, has a motivational component, and is arguably less specific. Another view of intuition that we have included under the banner of 'mystical' is the belief that the acquired piece of knowledge comes from 'nowhere.' This belief (although often latent) that the intuition came from 'nowhere' is critical to, arguably the majority definition of intuition, because, as soon as an individual believes that the knowledge is endogenous it means that the knowledge was acquired by remembering – even if the pathway to the knowledge is long forgotten.

A middle view is that the individual's neural system takes partial information from experience and the environment and generates heretofore unrealized possibilities and then selects the 'best' solution to present to consciousness. Exactly how this selection and presentation is made to consciousness remains a mystery. Of course there is also every gradation of this hypothesized continuum of views about intuition, and others that do not fit on this continuum at all. For the sake of brevity these three views are considered here as the three major views of intuition as they are broadly representative.

These three views all have relative strengths. Whereas the first view is the most amenable to scientific investigation and is supported by empirical evidence, the mystical view has been espoused by many of the world's great artists as well as scientists when they claimed to have constructed their works through intuitions and insights that were 'given' to them from something 'outside' of themselves. Whether or not their explanations are correct, any comprehensive account of creativity must be able to explain the experience reported by these creators.

The middle view is the way that some neuroscientists think the brain should work. Whilst this cannot at present be fully substantiated, there is growing empirical evidence to support the view that the brain does in fact work by constantly generating new combinations of associative neuronal firing.

The Ubiquitous Nature of Intuition

Consider the following scenario. You are buying your first home, you have selected three finalists, all of them have pros and cons and following weeks of scrutinizing research, deliberation, meetings with bank managers, meetings with architects – a decision has to be made. How do you choose? Many researchers argue that the final push to action is intuitive. That is, at the final stage, a rational deliberative decision is beyond the ken of the individual and the decision is made by attending to one's gut feeling – in other words, through intuition. This view is both abrasive and obvious at the same time. It does not seem right that important decisions in our lives are made nonrationally, but, at the same time, how else can we decide between alternatives that do not share a similar quantitative nature?

The other interesting thing about this phenomenon is that people almost always have a retrospective rationale for their decision that does not rely on intuition. For example people may firmly believe their post-hoc explanation – "The house that faced away from the sun was \$25,000 cheaper – it was better value" when in fact their decision was made because they had a moment of feeling at ease in the chosen property when standing in the sun. It appears that for the most part we are not comfortable acknowledging that we base decisions on feelings, and that intuition is an everyday practice.

Decision Making

People often make decisions without thinking about them. (It can be argued that most of our decisions are made this way.) In various experimental settings, when people are asked why they made the decision they did, they often respond that they do not know or that it seemed the 'right' thing to do, without being able to give a cogent account of a reasoning process that accompanied their answers. This process satisfies most of the definitions of intuition. What is perhaps more amazing is that

these decisions, at least under some circumstances, outperform people's conscious deliberations.

Highlighted in the previous paragraphs, the learning approach to intuition takes the view that all experience, about any and all situations, is compounded and therefore an intuition is based on a complex of all of these, often resulting in very accurate and good decisions. In this sense we may be building up potential 'intuitions' about all the experiences that we have. Thus, a novice chess player has little experience to draw on and therefore has little intuition about her moves and they are often wrong, resulting in poor playing ability. In contrast, an experienced player has a wealth of experience and can draw on many similar moves that have been successful in the past. The chess grand-master, Capablanca once said that when playing chess he sees only one move – always the best one. In other words, Capablanca did not consciously evaluate every possible move; his expertise and vast experience somehow enabled him to simply see and select the 'best' move. This statement raises many questions. First, given how poor we are at analyzing our internal workings, we must ask whether Capablanca's account is accurate. Second, is his process conscious or nonconscious? Third, if he only saw the 'best' move, by what process were all the other moves hidden? Or, inversely, how was the 'best' move revealed to consciousness? Unfortunately, although fascinating to ponder, these questions are not able to be answered without further information.

Several things need to be considered that may be weaknesses in the learning theory view of intuition. First, as mentioned before, people often do very well by acting on intuition, but in some cases they actually do better than when they make considered rational decisions. That is, their intuitive decisions outperform their choices made when they are given consideration time. This is not evidence against the learning theory approach, per se, but it does demand an explanation of the neural process that allows the best choice to be observable to consciousness whereas all the other reasoning is unconscious, as is illustrated by the Capablanca quote. That is to say, in these situations, the unconscious 'agent' that makes these decisions appears to do an exceptional job of choosing between alternatives. By what process is this 'agent' able to do this? In Capablanca's example this 'agent' is able to do this supra-rational processing at lightning fast speed. The further this line of investigation is taken the more the explanation begins to resemble the mystical interpretation of intuition.

Second, there is evidence that when the human nervous system is presented with any problem it will start generating alternatives. This may be a deeply embedded functional facility. Thus the stored knowledge of the nervous system may not be as important as its lightning fast ability to generate alternatives, perhaps without our being conscious of everything that is being generated. Some have argued that this is, in fact, the basis of creativity and the thing that separates the highly creative person from the less creative person is not their ability to generate creative ideas, (they are legion), but their ability to discriminate, and therefore act upon, the best ideas amongst all the ideas that they generate.

The study of firefighters does not provide consistent support for the view that intuition is the result of previous learning. In many emergency situations where there is too much information accruing too rapidly to process rationally,

decisions, nonetheless, still have to be made. Many studies have shown that it is better to make decisions, even when a percentage of them are wrong, than not to make decisions quickly enough or at all. Fire-fighters must rely on intuition because they simply do not have enough time to rationally consider each action they take. Studies of Australian firefighters have revealed that, in most cases, intuiting serves the fire-fighters very well. But when fire is going uphill with a breeze behind it, they (and members of the general public) systematically and drastically underestimate the speed at which the fire travels. This can lead to dire consequences. It appears that we have some sort of heuristic about the speed of fire, one that is difficult to over-ride even for firefighters who have witnessed fires moving up-hill. This evidence provides some support for the learning theory of intuition. On the one hand the fire-fighters, for the most part, seem to be using intuition as an effective tool. However, if intuition is only the accumulation of learned experience why does a persistent and stable error occur in the calculation of uphill fires despite prior experiential learning to the contrary? This provides some evidence that cognitive heuristics, that may be generalized, or 'hardwired,' play a part in the intuitive decision making process.

Are There Different Forms of Intuition?

Not surprisingly, the question of whether there are different forms of intuition can be tackled from several different perspectives – empirically, theoretically, and phenomenologically. The preceding paragraphs have suggested that, at the least, people have very different definitions of what intuition is and consequently from where it is derived. But are there different types of intuition in which individuals vary in their abilities? For instance, is there such a thing as emotional intuition, gambling intuition, mechanical intuition, artistic or scientific intuition?

It is conceivable that intellectual abilities may be less relevant for intuition than a person's interests and drives. Arguably this could be read as there being more than one form of intuition. Just as it has been argued (controversially) that there are multiple forms of intelligence operating independently of one another (practical, linguistic, spatial, musical, creative, emotional to name but a few), there may be different forms of intuition. Some people are reliably accurate at intuiting practical decisions while at the same time being unable to anticipate their partner's emotional needs. Other people can read emotional situations and intuit how best to respond with little effort yet find it impossibly hard to intuit which business opportunity is more likely to succeed or which new car to purchase. Does this justify there being different forms of intuition? People might differ in their intuitive abilities even when they do not differ in other cognitive abilities.

There is good empirical evidence that some people are very successful (and many, many more that are very bad) gamblers. Given this fact, one is faced with two possible explanations – first, the successful gamblers are just at the lucky end of a distribution of probabilities, that is somebody has to be the luckiest gambler, as evidenced by their winning streaks. Or, that successful gamblers actually have an ability that predicates that they will continue to be successful, because of something

they have learned, developed, or acquired in some fashion. Is this a form of intuition? They are, after all, trying to predict future events.

Another puzzling phenomenological argument can be made from occurrences throughout history, where people have come up with scientific theories apparently *ex nihilo* that turn out to be correct. Newton's theory of gravity is one oft-cited example of this. The pertinent point about Newton's theory is that before he espoused it, there was no such thing as 'gravity' – at least not in the mind of any human being on the planet – how on earth, pardon the pun, did he manage to come up with not only the idea, but a formula that accurately predicted the behavior of celestial bodies (previously considered inviolate and purely isolated) acting on one another? There was no precedent or prior learning in Newton's day adequate to even inform his theories.

Scientists such as Richard Feynman are famous for reliably coming up with solutions to problems that have no prior precedence, or foundation, from which they could have been built upon. The impact of these anecdotes is somewhat tempered by the fact that it is always a person who has experience in the particular field that comes up with these amazing breakthroughs; however, does this mitigate the intuitive nature of these breakthroughs?

In addition, confidence or certainty seem to mediate the form or type of an intuition or whether people consider something to qualify as an intuition at all. For example if we are absolutely certain of something we tend to regard this as 'knowledge,' even if we do not know how, or why, we came to the particular understanding. For instance, let us return to the example of riding a bike. Few people, can articulate, how to ride a bike apart from pushing the pedals (and steering the handlebars which is in large part fallacious). Yet, there is really quite a lot of knowledge that goes along with riding a bike, yet no-one really thinks they have an intuition of how to ride a bike. We are just certain that we can. We are certain that we do know all of the procedural knowledge even if we are unaware of what it is until we get on the bike. There are many other examples in the human experience which follow this pattern, such as (in some cases) religious views, political persuasion, and sexual orientation.

Can Intuition Be Learned?

It has been suggested that while some intuitions are formed by experience without formal instruction, other intuitions are learned within specific learning environments. Under this model, ability relies on both intuition and logical thought processes. Logical thought processes are a learned ability. Learning can thus be seen to influence intuitive assessments and intuitive decision making which suggests that there may be rules by which people can gain the relevant intuitions that affect or guide their behavior. From this learning approach it is implied that people have the ability to improve their intuition by attending to, learning and understanding the circumstances and environment involved in, or affected by, their decisions. Research indicates that this view is supported, at least anecdotally, within vocational domains. For instance, senior police state that 'rookies' become better officers as they develop their

intuitive abilities. This is interesting because it indicates that senior police believe that they use intuition to perform their various duties advantageously and that they also believe that this intuitive ability can be learned.

Intuition may be based upon domain – or vocation – specific latent thinking whereby our store of knowledge is somehow assembled into a framework from which a solution can be arrived at unconsciously by accessing memory and emotional pathways. This framework appears to follow some form of processing refinement as intuition is thought to improve with age and experience. Increasing knowledge, experience of diverse situations, and emotional responses each contribute to expand the framework through which intuition may result. This theory of intuition as a latent store of knowledge suggests that intuition may be underlaid by implicit, as opposed to explicit, learning processes. Again this view leaves a lot that is yet to be explained.

Further support of the theory of a store of latent, unconscious knowledge contributing to intuitive processes comes from research findings that explicitly attempting to learn a sequence may interfere with implicit learning. The more that is known about the subject or object of interest, the more information there will be available for selection.

Maintaining coherent attention toward the object of interest may allow access to implicit knowledge and, hence, the intuitive foreknowledge about the object of interest. For example, research into how mathematicians develop knowledge has shown that the majority of mathematicians interviewed state that intuition or insight is a necessary component for developing knowledge. This gives some indication that mathematicians are at least partially aware of how important implicit learning is to their discipline.

Learning and intuition can be seen as a bidirectional relationship with learning influencing intuitive abilities and intuition adding to, and expanding on, knowledge.

Neuroscientific research suggests that learning can occur via two distinct systems – a hippocampus-based system involving explicit learning and memory, and a system which is more dependent on the brain's reward mechanisms which is more implicit (and potentially intuitive). By knocking out explicit memory through the use of drugs which interfere with hippocampal processes (specifically Midazolam – a sedative), it has been demonstrated that, as a result, memory based on intuition has been enhanced. These findings suggest that implicit reward-association decisions are dissociable from explicit forms of decision making. In other words, when explicit memory is inhibited or fails, it may be useful to rely on implicitly learned memories to guide decisions and this may manifest to us as the experience of an intuition.

Intuition and Entrepreneurship

Investigations into the processes adopted by entrepreneurs conclude that there may not only be a place for thorough, in-depth research but also for intuition in risk-taking decisions. Under this model, research would allow for analysis of all the options which may then enable intuition to occur. Years of experience, expertise or extensive research may give decision-makers the confidence to move beyond speculation. It has been demonstrated experimentally that, when making decisions or trying to

come up with creative ideas, people should trust their hunches. This may be because hunches, or intuitions, might be based on past experience not consciously drawn on, or unconscious knowledge. Studies suggest that successful entrepreneurs permit themselves to depend more on their intuitive responses in order to identify and exploit opportunities. Intuition might therefore be seen to permit clarity of thought, decrease uncertainty, hasten the decision-making process, and provide valid solutions.

However, if one accepts the role of unconscious processing in intuition, over-researching and over-analyzing may hinder creativity by not permitting intuition the freedom to express itself. This counter-intuitive idea has garnered some empirical support. While it seems clear that having experience in a given field exposes one to more suitable options, it may also be that experience can be a constraining factor by limiting choices. In some situations, having little knowledge permits consideration of a wider range of possibilities. For both experts and laypersons, intuition may be aided by the process of incubation.

Entrepreneurs are inevitably exposed to both risk and uncertainty due to the fact that their endeavors are new. In this sense intuition is not simply something that entrepreneurs are forced to utilize but is probably an ability which is capable of discriminating between them. Some researchers argue that bold intuition is vital to young organizations with limited resources, and largely contributes to their ability to survive in a competitive market place.

Why Is Intuition Important for Creativity?

It has been argued that intuition is the key process by which creativity flows. Theorists who have made such bold claims often state that originality is a prerequisite of creativity and that intuition is the foundation of originality. Creativity, as a cursory investigation will reveal, is hard to define. However, some of its negative attributes are relatively easy to identify. For instance, it is often argued that if something is not original then it is not creative. It follows therefore that intuitive generativity has a good chance of being creative, because it does not follow a consciously deductive path and is therefore more likely to be original because it does not build on something that is already 'known.' If one is following a logical process then one will end up with a determined result. A facile analogy may serve to illustrate this point. Despite the quality of the end product, we would not consider someone who had painted a masterpiece using 'color by numbers' to be creative. Nor would we consider somebody who copied a masterpiece, however faithfully, to have created a masterpiece. And it is arguable whether a master themselves, having arrived upon a formula for producing beautiful work, when reenacting this formula, is actually being truly creative. Rather, we are committed to the idea, at least in the purest stance, that for artists to be creative, he or she, must be engaging in a largely intuitive process – responding to what they feel or are inspired by rather than what they know. However, this line of reasoning fails when one considers the artist who uses rational thought processes to arrive at a creative end. Such cases are common. The purist might argue that the 'creative end' in question is not truly original, or that if it is that it cannot be explained by the rational thought processes which preceded it. Such arguments

quickly end up on indefensible ground. It is easy to recognize something that is not original but very difficult to establish that something is truly original. Many theorists, since the creative process was first analyzed, have tried to avoid (or alternately highlight) these problems by suggesting that the only reliable indicator of creativity is the creative product itself. Nonetheless, a dispassionate assessment of the evidence suggests that intuition may not be necessary for creativity, even if it is considered sufficient.

It should be noted that the idea that intuition is central to creativity can be accommodated by the three major views of creativity considered in this article. Under the learning view, the artist is drawing upon all of her or his past experience, knowledge and talent, but they generate new and original work because the context, environment, and their own state are different. The neural view obviously generates new solutions by definition and the mystical view suggests that the ideas are truly novel because they are received without precedent. Many, eminent theorists (such as C. G. Jung), have stated the importance of intuition to creativity, suggesting that creativity develops from the generative interplay between intuition, the senses, feeling and thinking functions. In this respect the creative act involves the engagement of the majority, if not all, of our cognitive faculties, and intuition is a sort of fluid force that guides the action, allowing synthesis, but also the eradication of things that don't work. In a sense intuition is over-arching and constantly re-iterative. One might have an intuition that combining static knowledge with a feeling state or emotional memory will result in some creative outcome, and this can be tested again and again as the process unravels. Recent experiments have shown that intuitive perception of a future event is related to the degree of emotional significance of that event, whereby, the brain processes an emotional response that triggers cardiac involvement (and perhaps feedback), to the anticipated situation. Intuition may guide specific actions, and at the end, may provide the feelings about how successful the creative outcome is. Therefore mood may play a role in intuition.

Mood and Intuition

People differ in the way they make decisions. Some consider intuition to be an affective style of choice rather than a separate cognitive process. The role of affect in decision making literature has become increasingly important. When examining the effect of mood on intuition, it has been found that some mood states may have their effects on original insights and ideas because of enhanced cognitive flexibility, whereas others have their effects because of enhanced cognitive persistence. Positive moods relate to more creativity than negative moods, but this effect is limited to originality and fluency and has not been found to extend explicitly to intuition, insight, or flexibility.

As stated previously, studies suggest that creative people may be distinguished more by interests, attitudes, and drives than by intellectual abilities. It remains unclear whether these characteristics are consequents or determinants of creativity. Above-average, and the effective use of, intelligence, production of unusual/appropriate ideas, exceptional memory, ideational fluency, ability to synthesize disparate ideas, and general cognitive flexibility are all cognitive abilities which appear to indicate an

increased likelihood of a person being creative. (It might also be noted that they can all be construed as examples of creativity as opposed to abilities, somewhat mitigating the predictive validity of such notions). Interestingly, it is the findings regarding personality capacities that have discriminatory impact when investigating intuition and creativity. These studies suggest that a differentiating factor which specifically characterizes the creative from the noncreative subject is their relative lack of the use of repression for impulse and imagery control. It is this absence of self-defensiveness which may allow the creative subject wider access to both conscious and unconscious experiences, both of which are thought to be essential elements of intuition.

Processes Underlying Representative Views of Intuition

Under the mystical view there is not a lot that can be explained scientifically about the way in which intuition works, at least not in an internally consistent way with the paradigm. If intuition is supplied exogenously (or indeed from nowhere) then a study of the agent that supplied the intuition is required in order to elucidate the process. If one takes the view that it is mysteriously supplied, then by definition this process is ineffable and (at least mostly) unknowable. This is not to suggest that these topics are not worth pursuing, it is simply that they, like many other of humanities most intriguing questions, are not amenable to scientific practice in its current state. Indeed, a large number of scientists believe that this holds true for creativity as a whole. The result is that, at present when examining the mystical viewpoint, we are forced to rely on the anecdotal accounts of those who have received intuition or inspiration. These accounts are expansive, rich and heterogenous (and almost invariably interesting). But how is one to scientifically scrutinize these accounts? For example, what is one to do with Paul McCartney's account of how he wrote the melody for the most re-recorded song in history – *Yesterday*. McCartney apparently composed the entire melody in a dream one night. Upon waking he hurried to a piano in order to play it and thus avoid forgetting it. (For the sake of brevity, we will leave aside the process of dreaming, its purpose and creative potential, if interested see the article *Dreams and Creativity* in this encyclopedia.) His response to this event is fascinating to our topic. McCartney was initially concerned that he had subconsciously plagiarized someone else's work. He repeatedly played it to people in the music industry to see if they recognized the tune and eventually concluded that as no-one had claimed it, it must be his.

We can conclude several things from this if we take McCartney's account to be accurate. First, the song came to him as if it were from another composer (that is plagiarized). It 'felt' as though it were exogenous even though it turned out that it wasn't. Second, he was completely unaware of how (both regarding process and knowledge) he had written the melody. Third, when he sat down to manifest the creation for the first time it was complete.

It is interesting to examine how the learning theory approach might account for this anecdote. It would emphasize that McCartney had built up an extraordinary store of knowledge, feelings, and experience about musical melodies (in memory) and that these were, no doubt, drawn upon in

the composition of *Yesterday*. This assertion goes without challenge, but the learning theory approach appears incapable of explaining the motivation to action and the process by which the completely novel melody was generated, at least in this situation.

Perhaps we should turn to an examination of creative scientists, as they may have been interested in elucidating the processes by which their creative generativity occurs: amongst scientists, intuition is very often self-proclaimed as the starting point for many of their greatest scientific breakthroughs. Nobel laureates in various fields routinely explain their discoveries as starting from vague hunches, feelings, fleeting insights or 'out of the blue.' Their accounts abound with bizarre symbolism, and inchoate imagery, and indeed, ineffable experiences. What they lack is any clearer explanation of the creative process than artists are able to give us. The great discoveries are semi-explainable in some ways – they are the result of immersion in the problem field, immediate prompting by solution-oriented stimuli and are embedded in previous expert experience. Yet, although they are among the most venerated discoveries of our species, the process by which they were realized is often poorly understood, even by those that made the discoveries.

Interestingly, attempts have been made to study the phenomenological experience of intuitive creativity in an empirical manner. Generally experts within a field are selected and studied on a variety of tasks. Experts may have better mastery than lay-persons of key aspects of definable intuitive judgment such as: pattern recognition, similarity recognition, common-sense understanding, skilled know-how, sense of salience, and deliberative rationality. And often they exhibit these in laboratory settings. But, these experiments are limited by their ability to capture truly intuitive moments (as they are unpredictable) and also in their ability to study intuitions of great importance – for similar reasons.

Generative Creativity

There is emerging evidence that given any problem space the human brain will start generating possible alternative solutions. This evidence comes mainly from brain imaging studies and it is therefore hard to justify strong claims of its existence because of the correlatory nature of this evidence. However, it also accords well with anecdotal experience. Upon reflection, usually when one faces a problem it is not difficult to come up with solutions, it is simply that most of them are premature, simplistic, or wrong. The quantity of alternatives is not in question. The brain fires up enormous amounts of neural connections, combining different ideas and churning out combinations. The end result of this process may be that a lot of 'rejected' content never makes it to consciousness because it is inhibited. However, under this model it is claimed that a lot of content is generated. Creative people are seen as those who are able to take the content and assess it for what is best or most suitable for a purpose. Because this process may vary in its degree of conscious revelation it may account for the phenomenological experience of intuition. That is to say, previously unconscious ideas may bypass the normal process by which we are familiar with them entering into consciousness (whatever that may be!) and appear in consciousness apparently unbidden.

When considering the McCartney anecdote, this paradigm can partially explain the problem of why the melody was generated – the nervous system is geared to continually combine and recombine different patterns that result in an end product of ideas. However, it still cannot account for why new combinations are sought or valued, or how these neural resources are targeted and controlled. Again, it must be stressed that these areas of inquiry are in their infancy, and although it may appear we do not know much about the neural basis of intuition, we know a lot more than we did even two years ago.

No article on intuition is complete without a cursory examination of the psychic viewpoint. Way out on the fringe, some people believe that intuition is a psychic human ability that can be developed, whereby people can predict future events. Questionable empirical research has investigated this area. It has also been suggested that intuition is a psychic power that can be trained and improved. Certain parapsychologists have devoted careers to intuition training programs and the like, with results that are generally no better than chance. The most obvious value of these tests of intuition is that they are amusing. They can be easily located on the web (usually for a fee) if one is so inclined and one's putative intuitive ability can be measured. Interestingly, all of these rather dubious websites link intuition (and psychic abilities) to creativity.

Conclusion

Intuition is a fascinating and heterogeneous topic of study. There is abundant evidence that intuition is widely experienced, habitually acted upon, and extremely useful. However, people have highly different explanations about what actually accounts for the phenomenon. Previously, a considerable amount of scientists viewed the scientific study of intuition as impossible. They largely considered intuition to be a post-hoc fiction imposed upon the erratic experience of the individual and fueled by confirmation bias, Barnum effects, or other psychological phenomenon. This view has markedly changed. Increasing understanding of the human nervous system has revealed that abundant implicitly apprehended relationships affect conscious behavior (some extremists even argue that consciousness is an illusion that we experience after we have engaged in determined behavior). It is fairly safe to conclude then, (and on a sound scientific footing), that often, we act on 'good' and 'reliable' information somehow stored in our nervous system that we are consciously unaware of knowing completely, at least in the instant of action. This satisfies the most basic definition of intuition. Beyond this the neuroscience is fascinating, complex, variable and indeterminate (and advancing at an astronomical pace).

Intuition appears to be of central importance to creativity. It is likely that much creative behaviour is fuelled by experiences that are achieved when creators are engaged in – feeling, flow, disinhibition (experiences that are broadly akin to intuition), rather than consciously rational processes of method and recall and reasoning. Accordingly, what is experienced by the creative individual is commonly felt as an ineffable and inexplicable process that leads to their creative output. However, what is felt may be at odds with reality. The experience of exogenous inspiration may be a misattribution of erstwhile scientifically

explainable facts. If indeed, other worldly inspiration, was in fact, the cause of intuition, it almost follows by definition that there would not be scientifically measurable evidence to prove it. Again, this does not prove that this is (or is not) the true state of affairs.

Most people want to believe, when standing in front of their favorite painting or listening to their favorite song, that more occurred in its creation than the complex interaction of determined events. The actual works themselves appear to provide convincing evidence for more-than-rational processes. These works do more than entertain us, they move us emotionally, sometimes they make us feel connected to the universe, occasionally they even make us feel understood. There is no completely satisfactory account for how this is achieved. Within the bounds of science it would be reasonable to decide that due to a paucity of objective evidence we cannot conclude what the true nature of intuition is, nor can we determine its role in the creative process. Yet this conclusion appears to be unsatisfying to most people. If a definitive answer is desired then one must weigh up the evidence oneself, trying to reasonably balance what can be concluded from one's own direct experience with what can be considered objectively derived.

See also: Dreams and Creativity; Incubation.

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- [http://en.wikipedia.org/wiki/Intuition_\(knowledge\)](http://en.wikipedia.org/wiki/Intuition_(knowledge)) – Intuition (knowledge) wiki.
- <http://www.feynmanonline.com> – website dedicated to Richard Feynman; scientist, teacher, raconteur, and musician.

Invention

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Glossary

Cognitive unconscious Sometimes called adaptive unconscious. Set of cognitive capacities that are not the result of conscious reasoning or deduction and that produces results that cannot be accounted for verbally. Examples are intuition, insight, and procedural learning. A likely explanation for these capacities is the process of pattern recognition.

Functional fixedness A category or cognitive set or mental structure that manifests in rigidity or lack of flexibility in disembodied components from a given field.

Intuition The apparent ability to know things without a rational explanation for this knowledge. In the context of invention, intuition may provide knowledge about the goodness of a proposed solution for a problem, a feeling of direction of where to search for a solution, or the awareness of an image or other type of association that hints at the structure of a solution.

Invention The creation of a new device, process, composition, or understanding. Novelty in invention can range from the improvement or variation of preexisting models or ideas, to a radical breakthrough that moves the boundaries of human experience. Generally four types of inventive products are distinguished. Technological invention, which refers to the conception of a new technological tool; scientific invention creates new understanding through the finding of patterns, regularities and mechanisms underlying phenomena in our world; artistic invention produces a new composition, in any modality, without a particular purpose or usefulness; cultural invention refers to the new habits and behaviors that appear in society that can have wide or limited spread. **Serendipity** The occurrence of a valuable or unplanned discovery, especially while looking for something entirely unrelated. This is as opposed to chance findings that are useful for the problem one is actually working on.

What Is Invention?

Definition of Invention

Invention is the creation of a new device, process, composition, or understanding. Novelty in invention can vary from the improvement or variation of preexisting models to ideas that are a radical breakthrough that shifts the boundaries of human experience. The importance of an invention can be assessed by taking three aspects into account:

1. The social impact: some invention will have little social impact, for example, a new bottle opener, whereas others, like mass production of cars, change our lives in every way.
2. The level of an invention: an invention can occur on a system level, for example, world wide web, or at a component level, for example, a new web browser. Inventions at a system level form the breeding ground for many other inventions. In art a new genre is an example of an invention at the system level.
3. Finally there is the dimension of knowledge extension, which refers to the amount of knowledge that is required to get to a certain invention. To get a first useful application in nano-technology, extensive research is required to get to the required 'what' knowledge. Getting to a new mobile phone design requires only a limited amount of 'how' knowledge.

Invention Versus Discovery

There is a longstanding debate whether creative products should be labeled as invention or discovery. A constructivist approach to the issue will argue that all knowledge is

man-made and thus should be considered invention. Other scholars have stressed the fact that new knowledge comes from the unveiling of inherent structure and possibilities and thus should be seen as discovery. Although the discussion is not settled in a deeply philosophical sense, most authors will agree that one can distinguish 'what' knowledge that is of the 'discovery-type' and 'how' knowledge of an 'invention-type.'

Products of Invention

Generally four types of inventive products are distinguished. The first one is technological invention, which refers to the conception of a new technological tool or device. These products are often commercial in nature and stem from a predetermined search to serve a practical purpose. Typically these inventions are patented.

Scientific invention refers to the finding of patterns, regularities, and mechanisms underlying phenomena in our world. Science in general is not guided by practical considerations but by the search for understanding in its widest sense. Some science may receive special funding when in areas that are expected to lead to useful inventions (e.g., microbiology).

Artistic invention has the least constraints on its products in the sense that they do not require a particular purpose or usefulness. Valued artistic invention often stems from professional activity, but unlike technological and scientific invention, is commonly produced by amateurs as well. The Internet has greatly stimulated artistic inventions (e.g., photography and blogging) since it provides a cheap means for publishing. Artistic products may have great commercial value, as can be seen for example with artists such as Damien Hirst, who sold his work for hundreds of millions of dollars at auctions and

Abba, who for several years were the biggest contributors to the Swedish GDP.

Cultural invention refers to the new habits and behaviors that appear in society. They can be of limited influence such as punk or gothic subcultures, or as widespread as environmentalism. They can be short-lived or mark an entire epoch like the Renaissance or the Enlightenment.

The distinction between these different inventive products is not absolute and they greatly influence each other. Science and technology are increasingly synergistic; often scientific invention leads to technological applications, and technological invention such as instruments, open up new areas for scientific inquiry. Artistic invention may inspire scientific invention; design synthesizes technological and artistic invention and several inventors were also artists. Technological invention such as the Internet or television can have a profound impact on the habits of our culture, and in turn culture can determine if certain artistic or scientific directions are promoted or hindered.

Invention as a Process

Many instances are known where decisive insight was reached in a single moment. Poincaré's insight into a mathematical problem he was working on while getting on the bus, Archimedes' eureka moment sitting in the bath, and Kekulé's revealing snake dream which set him on the idea of a circular structure of benzene, are examples of such insight. These insights seem to occur in idle moments that have been caricatured as the 3Bs: the bed, the bath, and the bus. These insights may be so important that an invention can be reduced to such a single moment. However, a long period of problem seeking, experimentation, searching, and many failures precede such insight and often more than one insightful breakthrough is needed. A lot of persistence is needed before such crucial understanding is turned into a fully worked out theory, useful product, or artistic realization. Darwin worked on his original idea for 30 years before he published it. An initial idea has to be developed, made into a prototype, tested, and improved before getting to a marketable product. Invention is thus the result of a long and complex process. Creators take around ten years before they produce their first major invention. The different emphasis on sudden insight versus invention as a long-term process is called the sudden-gradual controversy.

Factors Influencing Invention

Invention is not a singular event but is determined and promoted by a number of factors that operate in conjunction.

Role of Personality

Successful inventors are shown to possess a number of personality characteristics that seem to favor invention such as: passion, optimism, nonconformity, tolerance for ambiguity, and a tendency to embrace failure as a learning experience. Especially important is persistence and the capacity to delay gratification, since most inventions take many years to reach a useful,

marketable, or publishable form. On the other hand it has been argued that creative invention is in reach of everyone and several studies have shown a normal distribution of creative production and number of patented inventions. This controversy is called the special-ordinary discussion.

Role of Context

Purposes of invention vary depending on context. Invention may be driven by a specific need, for instance searching for a solution for an engine that breaks down repeatedly. But it can also stem from a general search for understanding as in fundamental science. Artistic invention may be solely for the pleasure of discovering and creating, or it could be for a commercial purpose such as a movie or theatrical production. Economically this aspect is called demand-pull where inventors respond to demands that exist in the marketplace. Other inventions are supply push, the invention is unforeseen and creates a market for itself, for example, Post-it notes. Still others are invented before there is any use, like the parachute that was invented before there were airplanes. Inventors working in an entrepreneurial context are required to produce profitable inventions, whereas inventors who work in a university setting are less so. Also the epoch we live in influences invention; da Vinci designed war engines, and recently the ecological dangers of economical progress has liberated funds for environmental studies. Thus social context influences what is fashionable, acceptable, and desirable in scientific and technological invention and, to a lesser degree in artistic invention. Finally the team context and other resources are important factors in determining the outcome of invention.

Role of Knowledge

All novelty is created through cognitive processes that build on existing knowledge. Something new may be invented through analogy, combination, or abstracting, but it always depends on existing knowledge. Effective inventors build on the knowledge that has accumulated over centuries. It is possible to invent, in the sense of creating novelty, with a limited knowledge base, but the result will usually be poor and of little use. As much as invention depends on prior knowledge it also requires stepping outside existing boundaries, and abandoning or challenging what is known. People have a natural tendency to look at problems in a habitual way and to become trapped in this conservative view, which is called functional fixedness. It is necessary to take a new approach, thinking outside the existing knowledge.

Role of Chance

Several instances are known where inventions were made by chance. The inventor was looking for something completely different but then discovered something unexpected, a phenomenon called serendipity; a famous example is the 3M Post-it notes, an unexpected application of a failed adhesive product. Errors can also lead to invention. The metallic color of plastic resulting from accidentally adding a thousand times too much of a catalyst led to the idea of exploring its metal-like properties, leading to a Nobel prize winning invention

of electrically conductive and light emitting plastic. Invention normally comes from planned activity, an inventor has a problem in mind that he wants to solve and he consciously uses a number of strategies to find a solution. Often inventors consciously expose themselves to unfamiliar perspectives or areas to be inspired by the unexpected. Other times chance has an important hand in the process, as in the well-known example of Pasteur's discovery of penicillin. But it can seldom be attributed entirely to luck, because chance favors the prepared mind, as Pasteur remarked himself. Many people may have seen the same phenomenon before, but didn't recognize its potential.

Cognitive Processes in Invention

Invention is neither a process of arduous problem solving, nor the fruit of sudden inspiration. Various processes simultaneously play an important role.

Conscious Processes

In invention various conscious steps can be identified. A first step is setting the objective or problem. In technological invention the inventor usually searches for a solution to an existing problem: how can I achieve *X*, or how can this be better, lighter, or faster? In artistic and scientific invention this phase is rather one of problem finding such as: how can I express *Y* or understand *Z*? Sometimes the major invention is in the finding of the problem itself, when discerning a problem or possibility that wasn't noticed before and that may have a very simple solution. One might think of paperclips or toilet paper, where the application is the invention rather than the product itself. The inventor will then investigate existing solutions and subsequently start generating his own ideas. The heuristics described later in this article refer predominantly to this phase. Not all ideas are useful or executable and some are better than others so that the inventor has to select from his ideas according to certain criteria of goodness. In science these will include attributes such as testability or parsimoniousness; in art originality and expressivity; in technological inventions manufacturing aspects and cost. Since no idea is ready first time around, in the final phase the inventor has to fine-tune his ideas shaping them into a useful final product.

Creative Cognitive Operations

Invention requires the creation of something new. In principle there are four cognitive operations that can be identified that create novelty. Application is the adaptive use of existing knowledge. Something already invented is adapted, or variations are introduced, to fit it to the necessities of the current context. A brilliant defense of a lawyer might be an example of such an invention; no new legal concepts are introduced, but the existing ones are used creatively to fit the case. The second creative operation is analogy, which uses transposition of a conceptual structure from one habitual context to another innovative context. Many examples can be found in chemistry and physics wherever a model is used, for example, the planetary model of the atom. In art, the importance of analogy can be found in styles like Impressionism or Surrealism that spread

to other art forms. The third operation is combination: the merging of two or more concepts into one new idea. This operation is also referred to as synthesis. Combination is especially relevant for technological invention, since many inventions are the result of bringing together existing elements in a useful and practical manner; think for instance about the manufacture of a car. In artistic invention combination can be seen when artists incorporate aspects of others' work into their own artistic styles. Finally the most radical novelty is created through abstraction. Abstraction is the invention of any structure or pattern that describes the relation between a number of different instances of a certain phenomenon. For instance young children primarily use abstraction to organize the concrete external world into interiorized mental concepts. Repeated exposure to objects leads to more abstract notions such as color, weight, or number. Abstraction is most prominent in scientific invention. A good example is Einstein's theory of relativity where the relation between time and space is redefined into a new higher abstraction in which time and space are part of the same entity.

Cognitive Unconscious

Although the effort to invent comes from a conscious determination, inventors report that many of their most important breakthroughs seem to come from processes that happen outside awareness. After conscious effort to solve the problem it is helpful to put the problem aside to allow for a process called incubation to happen, after which insight can pop up in consciousness. In the last two decades research has identified and demonstrated the importance of a number of unconscious cognitive processes which are relevant for invention. Patterns in complex data are detected unconsciously and cause procedural learning: subjects are able to decide correctly on a task without being able to give a verbal account of why or how they did it. On several complex tasks conscious reasoning has been shown to worsen people's decisions. Similarly, asking people to give a verbal account of their strategy worsened their capacity to problem solve. This interference of verbal accounts or conscious reasoning occurs especially in so-called insight problems rather than analytical problems. This makes unconscious processing especially relevant for invention, a process characterized by the occurrence of insights and lateral thinking.

Intuition

The most elusive of cognitive processes that are important for invention is intuition. Many inventors report being guided by hunches and inspirations that they cannot account for but that were absolutely essential to get to the final invention. There is no clear theory for the workings of intuition, but the most likely candidate is a process of unconscious pattern recognition. In general, some people seem to be more intuitive or rely more on intuition than others. Meyers-Briggs studies have indicated that highly creative people tend to be extremely intuitive.

However, intuition is also related to experience and expertise since experts develop a capacity for intuitive insight in their field over time.

Certainly three different types of intuition can be distinguished. The first is evaluative intuition. It tells us whether to

trust people and solutions or not. The inventor knows that he is 'on track', or that 'it doesn't feel right', or 'something is missing.' A good example is the mathematical intuition that predicts if a proof or solution can be arrived at through a certain method. A second type is directional intuition. It informs the inventor where to look for solutions. It can take the form of 'the problem must be in the ...' or 'I should look at the ...'. In working on the relativity theory Einstein started to investigate the notion of simultaneity, as if he knew that this notion would provide information for solving this problem. The wobbling movement of a soup plate fascinated the physicist Richard Feynman, but only much later did he discover that it was analogous to the atomic spin problem he was working on. Finally there is metaphorical intuition. In this type of intuition solutions come in analogical or symbolic form. The inventor spontaneously gets certain images, memories, poems, words, or even kinetic sensations that hint metaphorically at a new way of looking at the issue he is working on. Kekulé's dream of a snake that led him to hypothesize a circular structure for benzene is a famous example of this type of intuition.

Heuristics in Invention

There are a number of strategies or heuristics that inventors use to get at ideas and novelty for invention. They don't guarantee success but often lead to (partial) insights that are helpful to arrive at solutions for the inventive problem they are working on.

Subgoalting

Subgoalting refers to the breaking up of a problem into nearly independent parts that can be solved separately. This can facilitate complex inventive tasks. For instance the Wright brothers were able to achieve their flying machine by working separately on the problems of lift, control, and power. Partitioning a problem into parts can speed up invention in collaboration because it permits division of labor.

Variable and Feature Extraction

When trying to get a scientific understanding of some phenomenon, a good strategy is to identify the entities that vary. These variables often lead to vital clues to get to an invention. The inventor can now study these variables, and their covariance with other factors that may be manipulated. Especially studying extreme values of variables can provide important insights for scientific invention.

The correlate in technological invention is feature extraction. Features that may be identified are for example size, materials, and functions. This identification subsequently facilitates and systematizes operations such as elimination, adding on, combination, rearrangement, and scaling of these features. One might for instance think about the variations one could apply to the features of a chair such as number of legs, back support, adaptation possibilities in tilt and height rotations, materials or arm support. Another example of this heuristic is morphological analysis, where a system which is too complex to fully quantify first is broken down into parts; then the

system is simplified by dropping trivial components only using vital parts. The desired models or scenarios are created by only taking the contributions of the simplified system into account.

Analogizing

Searching for analogies has proven to be a fruitful strategy for invention. In order to do so inventors may deliberately read outside their field to find ideas. Other phenomena can function as metaphors for invention. Alexander Bell took inspiration from the curved spiral form in the human ear to invent his first telephone design. The concept of homeostasis was imported directly from chemical theory into family therapy. Analogy is different from similarity. Similarity refers to directly observable characteristics such as form or color; analogy to the abstract underlying structure. There is nothing similar between a musical instrumental and an atom. Yet the idea of musical intervals and harmonics served as an analogy for the quantum mechanics atomic model.

Exhaustive Search

A crude but sometimes successful strategy to get an invention is exhaustive search. It is questionable if this deserves to be qualified as a heuristic strategy but has certainly proven its worth. Edison tested hundreds of different materials to get a suitable one to serve as a glowing filament for the light bulb. Pharmaceutical companies roam the forests in search of new plant species to test for medicinal power.

Combining

Purposeful combination has led to important inventions. It may be done on a feature level like combining different functions in a cellphone, or making existing products with new materials. For instance, plastic and sophisticated polymers have been combined into products previously constructed with traditional materials such as metal, wood or glass. But also concepts and principles can be combined into new ones. For instance paleontologist Steven Jay Gould brought together the ideas of chance statistics with evolutionary theory to get to a deeper understanding of the development of life on earth. Picasso deliberately tried to incorporate primitive art in modern painting and sculpture. Two specific techniques based on this principle are homospatial thinking: imagining two or more discrete entities occupying the same space and Janusian thinking: conceiving two or more opposite or antithetical ideas, images, or concepts simultaneously. Finally there is the phenomenon of synesthesia: the interfusion of perceptual modalities such as color with sound or taste with form, which inspired artists especially poets, in their work.

Modeling

Four different types of models may be distinguished that are instrumental in invention: a physical model which displays the physical characteristics of a real object; a functional model capturing the essential operations of an object or mechanism; a theoretical model embodying the basic concepts governing

the operation of some process; and finally the imaginary model to display aspects or features of something we cannot observe directly. All models are abstractions in some way or another, which helps to understand, predict, or manipulate certain aspects of reality. Probably the most famous invention that came from a physical model was Crick and Watson's discovery of the double helix structure of DNA. Another instance was Gaudi's inverted models with strings to determine the required force of his architectural inventions. Chemistry and physics are replete with functional models that predict or describe characteristics or behavior of phenomena correctly, without having a complete understanding of the phenomenon.

Imaging

Imaging is prominent in every invention and has been equated by some authors to thinking itself. Visualizing structures or objects, fixed or in movement helps to get a deeper understanding of the workings of things, can inspire new ideas, and is a tool for testing certain aspects of inventions. The inventor may imagine how his new invention may look, its form, its color, how it will be used, how it moves, etc. A famous example of imaging are Einstein's thought experiments in which imagined traveling in trains, spaceships and on a photon helped him understand the theory of relativity. But imagining does not only refer to the visual but also to other modalities such as the auditory and kinesthetic and in rarer cases even taste and olfactory modalities. Apart from the visual modality, the kinesthetic seems especially important. This body or kinesthetic thinking is common in choreographers and sculptors. The sculpture Henry Moore said that in order to create he needed a deep feeling of the statue on a physical level, to feel the statue from within. But also in less obvious areas such as engineering and science, kinesthetic imagining has been reported as crucial. Several scientists that work on particles such as molecules, chemical reactions or atom interactions reported gaining insight by imagining physically being these particles. Cyril Smith working on metallic alloys reported that he creates a feeling of how he would behave as an alloy, how brittle, hard or conductive he would feel in a truly sensual way. Many engineers are known to imagine buildings or bridges from within, detecting design flaws from a proprioceptive and muscular sense of their structure.

Shifting Representations

Successful inventors are characterized by using a rich variety of representations to look at the problem at hand. They may draw charts, maps, and diagrams or use computer simulations; problems can be represented using colors, numbers, symbols, or mathematical equations. For instance the graphic representation of the elements in a two dimensional grid by Mendeleev was a crucial step in revealing patterns in the underlying characteristics of different atoms. Most importantly inventors shift representations swiftly to detect unnoticed possibilities, regularity and analogies. It helps to break free of fixed and conservative ways of thinking about the inventive problem one is working on. Shifts may be made from physical models,

functional or theoretical models. Inventors may also consciously try to shift perceptual modality, for instance from visual to kinesthetic or from kinesthetic to auditory. Imagining other perceptual modalities (e.g., What sound would molecules make?) can open up new ways of understanding an issue. Dimensional thinking refers to shifts in scale and dimension. The inventor can move from two-to three-dimensional representations and *vice versa*, and in some cases even higher dimensions. For instance, in understanding the structure of proteins, both second and third dimensions have been instrumental in perceiving mechanisms of protein folding. In art the effort of representing three dimensions simultaneously into the two dimensional surface led to cubism. Finally in scaling looking at objects from short and long distances can help to discover new properties or even regularities. This was the case in discovering fractal patterns in studying geographical maps at different scales.

Experimenting

Experimenting is an important tool in gathering new knowledge about phenomena. Certain aspects of reality may be manipulated in order to understand their causal influence. The simple question of 'what if,' may generate ideas and open possibilities and is the basis for trial and error learning. Variations of existing concepts and products may be tried out to get to better, faster, simpler, or cheaper products. No invention is complete when it is devised for the first time. It needs to be tested, improved and perfected to reach its final form. Numerous aircraft prototypes crashed in experiments before a proper flying one was invented. Experimenting can also be conducted in a mental way by using thought experiments. Observing can be considered an experiment without manipulation. Observation of natural phenomena, with or without the aid of instruments, can be inspirations for invention. The novelist Somerset Maugham said that it is essential for a writer to study men. The mind has to be trained to observe and detect the relevant cues from natural occurring phenomena.

Playing

Play is not only important for the infant to train and discover its capacities, but it is a creative force throughout our life. The pleasure and curiosity that are inherent to playing, motivate and inspire us to think outside the box. We experiment new things just for fun and to see what happens. Playing is a heuristic for invention since it leads the player to the unexpected. It may cause serendipitous or chance invention and lead to observations that may be instrumental in finding the way to invention. For some inventors such as Richard Feynman and Alexander Calder, play was a way of life. The mental modality of play is daydreaming.

Blockbusting

Many authors have argued that invention requires divergent or lateral thinking to break free from conventional and habitual ways of thinking. People have a natural tendency to look at

problems in a fixed way and to become trapped in a conservative view. Blockbusting is the conscious strategy to identify and overcome this functional fixedness. Key blocks are perceptual, emotional, cultural, and intellectual blocks. A typical perceptual block is stereotyping, where one can only look at something in a preconceived way. Emotional blocks can be found in the fear of failure or risk taking, and intolerance for insecurity. Intellectual blocks occur when one is too fixated on one's specialty, one type of solution, or not wanting to abandon certain dogmas or assumptions. Einstein demonstrated an intellectual block when he rejected quantum mechanics for esthetic reasons. Cultural blocks occur when an inventor does not consider solutions that are not currently fashionable or are politically incorrect. Many of the aforementioned heuristics, in one way or another, circumvent this type of block. Thus the inventor may analyze explicitly what limits he has put on the type of representation, materials, size, perceptual modality, modeling, etc.

Collaboration in Invention

Although some inventions have been conceived and executed by individuals, most inventions are done in collaboration.

Advantages of Collaboration

It is true that any idea has to rise from one mind for the first time, but collaboration is important in many ways. It offers a critical perspective, fosters spotting problems and opportunities and can promote divergent thinking. Both understanding the ideas of others, as well as the effort to explain one's ideas to others, are useful instruments to sharpen and progress in one's own ideas. The dialog between Picasso and Braque brought about cubism. In addition, collaboration can greatly increase inventive potential through the division of labor. Think for instance about the teams of the Manhattan Project that worked on developing the atomic bomb.

Types of Collaboration

Studies show that several types of collaborations can emerge. In distributive collaboration, collaboration does not go beyond the exchange of information and experience by partners who have a shared interest in a topic. Common examples are email, newsgroups, or meetings. Complementary collaboration is found in the work environment and derives from a role definition and division of labor. Finally integrated collaboration is often long-term and develops a more intimate and lasting exchange of ideas. This latter collaboration has the most potential for generating new ideas required for invention.

Roles in Collaboration

Within the collaborative process it is important to have individuals who can fulfill the following roles. Visionary roles: people with the courage and imagination to search out new problems and challenges and step out of the obvious. Often

these visionaries also possess charisma to motivate others to assist in realizing their dream. This is quite opposite to the organized and rational management role that includes planning, setting deadlines, allocation of resources and maintaining relations with funding and supervising institutional structures. Peer roles represent the horizontal relation of working together on a common issue, the exchange of ideas, critical analysis of each other's work and generation of new solutions. Leadership roles mediate between the task and team, and form a communicative factor. A specific role is the bridge role that is important when collaboration occurs at the interface between groups that have different institutional cultures. Group collaboration seems to last about ten years after which members go on solo careers (e.g., The Beatles) or regroup.

Conclusions

Invention as Indefinable

Our understanding of invention still has many gaps in large part due to some of its unconscious aspects.

A number of creative cognitive operations such as application, combination, analogy, and abstraction are known, but it may be debatable if a particular inventive product should be understood as the result of, for instance, an analogous operation or rather as a combination operation, or even if several operations were involved. We understand important characteristics of the process and heuristics that can be helpful, but many times it is difficult to understand what heuristics or processes have contributed to a particular invention. It is clear that some strategies such as imagination, Janusian, and homospatial thinking may stimulate hidden process of lateral thinking, but the process itself remains essentially hidden. Another gap in understanding is that from a number of ideas, inventors somehow consider only the most useful ideas, suggesting that there are some selection criteria at work of which little is known. Successful inventors are probably well aware of an underlying required structure they use to sieve out ideas.

Complementarity in Invention

When describing invention a number of factors appear that are complementary or dialectic in nature. Invention can be seen as a conscious process trying to solve a problem or trying to understand a phenomenon, experimenting solutions and heuristics to get to a satisfying solution. But inventors report that their most important breakthroughs seem to occur outside conscious awareness and intuitive inspiration and feel for direction are essential. Invention creates a new product or understanding but it is always based on structures of old knowledge. Invention is often a long, gradual process with sudden jumps of insight. It requires hard work and effort as well as letting go and idleness to allow for incubation to help new ideas arise. Ideas can only come up for the first time in one person, but the collaboration and human interaction is vital in promoting invention. On the one hand the inventor has to work purposefully towards a product; on the other hand periods of undirected play and distraction can promote chance findings. Invention seems to result from a

special giftedness in some, yet is also an ordinary capacity we all possess.

Invention Can Be Learned

Like any other human activity invention can be learned and optimized. Everybody can invent and practice can improve results. Inventors can work hard acquiring knowledge and skills that will enrich their base on which to build new solutions. Applying heuristics may help liberate the inventor from conventional paths opening the door to innovative and creative ideas.

Questions and conscious effort function as motivators that somehow set the cognitive unconscious at work. An inventor needs to learn how to switch productively between conscious effort and allowing time to allow for unconscious processes that require incubation. They can become more sensitive to and listen for intuitive insights. Thus a cyclical process of conscious problem finding, followed by listening for intuitive inspiration, critically working out these ideas and asking new questions can be optimized. Pattern recognition skills can be applied to the mental process itself creating meta-knowledge of the inventive process. The experienced inventor can understand something of how the interplay of all these factors can be more productive and learn over time to use all these mental tools more effectively. Various authors argue that we should not only teach existing knowledge but specifically stimulate inventive skills.

See also: Analogies; Cognitive Style and Creativity; Collaboration; Discovery; Heuristics; Strategies in Creative Problem Solving; Insight; Janusian, Homospatial and Sepconic Articulation Processes; Paradigm Shifts; Pablo Picasso 1881–1973; Play; Problem Finding; Synesthesia; Teams.

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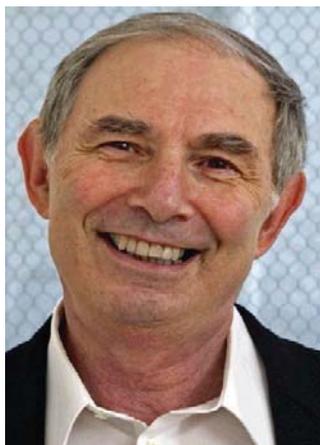
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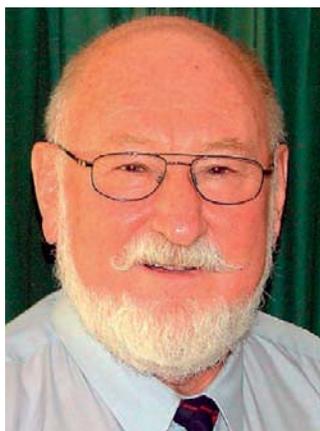
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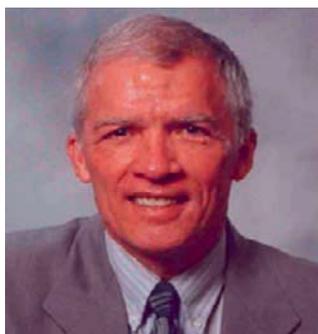
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PREFACE

When the first edition of *The Encyclopedia of Creativity* was published in 1999, creativity research had become broad and important enough to be treated as a legitimate field of scientific study. Since the first edition was published, interest in creativity has skyrocketed with more articles and books published than in the previous 40 years combined. This interest is an indication of the increasing complexity in our lives, where new ways of dealing with challenges on both individual and societal levels are essential. Creativity research is being conducted throughout the world in many different disciplines including psychology, arts and humanities, health sciences, education, and business. This global interest is reflected in the number of authors throughout the world who have contributed to this edition.

Some countries such as China, Korea, Singapore and New Zealand have made understanding, teaching, and encouraging creativity part of their national goals. Europe proclaimed 2009 the year of creativity. The leaders of these countries recognize that their primary natural resource is the ability of their citizens and organizations to develop new products and innovative concepts. As competition becomes more and more intense, the business community in the United States is finally accepting the concept that creativity can contribute directly to the bottom line. A recent poll of CEOs in the United States by IBM's Institute for Business Value indicated that creativity is the most important characteristic being sought in new executive hires. We have responded to the increased interest in the business community by including more entries on organizational creativity.

The *Encyclopedia of Creativity* is designed to inspire further recognition of the personal as well as professional benefits that accrue from encouraging creativity. We know, for example, that individuals who are more creative are healthier and more adaptive, and in some instances may even have a longer life expectancies. We also know that many innovations and ways of solving problems have already led to incredible benefits, such as cures for diseases, improved technologies, and higher living standards for billions of people. However, we are obviously losing a great deal of the creative potential on this planet by leaving so many of our children uneducated and unable to cope with the problems they face. Clearly we need new answers to such difficult problems as climate change, limited resources, religious and territorial conflicts, poverty, and energy.

If we want a more creative world, then we must construct an environment that allows creativity to flourish. This requires knowledge that crosses disciplines. The increased quantity and diversity of research continues for the most part to be focused on a specific area of interest. Most scientific research is still released only in academic journals. There is still not a broad cross-fertilization of knowledge that enhances the development of new ideas. One of the axioms in creativity research is that breakthroughs often occur when information or concepts from one field are applied to a different one. Darwin's theory of evolution was partially inspired by his reading Malthus' theory of population growth and Lyell on geological change. Jean Piaget, noted developmental psychologist, borrowed heavily from biology and epistemology. Freud used a medical model to understand the psyche. Our hope is that readers will roam outside their usual areas of interest in a search for new ways of thinking. The comprehensive nature of the encyclopedia offers readers the opportunity to find new perspectives, which we hope will suggest fresh insights about themselves, their work, and their place in the world.

In the first edition we stated that there was enough known about creativity that it could be integrated into every level of our educational system. Unfortunately "teaching to the test" has become more prevalent in the United States while arts programs have been all too often dropped. It is our hope that teachers at the elementary and high school level will learn about their own creativity and how to value and encourage students. It is not always an easy task, but it can help enhance and even save the lives of some creative students who are at risk.

Some progress is evident at the college and post-graduate levels where courses are taught in many schools throughout the country. There is still a tremendous need for degree earning programs and specializations in

creativity. The Torrance Center at The University of Georgia, Saybrook University, Buffalo State, and Drexel University are among the few schools that currently allow a specialization in creativity studies. By 2020 we hope that there are many more universities and professional schools which include courses and specialties in creativity studies.

Contents

Creativity is multifaceted and manifested in different ways in different domains. Moreover, there are different processes that can each lead to creative work. Thus a comprehensive *Encyclopedia of Creativity* required many different articles.

There are articles that present overviews of the research and theories about creativity from a variety of different areas:

- There are reviews of a number of domain-specific areas, such as acting, dance, expressive arts, film, food, music, religion, science, sports, theater, and writing.
- Creativity and education are examined in articles about thought processes, such as developmental trends in creative abilities and potentials, the enhancement of creativity, intelligence, knowledge, play, prodigies, programs and courses, talent and teaching creativity.
- Cognitive aspects of creativity can be investigated in articles about altered and transitional states, analogies, attention, cognitive style, divergent thinking, flow and optimal experience, metacognition, metaphors, problem-finding, problem-solving, and remote associates.
- Those interested in business and organizational creativity can view articles about advertising with art creative visuals, business/management, creativity coaching, creativity exercises, entrepreneurship, group dynamics, innovation, leadership, organizational culture, organizational development, teams, and training, among others.
- Many articles examine the creative process across domains, covering areas such as discovery, emotion/affect, gender differences, incubation, inspiration, insight, novelty and paradigm shifts.
- The complex interrelationship between society and creativity is explicitly examined in articles about awards, conformity and conventionality, the creative sector and class of society, cultural diversity, the dark side of creativity, East vs. West, networking, social psychology, war, zeitgeist, and others.
- Personal and interpersonal creativity is discussed in articles relating to collaboration, family, life stages, mentors, networking, personal creativity and self-actualization.
- Because the encyclopedia focuses on scientific information about creativity, there are also articles that discuss brain and neuropsychology, concepts of creativity, definitions of creativity, expertise, longitudinal studies, researching art, artists and art audiences, research methods, phenomenology research and qualitative research.
- Articles which look at theoretical perspectives include behavioral approaches, chaos theory, componential models, economic perspectives, the evolving systems approach, the four P's of creativity, and implicit theories.
- The creative process is examined in contrarianism, climate for creativity, discovery, dreams, heuristics, invention, motivation/drive, multiple discovery, novelty, time and rewards.
- Mental and physical health and creativity are reviewed in mental health: affective disorders, mad genius controversy, schizophrenia and psychosis, stress, suicide, and transforming illness and visual art.

Finally there are selected biographical studies selected with creativity as the key concern. The sampling of biographical subjects represents a much higher percentage of women in this second edition. Biographical subjects represent eminent individuals in different domains including composers, film directors, musicians, writers, painters, psychologists, scientists and spiritual leaders.

Audience

The encyclopedia is designed for use by students of creativity, as well as researchers, teachers, scientists, coaches and consultants, architects and designers, trainers, managers, actors, writers, directors, painters and other individuals in the creative arts, inventors, therapists and other professionals who utilize creativity in their work. Anyone who is interested in learning more about their own creativity and the creative process can benefit

from the articles presented here. Do not expect quick and easy self-help answers - individual creative growth requires work, time, serious thought and a commitment to deeper understanding of the process. And let's not forget the possibility of fun - creativity can help us experience the highest levels of involvement in work and play that ultimately leads to great joy. Readers are encouraged to follow their own interests and inclinations in exploring these volumes.

More than any other kind of book an encyclopedia is a collaborative effort. We thank our eminent panel of editorial advisors: Arthur Cropley, David Chan, Sandy Russ, Dean Keith Simonton, Ellen Winner and Jing Zhou. We also thank each of the distinguished contributors to the Encyclopedia. Finally, we appreciate the efforts of our editor, Nikki Levy, and our developmental editor Anna Gebicka. We hope this encyclopedia will not only inform but inspire readers to become more creative in their personal and professional lives.

*Mark A. Runco
Steven R. Pritzker*

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HOW TO USE THE ENCYCLOPEDIA

The *Encyclopedia of Creativity* is intended for use by students, research professionals, and interested others. Articles have been chosen to reflect major disciplines in the study of creativity, common topics of research by professionals in this domain, and areas of public interest and concern. Each article serves as a comprehensive overview of a given area, providing both breadth of coverage for students and depth of coverage for research professionals. We have designed the encyclopedia with the following features for maximum accessibility for all readers.

Articles in the encyclopedia are arranged alphabetically by subject. Complete tables of contents appear in both volumes. The Index is located in Volume 2. Because the reader's topic of interest may be listed under a broader article title, we encourage use of the Index for access to a subject area, rather than use of the Table of Contents alone.

Each article contains an outline, a glossary, cross-references, a further reading list and a list of relevant websites. The outline allows a quick scan of the major areas discussed within each article. The glossary contains terms that may be unfamiliar to the reader, with each term defined *in the context of its use in that article*. Thus, a term may appear in the glossary for another article defined in a slightly different manner, or with a subtle nuance specific to that article. For clarity, we have allowed these differences to remain

so that terms are defined relative to the context of each article.

Each article has been cross-referenced to other related articles in the encyclopedia. Cross-references will always appear at the end of an entry. Where multiple cross-references apply to an article, the cross-references will be listed alphabetically. We encourage readers to use the cross-references to locate other encyclopedia articles that will provide more detailed information about a subject.

The further reading lists recent secondary sources to aid the reader in locating more detailed or technical information. Review articles and research articles that are considered of primary importance to the understanding of a given subject area are also listed. The further reading lists are not intended to provide a full reference listing of all the material covered in the context of a given article, but are provided as guides.

A select number of biographies have been included. These biographies discuss the lives of individuals famous for their creative endeavors. No living people have been included because we wanted creators whose work had stood the test of time. Although there are many individuals famous for their creative pursuits, you may not find coverage of your favorite here. Inclusion is not intended to be a judgment on the impact or value of these individuals or their creations.

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Janusian, Homospatial and Sepconic Articulation Processes

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Glossary

Analogic reasoning Drawing of inferences or conclusions based on likenesses and comparisons.

Catharsis Purging or discharge of unacceptable or unpleasant emotions.

Condensation The representation of two or more ideas, memories, feelings, or impulses by one construct or image as in a person's humor, accidental slips, and dreams.

Deductive reasoning Making inferences or conclusions based on predetermined premises.

Dialectical reasoning Practice of weighing and reconciling juxtaposed or contradictory arguments for the purpose of arriving at the truth.

Gestalt Term used for an organizational whole, therefore the perceptual organization of a whole visual space into foreground and background features. The term is used for a psychological theory and movement based on principles of the whole in mental processes.

Inductive reasoning The process of drawing out or making inferences or conclusions based on facts and observations.

Kent–Rosanoff word association test Psychological test usually composed of 100 stimulus words requiring a response, usually timed, of the first word that comes to mind on exposure to each stimulus word. Developed by psychologists Kent and Rosanoff in the early 1900s and standardized on over 1000 subjects.

Oxymoron A figure of speech in which incongruous or contradictory terms are brought together.

Semistructured research interviews Use of prepared questions and categories for eliciting interview information relevant to specific preconstructed hypotheses. These questions and categories are not presented in a set sequence but according to the flow and logic of the interview interaction.

Statistical significance Method for assessing the operation of nonchance factors in an event or series of events.

Unconscious Mental aspect containing psychic material that is not accessible to awareness but has a pronounced effect on conscious thought and behavior.

Creativity consists of the capacity or state of bringing into being entities that are both new and valuable. Three cognitive functions responsible for creative constructions and effects are the Janusian, homospatial, and sepconic articulation processes. During the course of creative activity, these processes operate both independently and in conjunction with each other. Dynamic interactions within and among the three processes produce emergent creative integration.

Empirical Studies

The creative cognitive processes were discovered through long-term empirical investigations consisting of extensive semi-structured research interview procedures (*Int=verbatim* quotations used) with consensually recognized highly creative achievers in the arts and sciences. Subjects have been: in literature – Nobel laureates (IntNL), Pulitzer (IntP) and other notable literary prizewinners; in science – Nobel laureates in physics, chemistry, and medicine or physiology (IntNLS)

in both the United States and Europe. Interview procedures were carried out over the course of the subjects' both long- and short-term creative projects and consisted of detailed objective examination of psychological processes in ongoing work and, where appropriate, past creative breakthroughs. Experimental assessments, as reported below, were also done with these and other creative subjects and noncreative controls. Additionally, comparison control research interviews, carried out in the same semistructured manner as with the creative subjects, were performed with less creative matching cohorts.

Documented accounts of breakthroughs and other creative productions of outstanding art and science creators of the past were also systematically analyzed. The large body of evidence collected indicates that the three conscious and intentional processes, Janusian, homospatial, and sepconic articulation, are used for creative work and thought in literature, art and science and, by extension, in various degrees in fields such as business, education, politics as well as general creative problem solving and everyday creative activities.

Janusian Process

The Janusian process, most commonly operative in the early or inspiration phase of creative production, consists of actively conceiving multiple opposites or antitheses simultaneously. The term, based on the multifaced (variously possessing two, four, or six faces) Roman god Janus looking always in diametrically opposed directions, denotes conscious conceptualization during the creative process of simultaneously coexisting and operative opposite or antithetical ideas, propositions, or actions. Although seemingly illogical and self-contradictory, creators construct these conceptualizations in rational states of mind in order to produce creative effects. In art and literature they are responsible for early conceptions of plot, character, metaphor, organization, and design; in music for compositional construction; in science for creative breakthroughs, theorizing, and experiments. Depending on the level of development of a creative product, the Janusian process also operates at later critical junctures and with practical solutions in a wide variety of fields.

Simultaneity of the multiple opposites or antitheses is a cardinal feature of the Janusian process. Creators conceive firmly held propositions about the laws of nature, the functioning of individuals and groups, or the aesthetic properties of visual and sound patterns as simultaneously true and not-true; harmonious and non-harmonious or, both opposite and antithetical propositions are entertained as concurrently operative. A person running is both in motion and not in motion at the same time, a chemical is both boiling and freezing, or kindness and sadism operate simultaneously. Previously held beliefs or laws are still considered valid but opposite or antithetical beliefs and laws are formulated as equally operative or valid as well.

These formulations within the janusian process are waystations to creative effects and outcomes. They interact and join with other cognitive and affective developments to produce new and valuable products. Homospacial and sepconic articulation particularly operate as later unifying processes. Analogical, dialectic, inductive, and deductive reasoning are applied also in the development of theories, inventions, and artworks.

The Janusian process initially disrupts preexisting contexts and conceptions. Highly surprising, even incredible and inconceivable, are propositions that the contradiction or opposite of well-grounded fact, theory, or actuality is simultaneously valid. Previously held ideas and systems of ideas are split apart and broken, even essentially destroyed. This disruption engenders the development of something new.

Janusian Process in Science

While working on an essay for the *Yearbook of Radioactivity and Electronics* in 1907, Albert Einstein had what he called "the happiest thought of my life." This happy thought was the key to one of the most far-reaching scientific breakthroughs of the twentieth century: the general theory of relativity. The circumstances producing it were revealed in a document by Einstein himself which was unpublished during his lifetime, titled, "Fundamental Ideas and Methods of Relativity Theory, Presented in Their Development."

Einstein had already developed the special theory of relativity, which holds that since the speed of light is constant for all frames of reference, perceptions of time and motion depend upon the relative position of the observer. He had been forced to postulate the theory, he said, to explain the seeming contradictions in electromagnetic phenomena:

[that] one is dealing here with two fundamentally different cases was, for me, unbearable. (Translations, Gerald Holton)

He felt strongly that he had to come up with a new and meaningful solution. For many years, he struggled to modify Newton's classical theory of gravitation so that it could be encompassed within a broad relativity principle, but he lacked a specific physical basis for bringing together the seemingly different or antithetical choices of Newton's theory and his own special theory.

All at once, Albert Einstein conceived his happiest thought. It was:

For an observer in free fall from the roof of a house, there exists, during his fall, no gravitational field . . . in his immediate vicinity. If the observer releases any objects, they will remain, relative to him, in a state of rest. The [falling] observer is therefore justified in considering his state as one of 'rest.'

Development of the general theory itself was highly complex, but the specific structure of the key step is clear. Einstein had consciously formulated the simultaneously antithetical construct that a person falling from the roof of a house was both in motion and at rest at the same time.

(IntNL) Physicist Edwin McMillan's formulation of critical phase stability leading to his development of the synchrocyclotron (later called the synchrotron) was derived from a sudden formulation involving simultaneous opposition of too high and too low energy. The synchrotron is a high energy particle accelerator that has allowed for the discovery of a number of new particles and other nuclear effects.

'I was lying awake in bed and thinking of a way of getting high energy,' he said, and I was thinking of the cyclotron and the particle going around and encountering the accelerator field. . . . It's going to oscillate back and forth, be going at too high and too low energy. Once I realized that, then the rest was easy. . . . Once you have an oscillation, you have the element of stability. The things will stay put. They will wiggle around but they won't get away from you. Then all you have to do is to vary your frequency, or vary the magnetic field, either one or both, slowly, and you can push this thing anywhere you want. That all happened one night and the next day I started to write down the equations for that and proved that it would work.

In physicist Niels Bohr's (1927) first formulation of his theory of complementarity, the theory that has been a foundation for modern quantum physics, he stated that wave or else particle states of light and electrons, widely believed at the time to be completely conflicting alternatives, involved:

no question of a choice between two different concepts but rather of the description of two complementary sides of the same phenomenon.

He then went on to formulate the full blown complementarity theory stated as follows:

two descriptions or sets of concepts, though mutually exclusive, are both necessary for an exhaustive description of the physical situation.

His key initial formulation of the complementarity idea was a Janusian process construct that both light and electrons were phenomena with simultaneously antithetical wave and particle aspects.

Janusian Process in Literature, Art, and Music

(IntPP) Novelist William Styron reported that he developed the initial idea for his Pulitzer Prize winning novel *The Confessions of Nat Turner* as he sat in a lawn chair reading Erik Erikson's book on Martin Luther's rebellion. He thought, in a Janusian process construction of simultaneous opposition, of creating a novel about another rebel, a revolutionary hero who, he said:

was responsible for the deaths of hundreds of people, but he himself would kill only one person with his own hand – and this was the one person who had been very kind to him and the one person he loved.

(IntPP) Playwright Arthur Miller disclosed that he had come up with the specific idea for the play "Incident at Vichy" while traveling through Germany:

Driving on the autobahn, I suddenly felt amazed and overwhelmed at how beautiful Germany had become.

He conceived of writing a play that would simultaneously express the opposites of the beauty of modern Germany and Hitler's destructiveness.

And then, I remembered a story I'd been told about a sacrifice made by an Austrian nobleman for a Jew in a Nazi official's waiting room.

He developed the story of the political simultaneously antithetical sacrifice in his play.

(IntPP) Poet Richard Wilbur related that he had been walking on a beach and became interested in the quality of some rocks along the sand. As he touched the surface of the rocks, he noted that they seemed to feel like human skin. They were, however, also hard, heavy objects – violent weapons. The idea that the rocks were at once sensual objects and weapons led to a conception of the simultaneous operation of sex and violence in the world, and Wilbur elaborated those aspects separately into the final version of a poem.

(IntPP) Poet James Merrill (1972a) had been home thinking about a past incident in which a horse had appeared at a lonely desert site, when it occurred to him that horses are animals who "renounce their own kind in order to live our lives." The idea that horses live human lives, that they are antithetically both beast and not-beast and human and not-human simultaneously, generated the poem, "In Monument Valley," with the central image and theme of a happy and

intense relationship between a young person and a horse, followed by a sad, resigned separation.

(IntPP) Poet and novelist Robert Penn Warren recounted that he was doing his morning exercises when he thought of a series of poetic lines that, as he described them, would use the last word of each line as the first word of the next – a juxtaposition that sets one word to simultaneously opposite functions, both ending and beginning a poetic thought. In the end, his poem implicitly retained that structure.

Artist Jackson Pollock's early drawings and paintings were strongly based on the styles of Thomas Hart Benton, Diego Rivera, and Jose Clement Orosco. During the summer of 1939, when he was improving from alcoholism and mental illness, he created his first abstract expressionist paintings, becoming the so-called father of that style. These revolutionary artworks, he later explained, were based on his conception of both obscuring an image and expressing it at the same time, a Janusian process formulation.

In music, the writings of composers from early to more recent modern times have stipulated simultaneous oppositions regarding germinal aspects of their compositions. Renaissance composer Claudio Monteverdi (1956) described his method of producing slow and fast tempos simultaneously as a means of conveying the "contrary passions aroused by war, prayer, and death." Modern composer and conductor Leonard Bernstein (1976) wrote of the use of "contradictory forces, chromaticism and diatonicism, operating at the same time." Composer Arnold Schoenberg conceived the simultaneous use of the opposites of consonance and dissonance in his musical creations and compositional instructions to disciples.

Homospacial Process

Mental representation of space is potentially more far reaching, extreme, and diverse than any physical actuality. The homospacial process responsible for many types of creative results involves mental representations that defy or go beyond actual physical space. This process consists of actively conceiving two or more discrete entities occupying the same space or spatial location, a conception leading to the articulation of new identities and integrations. In conscious mental space, creators superimpose, interpose or otherwise bring together shapes, patterns, written words, dimensions, distances, and other concrete entities. Subjectively, eyes closed or open, other physical receptors attentive or inattentive, the resulting mental image totally fills the conceptualized perceptual space. Any sensory modality may be involved: visual, auditory, tactile, kinaesthetic, olfactory, and gustatory. The imaginary image location may be considered to be the 'mind's eye,' 'mind's ear,' 'mind's taste,' etc.

Once the discrete entities in the homospacial process are consciously brought together, the mental conception is a rapid, fleeting one. In the creator's mind, the superimposed and interposed elements begin immediately to interact and produce new identities, including new ideas. These ideas constitute solutions to scientific and other problems and in the arts, they consist of created metaphors, plots, visual themes and constructions, musical passages, and other integrations.

Not a matter of simple combination, unconscious condensation, or of the discrete entities considered in stepwise or

analytic fashion, the homospatal process involves unstably related entities that interact. Ordinarily used later than the Janusian process but, as in an oxymoronic metaphor such as Hart Crane's 'penniless rich palms' from his *Voyages II*, both processes may operate early and concurrently. Newness in the created results produced by the homospatal process begins with creators breaching the physical percept that two or more discrete entities cannot in actuality occupy the same space. The valuable aspect emerges from rapid or delayed interactions among the superimposed and interposed elements.

Homospatal Process in Science

Mathematician Jacques Hadamard (1949) described the conception leading to the important 1892 discovery of the valuation of a determinant as a schematic diagram consisting of:

a square whose sides only the verticals are drawn and, inside of it, four points being the vertices of a rectangle and joined by (hardly apparent) diagonals.

He visualized a rectangle occupying the inside of a square, two discrete entities within the same spatial location.

Mathematician Henri Poincaré (1952) described the mental conception of a coalescing spatial superimposition of mathematical formulations which led to the discovery of a crucial aspect of his famous Fuchsian functions:

One night, I took some black coffee, contrary to my custom, and was unable to sleep. A host of ideas kept surging in my head; I could almost feel them jostling one another, until two of them coalesced, so to speak, to form a stable combination. When morning came, I had established the existence of one class of Fuchsian geometric series. I had only to verify the results, which only took a few hours.

(IntNLS) Microbiologist Joshua Lederberg reported that he arrived at an important new idea regarding enzyme replication after consciously visualizing himself superimposed upon a living cell.

Similarly, (IntNLS) chemist William Lipscomb described one of his Nobel Prize discoveries in boron chemistry as arising from a superimposed image of a hydrogen atom and a three center chemical bonding:

What I mean by the superimposition ... this hydrogen comes over here [points to formula], and interchanges with this vacancy. I saw the previous three center bond there, and then it came loose and twisted around. I did that in my head and it became perfectly clear in the nuclear resonance study I published. I had the right structure.

Homospatal Process in Literature, Art, and Music

The homospatal process is a prime factor in the production of poetic metaphors. To produce what was to be a central metaphor in a lyrical poem, 'the branches were handles of stars,' an author had become attracted early to the words 'handle' and 'branch' because of their shared sound qualities – the assonance or shared 'an' sound in the center of each – as well as the

shared shapes of the wooden objects themselves. He then superimposed these words and their concrete images in his mind's eye; he brought them together because he felt they ought to be together. In the next fleeting moments, he asked himself when in reality they were the same, and also fleetingly experienced a vivid impression of the letter 'a' overlapping in the two words. At that point the idea of stars was generated. Associational or analogical ideas of the country (or park) at night did not generate the metaphor; it was derived directly from the homospatal process conception that provided both the real scene and sound qualities that unified the words and their meanings.

In the creation of another type of metaphor, 'the tarantula rays of the lamp spread across the conference room,' this author was thinking about writing a poem about a vacation in the tropics and, among the various thoughts and words that came to mind, he became interested in the sound similarity between the words 'tarantula' and 'lamp.' He then actively superimposed images of the spider and a light source together, along with images of the letters in the words, because he felt these ought to be together. After mentally visualizing spidery light radiating out from a central source in the superimposed images, he thought of the metaphor, 'tarantula rays of the lamp.' Deciding to elaborate that fragment with a suggestive context, he next conceived of 'conference room.' Once the entire creation was constructed, he thought of overtones such as wars in the tropics, the idea of the slow crawl of a tarantula in contrast with the dazzling speed of light, and experiencing an awesome type of beauty, he was pleased. With both poetic creations, the author visualized a vague scene as well as found the answer in words. Later, he visualized more fully developed and vivid scenes similar to the ones experienced by a reader or audience, and he (sepconically, see below) articulated the metaphors as well as descriptions of the scenes into poems. The fully visualized scenes did not, however, produce the metaphors, they mainly added to the poet's feeling of the aptness of his creation.

Sculptor Henry Moore (1937) indicated the crucial role of a homospatal process in the creation of sculptural works of art as follows:

This is what the sculptor must do. He must strive continually to think of, and use, form in its full spatial completeness. He gets the solid shape, as it were, inside his head – he thinks of it, whatever its size, as if he were holding it completely enclosed in the hollow of his hand. He mentally visualizes a complex form from all round itself; he knows while he looks at one side what the other side is like.

In music, auditory metaphors and new musical patterns and themes develop from homospatal process constructions. Ludwig van Beethoven (1952) described that:

the underlying idea [of a musical work] ... rises ... grows, I hear and see the image in front of me from every angle, as if it had been cast.

Robert Schumann (1922) said regarding his composing process:

certain outlines amid all the sounds and tones ... form and condense into clear shapes.

Interaction Between Janusian and Homospatial Processes

(IntPP) James Merrill's previously described Janusian formulation of a horse as both beast and human simultaneously for the poem, 'In Monument Valley,' was subsequently integrated into a particular central poetic metaphor by a homospatial process conception. A horse and human being were conceived as occupying the same space; that led to the construction of the following poetic image:

Stillnesses were swarming inward from the evening star/ Or outward from the buoyant sorrel mare/ Who moved as if not displeased by the weight upon her./ Meadows received us, heady with unseen lilac./ Brief, polyphonic lives abounded everywhere. With one accord we circled the small lake.

The resulting image was neither a centaur, a mythical entity that is part human and part horse, nor was it some other mixture or combination of horse and man.

Experimental Evidence for Janusian and Homospatial Processes

A tendency or capacity for the use of the Janusian process among proven and potentially creative persons, manifested by very rapid opposite responding on word association tasks, was experimentally identified. Standard Kent-Rosanoff word association tests were individually administered to 22 Nobel laureates in science (physics, chemistry, medicine or physiology) and to rated-as-creative Yale College students. Control groups consisted of matched but rated-less-creative students and high IQ psychiatric patients. Test instructions were to give the first word that came to mind in response to a standardized list of word stimuli and both speed and content of response were electronically recorded. Results signified, for the most creative subjects, formulation of simultaneous or virtually simultaneous opposite associations. The statistically significant highest number of extremely rapid opposite responses (averaging 1.1-1.2 seconds) were given by proven creative subjects, the Nobel laureate group, and the next highest by the rated-as-creative Yale students.

Experimental assessment of the creative effect of the homospatial process, using the stimulus effects of ten concrete representations of such mental conceptions consisting of a series of ten transilluminated superimposed component slide images, were carried out with artist and writer subjects. Controlled side-by-side slide presentations of each of the individual component images were shown to half of each group. Results were the statistically significant greater production of both creative literary metaphors by writer groups and creative pastel drawings by artist groups in response to the superimposed images in comparison with the side-by-side controls. An example of a test superimposed stimulus image, consisting of nuns in front of St Peter's and racing jockeys is shown in Figure 1. An experiment using shorter stimulus exposure times to facilitate more rapid mental superimposition and manipulation produced similar results.

With highly talented award winning artists, another experiment was carried out to assess whether the results of the

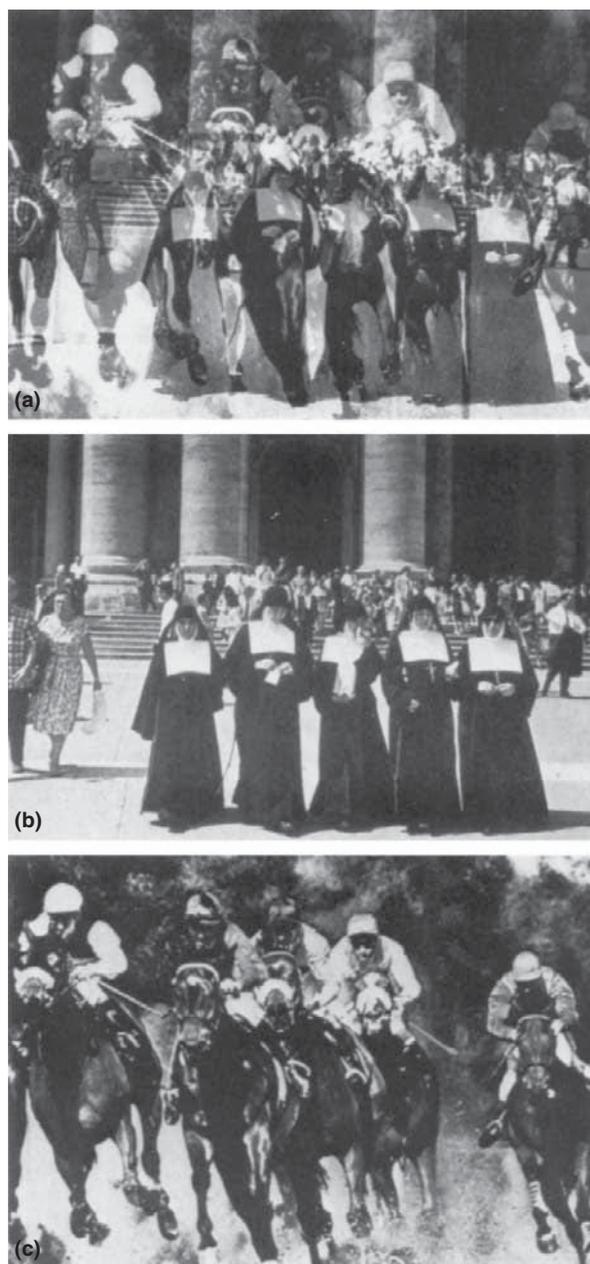


Figure 1 The first slide pair, superimposed and separate. (a) Photograph of colored slides as projected superimposed onto the viewing screen. (b) and (c) Photographs of individual color slides.

previous experiments could have been due to stimulus presentation effects. Results indicated that presentation of test superimposed images in controlled comparison with foreground-background (gestalt) displays of the same subject matter yielded significantly higher rated creative products.

Sepconic Articulation

The sepconic articulation process consists of conceiving or constructing separation and connection concomitantly. The term derives from the root meaning of articulation as joining,

joint, to join, and the commonly applied phrases, 'being articulate' or 'an articulate speaker.' Speaking smoothly and continuously, the articulate speaker joins words and ideas together and keeps them clearly separate at once. In creative work and activity, the creator uses such concomitant separation (SEP) and connection (CON), the process of sepconic articulation, in many different dimensions – conceptual, perceptual, affective, and physical. It differs from blending, fusion, combining, connecting or connectivism alone, in that the creator brings together separate component elements that retain their individual characteristics.

Integration characterizes created works and is a crucial factor in their positive value. The process of sepconic articulation, because of discordance of concomitant separation and connection, leads, as with conflicting elements of the Janusian and homospacial processes, to dynamic interaction and the emergence of integration. Separate individual elements retaining their identities contribute to the functioning of a large or small whole connected system. This integrated whole has qualities not present in any individual element or factor; it is greater than the sum of its parts.

When creators produce new ideas, procedures, experiments, neologisms, plot themes, artistic or musical patterns, they integrate them into a created result by means of the process of sepconic articulation. Integration, contingent organicity, and usefulness produce the value aspect of creations in all fields, science and art as well as the products of everyday ingenuity. Newness or originality alone does not guarantee successful application or appreciation. New elements, forms, or mechanisms must have articulating concomitance with previously existing elements, forms, or mechanisms in order to become creations. New factors must have connections with comparable past ones. Creative new theories and experiments, for example, are always connected to some degree with existing canons of scientific knowledge, creative new postmodern sculptural or painting styles are in some part connected with realism, op and pop art, action painting and many other previous approaches. Joyce's and Shakespeare's literary creations are connected both in subject matter and form with previous works of literature and life events. New factors, therefore, which are clearly distinct and separate are at the same time connected in some measure with the past. Creations are articulating concomitants of new ideas, objects, and structures with aspects, sometimes totalities, of the past.

Sepconic Articulation in Science

(IntNLS) Physicist Norman Ramsey conceived the 'Separated Oscillatory Field Method' which provided critically important high resolution in atomic and molecular spectroscopy for the production of the most precise atomic clocks. He disclosed that he had been working on making a connection between a short and longer magnetic field apparatus and had first conceived that the nature of the field was crucial and also that it would have to be uniform. Then, deciding later all at once that the uniformity of the field itself was less important than the separated beginning and ending, he conceived a solution in which the distinctly separated 'bits,' were concomitantly connected through oscillations. The interactions between the

concomitant separations and connections produced mutual modifications and a creative outcome. He said:

[the connecting oscillations produce] a short, much stronger field at the beginning and a short, much stronger field at the end, and then the middle part averages out.

(IntNLS) Chemist Jean-Marie Lehn is responsible for the creation of the field of supramolecular chemistry, developments in which have made important contributions to nanotechnology, work with catalysts and catalysis, pharmaceutical therapies, and drug delivery. 'Supramolecular chemistry,' he said:

has to do with the designed manipulation and use of weaker interactions, weaker forces, compared to intramolecular ones, which glue molecules together and allow you to construct large architectures.

He developed supramolecule structures from conceiving concomitant separation and connection:

What one wanted was building a three dimensional negative image in space. ... This is a cavity, a "crypt"; so there are "cryptands," "cryptates," and so on. ... The hidden aspect is important because the interactions of the outside species with what is hidden determines both the properties of what is inside ... and also what's outside.

Sepconic Articulation in Art, Literature, and Music

In literature, the development of characters results from the process of the author's sepconic articulation of self. Created literary characters are neither simply representations of the writer's personality or life history nor combinations of these factors with those of other persons, real or imaginary. Throughout the course of writing a novel, play, or poem, the author concomitantly connects and separates his own emotions, personality characteristics, and experiences with the fictional characters being created. There is continual interaction of features of the author's self and the developing portrayal.

The sepconic articulation process also operates in the creation of poetic form. (IntPP) James Merrill (1972b) created a central metaphor, 'a mastermind kept track above the mantel' of the poem entitled, '18 West 11th Street' through concomitant separation and connection of words pertaining to his self and the destruction of the eponymic house. It was the street address of a brownstone house in Greenwich Village that Merrill lived in as a child. The house much later was actually accidentally blown up by a revolutionary group called 'The Weather Underground' during a project of making bombs in the basement.

The 'mastermind' mirror in the poem allows a passing through in imagination of both the poet's childhood images and the world of the Weather Underground. During the process of creation, he wrote more than twenty-five different versions of these lines. Before the final step, he focused on an off-rhymed word-pair, 'mental' and 'mantel.' Then, in the process of sepconic articulation, he conceived the metaphoric word 'mastermind' by separating out from 'mental' the idea of mind and connecting it concomitantly with the idea of plotting

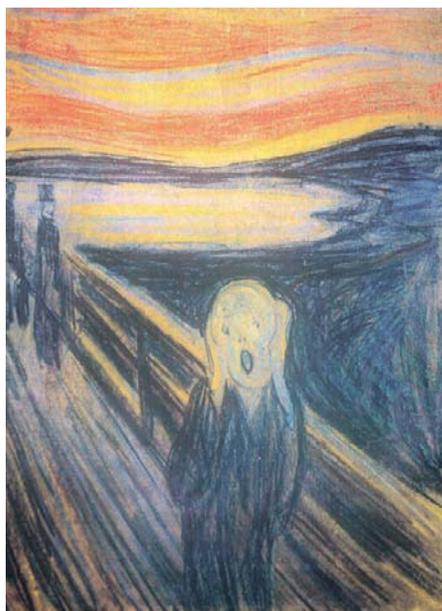


Figure 2 Edvard Munch, *The Scream* 1893. Oil, pastel and casein on cardboard. Oslo National Gallery, Oslo.

'saboteurs' from another portion of the poem. He was aware at the same time of continuing to separate out the initial consonants and vowels of the word pair 'mental' and 'mantel' and connecting them into an effective alliterative sound similarity: both alliteration (m) and assonance (en/an). The mastermind metaphor, effective in both structure and meaning, became an aesthetic integration in the poem.

In his diary, in 1892, expressionist artist Edvard Munch described a visual hallucination of a bloody red sky that provided the inspiration of emotionally charged elements that he integrated by means of the sepconic articulation process and, to a lesser extent, the homospacial process, into the famous artwork, 'The Screech' or 'The Scream' (Figure 2). Over a period of more than a year, he several times progressively connected and separated himself and his hallucination, as represented by a human subject viewing the sky, with nature.

He first did a drawing showing a solitary man far at the back leaning in profile over a bridge and looking at the sky and a boat on a small lake, then later a painting depicting the leaning still-profiled man located right at the front of the scene. In the next two charcoal drawing versions, he put a round bowler hat on this profiled spectator. After that, in an ink sketch much later in that year, he depicted the then bowler-hatted man facing fully forward and matched the rounded shape of the hat with the curved lines of both the sky and the contours of the man's body, a probable result of conceived superimpositions of the homospacial process. In the final version, first done as a lithograph and later as a painting, he developed critical aspects of the image by presenting the man concomitantly separated and connected with the nature scene. The forward-facing man was portrayed with no hat but with an oval screaming mouth. Both the red sky and man's body contained differently oriented ovoid types of curves. Mouth, sky, and body all were in this way separated and connected concomitantly. He thereby

produced a universal pictorial metaphor, a metaphor verbally described as 'the scream of nature,' that provides much of the integrated aesthetic power of this painting.

The process of sepconic articulation operates throughout musical creation. Just as the articulate and creative speaker brings phrases and ideas together smoothly and in continuous flow while concomitantly separating these phrases and ideas clearly, created music brings rhythms, themes, instrumental effects, and other sonorities together smoothly while clearly separating these elements. It produces the organic integration of created music. Classical composer Paul Hindemith (1961), using the analogy of seeing a heavy flash of lightning in the night, described the musical operation of both the homospacial and sepconic articulation processes together as follows:

Within a second's time we see a broad landscape, not only in its general outlines but with every detail. . . . We feel that not even the smallest leaf of grass escapes our attention. We examine a view, immensely comprehensive and at the same time immensely detailed. . . . Compositions must be conceived the same way. If we cannot in the flash of a single moment, see a composition in its absolute [connected] entirety, with every pertinent detail in its proper place, we are not genuine creators.

Phases of Janusian, Homospacial and Sepconic Articulation Processes

All three processes function in creation individually as well as in conjunction with each other. There are four phases in the creative process that occur over extended periods of time or else condensed into a very short span such as sometimes occurs with sudden breakthroughs and insights. Ordinarily, the creative thinker uses the Janusian process earlier than both homospacial and sepconic articulation processes. All three begin with a first phase consisting of the deliberate motivation to create; nothing new and valuable is created without the intention to do so. Both the intentional goal and the area chosen for creation have emotional (including aesthetic) importance for creators themselves. Combined emotional and ideational motivation provides the drive to conceive the inconceivable and use other daring and unusual cognitive modes in the next phases.

In the second phase for each of the three processes there is a deviation from the customary. The creator using the Janusian process focuses on seemingly unreconcilable poles of opposition or antithesis. Scientific creators, highly knowledgeable about their fields, at this time begin to break away from widely held precepts of approach and content. In art, literature, and music, knowledgeable creators' choices of particular opposing elements of form or content in their works differ in some fashion from those of previous writers, artists, or composers. This is the beginning of a small or large departure from the known and accepted that ultimately produces newness in the created product. Creators' gradual and continuing development of specific thematic poles and aspects serves to separate and isolate critical factors in the area of investigation, technology, or aesthetic production.

In both the homospacial and sepconic articulation processes, in the second phase, creative thinkers choose entities that, while they differ both singly or in multiples from the

usual, have functional or structural similarities with each other. For the visual artist it may be repetitions, juxtapositions, contraries, or oppositions in shape and color, for the writer (especially the poet) and musician it may be sound and physical relationships, and for the scientist it is functional, conceptual, or physical relationships within the problem being worked on.

In the third phase of the Janusian process, creative thinkers conceive multiple opposites or antitheses as operating simultaneously. It is here that ideas constructed sometimes seem surprising to the creators themselves. At first unthinkable, even disjunctive, are postulates that antithetical factors co-exist or operate together, or that something that has existed or was known previously continues to operate together with its diametric opposite. Also, one pole or portion of an opposite or set of opposites may up to then have been in conscious focus while others have been dimly held at the periphery. Conscious positing of the simultaneous validity of these opposites may become a sudden and enthralling experience, producing a sense that is sometimes described as 'something coming out of the blue.' With respect to newness, the simultaneity of opposition is a phenomenon experienced as being out of time. As it is out of time, or out of temporal succession, it appears as discontinuous with previous factors and therefore new.

Distinct cognitive abilities and proclivities are involved in the Janusian process and emotional underpinnings interlock with these. When emotional involvement involves meaningful conflict, it especially jibes with the cognitive tendency in the Janusian process to focus on opposites and antitheses and bring these together simultaneously. The simultaneous opposition and antithesis with its retained conflict among composing elements is isomorphic with emotional conflicts in all types of creators.

In the third phase of the homospacial and sepconic articulation processes, creators bring together the functionally or structurally similar elements. In the homospacial process, they are superimposed or interposed in the same mental space; in the sepconic articulation process they continue to be separate identities while they are connected. Creators bring together these entities because they conceive that they ought to be together. The conception deviates from previously known composite structures in similar fashion to the types of deviations of the Janusian process. There are several reasons for this conscious act of volition, many of which are emotionally driven and may be unique to the particular thinker.

In the fourth phase, both the homospacial and sepconic articulation processes lead individually to partial or complete integrations. Also, they operate together with the Janusian process, modifying it and integrating the simultaneous opposites into the full dimensions of the artwork, theory or discovery. Stepwise logical and synthesizing mental processes operate in this phase as well. Not to be minimized in any way, specific skills are critically important, such as, in science, high intellect and intelligence, observational and deductive capacities, and knowledgeable attention to canons of empirical validation. In art, music, and literature, high level skills with language, sound and pictorial relationships are necessary to produce the fully developed aesthetic product. Other specific skills are necessary for creativity in various other fields.

Aspects of both Janusian and homospacial processes have features in common with sepconic articulation. Opposites and antitheses in the Janusian process are both separated and connected when simultaneously posited. In the homospacial process, discrete separate entities become connected within the same space. Sepconic articulation is used conjunctively throughout all phases of the creative process, interacting and interlocking with the various phases of both Janusian and homospacial operations. Creators use it independently primarily in the fourth phase construction of the completed work. Overall, the sepconic articulation process has a biphasic configuration. In the early aspect, the person who is motivated or 'inspired' to create takes in emotionally laden stimuli, experiences, and concepts. Analogous with the literal meaning of the term inspiration in breathing or respiration, the taken-in contents are, like elements in inspired air, modified and mentally interact both consciously and unconsciously. Not simply expelled or expired, through such postulated mechanisms as unconscious breakthrough or as catharsis, the elements are sepconically and consciously articulated. Similar to the everyday creation of human utterance in which inspired air is articulated by the voice apparatus and the brain to construct words and language, the sepconic articulation process modifies initially taken-in inspirations in an extended final phase.

See also: James Joyce 1882–1941.

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James Joyce 1882–1941

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Background

Dublin: 1882–1904

James Augustine Aloysius Joyce was born on 2 February 1882 in Rathgar, a suburb of Dublin, Ireland and died on 13 January 1941 in Zurich, Switzerland from a perforated duodenum. He was the oldest of ten children (six sisters and four brothers). His father was John Stanislaus Joyce, his mother was Mary Jane Murray. Joyce's father was able to support the family quite well for a number of years before losing his job as a tax collector, at which point the family went into financial decline that forced them to move from apartment to apartment, often doing so in the middle of the night to avoid landlords demanding back rent.

From 1888 until 1891 Joyce attended Clongowes Wood College (a Jesuit-run school); he dropped out when his family could no longer pay tuition. While at Clongowes Wood College he excelled in academics and often found himself the head of his class. Joyce briefly studied at a school run by the Christian Brothers before taking up studies in 1893 at Belvedere College, another Jesuit institution. At Belvedere Joyce studied French, Italian, and Latin. Also he began writing poetry and honed his writing skills with a series of essays. Joyce's poetry is often overlooked when compared to his later prose work. However, he did publish two collections: *Chamber Music* (1907) and *Poems Penyeach* (1927). Joyce was uncertain whether he had the talent to write poetry but continued to write it for many years. During his last year at Belvedere Joyce discovered the work of Henrik Ibsen (the Norwegian dramatist). Ibsen figured prominently in Joyce's artistic development. It was Ibsen's questioning of middle class values, his individualism, and his ability to represent the events of everyday realistically that attracted Joyce to him. Joyce's only play, *Exiles*, was heavily influenced by Ibsen's dramas. Joyce was to look to other European writers for inspiration rather than Irish writers.

After leaving Belvedere College, Joyce enrolled at University College, Dublin. In 1902 he obtained a degree in modern languages. While at university Joyce was more interested in acquiring life experiences than academics. It was at this time the he began to question more deeply the Catholic Church and the role it played in restricting intellectual freedom in Ireland. From 1900 to 1902, Joyce gave a series of controversial lectures in which he presented the view that art and drama need not be related to morality or ethics but should reflect the real life of characters. Drama, for Joyce, was the highest form of art. In addition to all of these activities, Joyce made the acquaintance of William Butler Yeats, George Russell, and Lady Gregory, all of whom were to support him artistically as well as financially.

In December of 1902 Joyce left Dublin for Paris where he planned to attend medical school with the intention of combining a career in medicine with one in writing. Yeats and Lady Gregory provided him with valuable contacts. However, this endeavor was short-lived as Joyce recognized that he could not

afford the school's fees. He did not return to Dublin but remained in Paris living on what he could make from book reviews, English lessons, and money from his family.

Joyce did finally return to Ireland upon learning that his mother was dying. She died on 13 August 1903. Her death broke the family apart and left it poor and desolated. Joyce would never forget this. It reinforced his increasingly negative feelings for Ireland and significantly shaped his emotional life, influencing his artistic development. It was during this time that Joyce began to drink. Prior to this he refrained from drinking partly in response to his father's intemperance. His drinking was encouraged by his friend Oliver St. John Gogarty. Joyce would continue to drink heavily for the rest of his life, even at the risk of damaging his already impaired vision and breaking up his family.

Out for a walk on 10 June 1904 Joyce spotted the person who would change his personal and artistic life forever, Nora Barnacle, walking along Nassau Street. He was immediately smitten with her. They met on 16 June and walked from Dublin to Ringsend. It should be noted that this is the same date on which the events of Joyce's *Ulysses* take place. Nora was to be Joyce's companion, wife, and muse for 36 years. In Nora Joyce found someone who could fill the void left by the death of his mother and someone who understood him but was not intimidated by him. Nora attended school only until the age of 12 and had little interest in literature, so she would seem an unlikely mate for someone such as Joyce, but she was self-possessed, courageous, and witty. She determinedly looked after Joyce, constantly berating him for his almost nightly drinking bouts. He was impervious to her concerns about his drinking, even when she threatened to leave him. Joyce viewed his nightly drinking as a way to relax and as a way to mingle with people and observe their behavior and habits of speech as a source of material for his writing. He did not drink during the day.

Joyce was in awe of Nora and she would be the wellspring of his inspiration. Their letters to one another are voluminous and range from being obscene to outpourings of love and admiration. He would spend hours listening to her talk, eventually using this material in his work. Nora's ways of thinking and speaking was the model for Molly Bloom.

Trieste: 1904–1915

Joyce rejected the institution of marriage, and since they could not live together unmarried in Ireland Nora and Joyce moved to Zurich, Switzerland where Joyce had been promised a job at the Berlitz School. Upon arriving they were informed that the position had been filled. Next they traveled to Pola and to another Berlitz School. After five months they relocated to Trieste, Italy, where they would live for the next ten years. Nora gave birth to two children: Giorgio and Lucia. While in Trieste, Joyce returned to Ireland three times. After each visit he became more and more aware that if he were to develop as an artist he would have to remain an exile.

Life at this time was difficult because Joyce had to find ways to support his family. He worked at a bank for a while then gave English lessons at a Berlitz School. His roles as provider, husband, and father intruded upon Joyce's artistic development. In 1905 Joyce convinced his brother, Stanislaus, to move to Trieste. While there he took on many of the problems besetting the family, leaving James the time to write.

During the Trieste years Joyce began or continued work on a number of writing projects. Shortly after arriving in Trieste Joyce commenced writing stories for the book that would be called *Dubliners*. It would not be published until 1914. He also continued to write an autobiographical novel entitled *Stephen Hero*. This work would be reworked and given the title *A Portrait of the Artist as a Young Man*. This was published in 1916. Joyce also began writing *Ulysses*. It would be published in 1922.

In 1913, at the recommendation of Yeats, the American poet Ezra Pound contacted Joyce and offered him the opportunity to publish in American and British journals. Pound played a significant role in getting Joyce the exposure he needed. He published several of Joyce's stories from *Dubliners* and encouraged his contacts to promote Joyce. The ten years spent in Trieste were among the most productive years of Joyce's writing life. However, in July of 1914 Austria–Hungary declared war on Serbia, thus bringing on World War I. This made life in Trieste difficult and even dangerous, compelling Joyce and family to move to Zurich, Switzerland, leaving their books and furniture behind.

Zurich: 1915–1919

After arriving in Zurich the Joyces discovered that it was an expensive city and that they needed assistance. That assistance came from Yeats and Pound and two other benefactors, Harriet Shaw Weaver and Edith McCormick Rockefeller. Weaver would prove to be a great supporter to Joyce; she helped him both financially and intellectually for many years. Because of this financial help Joyce was able to devote most of his time to writing *Ulysses*, and was able to write a great deal of it during this time. The final installments of *A Portrait of the Artist as a Young Man* were published and Joyce attempted to have his play *Exiles* produced. This proved to be extremely difficult as there were legal and artistic battles at every turn. The play was performed only sporadically throughout Joyce's lifetime.

After the war the Joyces returned to Trieste for a year. The city had changed for the worse in Joyce's eyes. They moved in with James' brother Stanislaus and sister Eileen, along with her husband, two daughters, a babysitter, and a cook. In these less than ideal conditions Joyce continued to work on *Ulysses* and helped translate *Exiles* into Italian. After seven years of corresponding Joyce and Pound finally met face-to-face in June of 1920. During this meeting Joyce was persuaded by Pound to move to Paris where he would be able to get *Ulysses* published. The Joyces left for France in 1920.

Paris: 1920–1940

Joyce and family lived in Paris until 1939. Unlike their life in Trieste, Paris confronted the Joyces with numerous cultural experiences and the attention of the literati. Because of Pound's efforts Joyce was now seen as a celebrity of sorts.

Joyce was nearly finished writing *Ulysses* and began looking for a publisher. This proved to be very difficult as four chapters of the book that had been serialized in America were confiscated and deemed to be obscene by the US Post Office. A court case ensued bringing with it negative publicity. Potential publishers were scared off by this and Joyce doubted if the novel would ever be published. One of the most important contacts Joyce made in Paris was with Sylvia Beach, an American expatriate who owned the bookstore Shakespeare and Company. She agreed to publish *Ulysses*. Once Beach agreed to publish Joyce had to write the final three episodes and revise earlier ones. Joyce viewed the revision process as a part of the creative process. With earlier drafts and his notes, Joyce began to link themes, phrases, and words to give *Ulysses* an overall sense of coherence. Because of the speed with which Joyce had to make revisions the first edition of the book was filled with errors. *Ulysses* was published in February of 1922.

Ulysses received critical praise. However, British customs officials confiscated the book on charges that it was obscene so it was not allowed to be published in England. The first American edition of *Ulysses* was published in 1934 and the first British edition in 1937.

After the publication of *Ulysses* Joyce began to contemplate his next writing project. He began studying his unused notes for *Ulysses*. This is notable, as Joyce's novels seemed to develop or emerge from one another. In March of 1923 Joyce declared to Harriet Shaw Weaver that he had written two pages. These two pages represent the beginning of Joyce's last work: *Finnegans Wake*. It would take Joyce 16 years to complete the book. Two reasons it took such a long time to write were Joyce's worsening eye problems due to glaucoma, and his daughter Lucia's increasing mental instability. Three other very personal events occurred in 1931 and 1932. Joyce and Nora were officially married on 4 July 1931. The marriage took place so that in the event of Joyce's death his estate would be transferred to Nora and their children. On 29 December 1931 Joyce's father died. He did not attend the funeral and considered abandoning *Finnegans Wake*. On 15 February 1932 Joyce and Nora became grandparents to Giorgio's son, Stephen. Through all of this Joyce continued to work on his next project and would write and revise in outbursts of creativity. Joyce and his family moved from Paris and lived in Saint-Gérard-le-Puy in the south of France for a year. During this time, the stomach pains that had plagued Joyce became more severe. Doctors discovered that he had a duodenal ulcer. With the arrival of the Nazis, Joyce and family, except for Lucia, his daughter, left France and returned to Zurich. Joyce would never see Lucia again.

Zurich: 1940–1941

Once in Zurich Joyce's stomach condition worsened and it was decided that he should be operated on. He was conscious after the surgery but fell into a coma soon after. Joyce died of a perforated duodenum on 13 January 1941.

The Work

Joyce is best known for his four novels: *Dubliners*, *A Portrait of the Artist as a Young Man*, *Ulysses*, and *Finnegans Wake*. At the

time they were published these works stirred controversy and were deemed to be obscene by authorities. However, many others saw them as revolutionary and changing the form of the novel and ushering in modernism. *Ulysses* and *Finnegans Wake* are considered to be among the greatest novels ever written. Throughout his writing life Joyce encountered editors who insisted that some word or phrase be changed or deleted because they were confounded by what they had read or feared retribution for publishing obscenity. In each case Joyce refused; it was essential for him to keep his works as he wrote them, and he battled editors throughout his life.

Joyce as a modernist writer overturned traditional ways of writing and experimented with different narrative techniques and focused on the psychological lives of his characters. Joyce, along with other modernist writers, was able to reflect in their work the ever-changing realities of everyday life. The only way to do this effectively was to write very complicated works that reflected the complexities of real life; this is especially true of *Ulysses* and *Finnegans Wake*.

As one reads Joyce's works it is clear that although he lived in exile from Ireland for most of his life, he maintained intellectual ties with it, as all of his novels take place there, especially in Dublin. Another striking characteristic of Joyce's work is its increasing complexity. The early novels, *Dubliners* and *A Portrait of the Artist as a Young Man*, are accessible and are the most widely read works Joyce produced. The late novels, *Ulysses* and *Finnegans Wake*, are challenging to read as Joyce does his most daring experiments with language in these later works. Despite their differences from the longer works, Joyce's earlier, shorter works resemble the longer ones in their structures and themes. Joyce would reinterpret, revise, and reuse much of the material from his earlier writing in his later work. The transformation and increasing complexity of the themes and issues of the early novels in the later ones illustrates Joyce's incessant reading, writing, revising, and experiencing. This accumulation of material from different sources is called accretion. Joyce used all of the knowledge and material he had at his disposal in the writing of his novels.

Dubliners

With this collection of short-stories Joyce first experienced what would be a common reaction to his work, namely, that it was obscene. It took Joyce nearly ten years to get the book published. It was published on 15 June 1914. It is organized around four themes: childhood, adolescence, maturity, and public life.

Joyce did not originally intend for *Dubliners* to be a short-story collection. He had been asked by George Russell to write something about rural Irish life for the *Irish Homestead*. For this Joyce wrote *The Sisters*. Joyce wrote two more stories for the *Irish Homestead* before being told by Russell to stop. This was due to countless complaints of obscenity. When Joyce submitted the 15 stories of *Dubliners* for publication he doubled the length of *The Sisters* and made it a more complex story. The last story of the collection, *The Dead*, could be a novella on its own. In it Joyce repeats and recombines themes from the other stories in the collection. Many consider *The Dead* with its complexity the beginning of Joyce's transformation into a novelist.

This early work has features that will characterize all of Joyce's later novels: the allusive method and gnomons. The allusive method refers to the indirect presentation of an idea or fact through concrete symbols. Gnomons are missing pieces of information in a story that make it difficult to come to an interpretation of the action. The gaps produced by gnomons force readers to speculate about what might be happening or what some action might mean. Another characteristic found in *Dubliners* and reflects Joyce's realism is the technique of presenting multiple and overlapping conversations and points of view without a narrator to sort them out. This technique is used again in *Ulysses*. This may give the reader the very real sense of eavesdropping. Characters often use idiomatic words and utter incomplete sentences and it is up to the reader to render an interpretation.

A Portrait of the Artist as a Young Man

This second of Joyce's novels began as his autobiographical novel *Stephen Hero*. After much revision Joyce produced *Portrait*. It was serialized in *The Egoist* from 1914 to 1915; it was published as a book 29 December 1916.

The central character of this novel is Stephen Dedalus. In many ways Stephen is Joyce. This novel can be seen as an expression, through Stephen, of Joyce's views on Ireland, religion, aesthetics, and love. It also represents a move from an entirely realistic novel, such as *Dubliners*, to a focus on Stephen's psychological life. That is we see the world from Stephen's perspective and are privy to his artistic and personal struggles. *Portrait*, thus, falls into the categories of Bildungsroman (a novel of education that describes the psychological and spiritual development of the main character) and Künstlerroman (a novel in which a character seeks life experiences and artistic expression).

Ulysses

Joyce originally conceived *Ulysses* as a short story to appear in *Dubliners*; abandoning the idea of a short story, he considered it as a sequel to *Portrait*. Only after seven years had passed did Joyce commence writing it as a novel. It was published on 2 February 1922; Joyce's fortieth birthday. It is based and structured on Homer's *Odyssey* and represents one of the first examples of a modernist text. The action of the novel takes place on one day, 16 June 1904. This is perhaps the book most associated with Joyce and the one not likely to have been read by most people. It runs to 700 pages and displays a vast amount of knowledge and rhetorical styles. It is divided into 18 episodes; each episode representing a particular style of narrative and theme. The three main characters are Stephen Dedalus, from *Portrait*, Leopold Bloom, and Molly Bloom.

One of the most important narrative techniques Joyce used in *Ulysses* was the use of interior narration. This is unspoken material that is revealed in the thoughts or internal dialogue taking place in a character's head. Joyce presents interior narration in a realist way, meaning that the thoughts a character may be having are fragmented, incomplete, or random. Joyce does not explain them; it is up to the reader to figure out what a character's thoughts might mean. A related technique is

stream-of-consciousness. This is a form of narrative that reveals the conscious experiences of character. It is a way to lay open their inner lives. The use of these two techniques represents the beginnings of the modern novel. The novelist invites readers to explore the psychological worlds of characters, leaving it up to readers to figure out what a character is thinking and experiencing. Thus, the modernist novel is a work filled with a great deal of ambiguity.

Finnegans Wake

Joyce began writing *Finnegans Wake* in 1923. Until it was published in 1939 it was referred to as 'Work in Progress.' The actual title was known only to Joyce and Nora. This work represents Joyce's most radical exploration of narrative form and language. As with many of his other works how Joyce actually wrote this is still a mystery. There are those who view Joyce's method as being random; explaining that Joyce had a keen ear and would pick up an odd word overheard on the street or in a restaurant and jot it down in a notebook. He would even rely on his own conversations for material. This approach to writing is somewhat random. Others see Joyce's method of composition as being logical and mechanical. Joyce would consult and study a vast array of literary material. His knowledge of languages is best displayed by his use of portmanteau words. This is the blending of two or more words to form a new word; for example breakfast plus lunch is brunch. Given the length of time it took Joyce to write and the complexity and length of the book, there are others who argue that Joyce's method of composition was a mixture of these two. It is clear that Joyce did not work from beginning to end; rather, he composed and revised various sections at a time going back and forth between sections. This is referred to as a diachronic method of composition.

'Work in Progress' appeared in serial form as it was being written. It was not well received by many of Joyce's supporters who found it incomprehensible. Discouraged by the reception Joyce thought about handing the work over to Paul Stephens, another Irish writer. However, Joyce continued writing and produced a novel that revolutionized Western literature.

Influence

James Joyce is one of the greatest and most controversial writers of the twentieth century. His work still amazes and confounds many a reader. Joyce's feat transformed literature

from a clear and logical description of reality to an exploration of human consciousness and unconsciousness, of waking and sleeping. He redefined the relationship of both writers and readers to literary texts. Joyce's texts *Ulysses* and *Finnegans Wake* have less to do with representing reality than they have with the experience of language itself.

As we read Joyce's works from his earliest works to his last, we see a transition from a description of a reality to which most of us can relate to a reality disconnected from the world and tied to the unique consciousness experiences of Leopold and Molly Bloom in *Ulysses* and Humphrey Chimpden Earwicker and Anna Livia Plurabelle in *Finnegans Wake*. The inner lives of the characters become the focus. This shift from objective experience to subjective experience and focus on form and language would transform literature and influence writers to this day.

See also: Cognitive Style and Creativity; Creative Environments, Conditions, and Settings; Divergent Thinking; Substance Abuse and Creativity; Writing and Creativity.

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Relevant Website

<http://www.jamesjoyce.ie/> – The James Joyce Centre.

Jungian Theory

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Glossary

Analytical psychology A psychological science, developed by Carl Gustav Jung, that grew out of psychoanalysis and includes theory, research, and practice.

Archetypal image A representation, or motif, of an archetype that has infinite manifestations. The produced archetypal image gives a voice to the archetype itself and is commonly found in fairy tales, legends, religion, mythology, dreams, and art. Also referred to as a primordial image.

Archetypes Limitless instinctual forms, not yet ideas or representations, within the collective unconscious thought to be passed down through the ages and found in all cultures. Archetypes are not visible until an image is created.

Autonomous complex An emotionally charged part of the psyche that usually includes material from consciousness as well as the unconscious. Forms the connection between the personal and archetypal parts of a person. Autonomous complexes, which are many, include the creative complex.

Collective unconscious The second layer of the unconscious, preceding the personal unconscious, which

houses the archetypes (often used interchangeably with the concept of archetypes, defined above). Considered the reservoir of great art.

Individuation The cornerstone of Jung's theory of personality development. The process is life long and the goal, which is attainable only in stages and not in total, is to become whole, complete, and truly individual. Making great art is linked to this process.

Personal unconscious The first layer of the unconscious that stores traumatic memories, experiences, and ideas that are unique to the individual's past. This layer of the unconscious precedes the collective unconscious.

Symbol The greatest conceivable expression for an idea; the idea cannot be produced in a better way. Symbols can be recognizable connections to archetypes, but their actual meaning is unknown. Great art is truly symbolic.

Wholeness The ultimate form of expression of all parts of the personality to one's self, others, and nature. Being psychologically whole equates with health, and health equals creativity – the goal of individuation.

Carl Gustav Jung – The Man

Carl Gustav Jung was born on July 26, 1875, in Kesswil, Thurgovie, Switzerland (also spelled as Kesswil, Thurgau in other biographies). His family was economically poor. Jung's father, a doctor of philosophy, worked as a pastor in the Swiss Reform Church and was also an Oriental and classical scholar. His father was described as quite conventional in his religious beliefs, from which Jung later strayed. Kind, tolerant, reliable, and otherwise liberal were also reflective of his father. By some accounts, Jung believed his father was weak and unpowerful. On the other hand, Jung's mother was thought to be inconsistent and divided in her thoughts. She often contradicted herself. He seemed to identify with her in many ways, especially regarding his intensely complex inner world and that she seemed to have two strong parts of her personality that opposed one another. This opposition was part of Jung's experience of himself (and later a central part of his theory of personality.) When Jung was three years old, his mother was hospitalized for several months, probably due to problems in her marriage that continued throughout his youth. Over time, Jung developed mixed feelings for his mother. Jung was a highly sensitive, curious, and bright child who had several bouts of physical illness. He was acutely aware of his thoughts, feelings, and surroundings. Growing up in the country afforded him a great deal of pleasure and a place for exploration. He enjoyed the beauty of his homeland and was in a frequent state of discovery about the world around him.

The beauty and brightness he experienced was contrasted by several dark experiences that followed him for much of his life. The dark experiences included themes of death, religious activity, dreams, and fears. This duality serves as the cornerstone for much of his theoretical frame. Jung took playing quite seriously, and playing alone became a constant for Jung as he was an only child until the birth of his sister when Jung was nine years old (he had a brother who died two days after his birth, two years preceding the birth of Jung). He was quite interested in Eastern religion, mythology, and nature as a young boy. Being alone allowed him the space to ponder the many questions he had about life, especially religion. Some believe that the materialization of analytical psychology was his way of finding a replacement for religion. He did not have any companions that he trusted enough to share his meaningful ideas or questions, and thus he felt even further isolated.

School for Jung was wrought with ups and downs. At times he was strongly engaged and at other times he was disengaged. His interest varied depending on experiences he had with other students and his teachers, as well as their perception of him.

After much deliberation, Jung decided to attend medical school. He struggled with this decision because he originally wanted to study natural science or the humanities. His decision was largely based on practical matters of expenses and obtaining a reasonable income after college. Within the field of medicine he was inclined to choose surgery or internal medicine. Psychiatry, which became known to him late in his academic career, was his final choice. He found his university

experience exciting and challenging. In addition to medicine he was able to continue his study and exploration of theology, philosophy, and Eastern theories. After finishing school in 1900, Jung moved to Zurich, Switzerland, where he lived for the duration of his life. He began training at a psychiatric hospital in the city. For the first six months he lived in the hospital, immersing himself with psychiatric literature and learning firsthand what the experience was like. Here he became fascinated with the minds of patients with many disorders, including schizophrenia. Many of his theories originated from his work in the hospital. He became rather disillusioned by the way patients were treated and began to experiment with alternative therapies. This disillusionment led him to the work of Sigmund Freud. Jung published his first paper in 1902 and began lecturing at the university in 1905, meanwhile building a private practice in Zurich. In 1907 Jung met Freud. From the beginning, Jung was reluctant to embrace many of Freud's theories, yet conversely he was intrigued with Freud and his work. At times Freud and Jung worked closely. Jung was beginning to formulate more of his own theories and had trouble accepting key ideas in Freud's theories. Yet he found himself unable to disagree overtly with Freud as Freud saw him as a loyal protégé. The final break between the two men occurred with the publication of Jung's book on libido (psychic energy) in 1913. Jung's work was met with a great deal of judgment, and he was rejected by many of his friends and colleagues leaving him isolated once again. The next four years were wrought with a great deal of distress, mystery, and growth. Some reports indicate that Jung had a psychotic break, primarily because he was experiencing visions and emotional turmoil. Through these experiences he began to further understand the workings of his unconscious, which led him further along the path to the idea of the collective unconscious. He studied his dreams and fantasies, drew pictures of his visions, and began to create mandalas (circular drawings that become central to his theory of individuation). This creative and very dark period gave him the material to sort through and define for the rest of his life. He did not understand all that was occurring, only that it was significant, and later the meaning would be revealed. From 1918 to 1919 Jung came out of his so-called darkness. He attributed the change to ending a relationship with a woman who continued to believe his fantasies were that of art. He adamantly opposed this assertion. Some writers point to the curious nature of his insistence on this matter. For when he was a young boy he derived great pleasure, and felt successful, making art. The second factor that released him from his darkness was his understanding of the mandalas he created. Mandalas will be discussed later, but for the sake of his story, Jung found them to be a way of journaling his internal growth. Jung continued on this journey of understanding the psyche, especially that of the collective unconscious. He traveled throughout the world, which gave him greater evidence for his belief in the collective unconscious and the role of archetypes. Everywhere he visited he was able to see connections to the archetypal and mythical world. The common images existed despite cultural, language, or age barriers. Jung spent the majority of his life writing about these experiences as well as maintaining an esteemed clinical practice. Regarding Jung's family (which he rarely wrote about), he was married in 1903 and had five children. Jung's wife, Emma, also an analyst,

contributed to the work of analytic psychology and wrote several works. At the time of his death in 1961 he had 19 grandchildren. Most of his life, he had a great number of students and people who worked with him. He was frequently sought after and deeply respected by most accounts. He received many awards throughout the world. He has contributed enormously to the field of psychology and continues to have a great number of followers with Jungian analytic institutes worldwide.

Model of the Mind

As mentioned earlier, Jung's theory of the mind rests on the concept of opposites and opposite forces, which is important to be mindful of as his theory unfolds. This section provides an overview of several key concepts of Jungian psychology, including the ego, consciousness, personal unconscious, collective unconscious, individuation, and wholeness. Whenever possible, the implication to the creative process associated with the corresponding structure of the psyche will be made. Psyche, or psychic material, refers to the entirety of both conscious and unconscious psychological processes. The psyche is very complex and works to keep itself in balance.

The Conscious Mind

The conscious part of the mind has the primary job of sustaining the relationship with the ego. The ego is a complex (see the definition of *autonomous complex* in the glossary at the beginning of this article and a further description following the archetypes) that contains a great deal of continuity and identity. For psychic material to be conscious, the ego must be aware of the material. Conversely, when psychic material is unknown to the ego, it remains unconscious. Awareness in this case is not merely intellectual but rather intuitive, emotional, and with meaning. Further, consciousness is thought of as the opposite of the unconscious.

The Unconscious Mind

The unconscious is the second psychic structure to which Jung referred. Consciousness is the unconscious' opposite and houses information that is not accessible to the ego but may later be accessible. The unconscious is vast in size and fluid in movement. The relationship, or link, between consciousness and the unconscious is referred to as compensation. Compensation means balancing or adjusting. In this case, compensation comes into play when consciousness is too one-sided, leading the unconscious to try and reach a balance. The personal and the collective are the two substructures of the unconscious. Both substructures serve as a source of art, although in very different ways (which will soon be illustrated). First we take a closer look at the personal and the collective unconscious.

Personal unconscious

The personal unconscious, the first layer, is that part of the unconscious specific to the individual. Included in the personal unconscious are repressed memories (memories that have been pushed down into the unconscious without one's

control), ideas that are painful, and information without the strength, or the timing, to reach consciousness. Material in the personal unconscious was once conscious and may later be conscious again.

Collective unconscious

The collective unconscious, the second and deeper layer, is that part of the psyche that is shared by all people, in all cultures, throughout the ages. Jung believed that the collective unconscious is much more important than the personal unconscious because it is the seat of power, wholeness, and internal transformation. The collective unconscious holds dreams, visions, religious experiences, and myths.

He arrived at the idea of the collective unconscious through his knowledge of mythology, anthropology, religion, and art. The collective unconscious concept was further materialized from Jung's work with patients who were diagnosed with schizophrenia (importantly, the collective unconscious is found in everyone, not just in psychotic patients.) Furthermore, in his work he realized that images in people's dreams were not from their own personal experience, or life, but rather reminiscent of archaic symbols and images. He began to recognize these images in ancient works and religions that the patient who dreamed the material was not aware of. In many of Jung's original writings he unknowingly referred to the collective unconscious and the archetypes interchangeably. This confusion has led subsequent authors to speak of the collective unconscious and the archetypes together, not as separate structures.

Archetypes are universal structures in the collective unconscious that allow for the *potentiality* of ideas, but they are not ideas themselves. This point is often a source of confusion and the distinction is important to understand. Archetypes are known because of the archetypal image they represent in consciousness – in other words, how the archetypal images appear. The image is what gives proof of the existence of the archetype. You cannot see an archetype; you can see an archetypal *image*. Archetypes, and archetypal images, have a strong creative force along with many other qualities. Among the qualities present are that of favorability, emotion, number, intensity, and type. Archetypes are neither all bad nor all good. Rather, they simply exist, and understanding the importance of the structure is what is key. Intense emotion exudes from archetypal images. Experiences may be within the likeness of all human behavior, but the experiences that manifest within the category of archetypal are extraordinarily human. Going beyond the ordinary into the realm of the extraordinary, emotional response to an archetypal imagery is enthralling, bigger than life.

Because of the emotional magnitude of the archetypal image it acts as a communication device from the unconscious mind of the individual who produced the work, to the unconscious mind of the individual seeing or reading the work, through the symbolism inherent in the image. The communication is further enhanced by the image relating to mythological figures, or motifs, from ancestry. The manifestations of archetypal images change based on the current culture but are always linked to the past. When an archetypal image is seen or heard or read it evokes a great deal of emotion, power, and release. It is as though we are connected to our past and the *past of all mankind*.

Examples of archetypes

There are infinite numbers of archetypes and archetypal images. Some of the key archetypes that will be discussed are the anima and the animus, the shadow, the persona, and the self. Other archetypes are the mother, father, warrior, and wise old man, to name a few.

Unconscious archetypes of the opposite sex are referred to as the anima and animus, in Latin these words mean "the soul." The anima refers to a man's image of a woman; and animus refers to a woman's image of a man (which Jung viewed in traditional roles of the 19th century). The anima and animus are thought of as guides, primarily throughout the terrain of the unconscious creating a richer level of understanding of one's internal world. Another way of thinking about the anima and the animus is in their role of moderating between the conscious ego and the unconscious mind.

The anima was intensely studied by Jung as well as his followers. Less was written by Jung, and his followers, on the concept of the animus. The anima and animus are important for many reasons; especially in relation to the creative process. They are both portrayed continuously in fairy tales, myths, literature, film, and other art forms.

The shadow is another archetypal figure or image. The essence of the shadow is that part of everyone's personality that is disliked and incongruent with how one would like to be perceived. The part that harbors unacceptable feelings, thoughts, or wishes, distasteful impulses, and negative assessments of oneself. The shadow is actually the part of ourselves that we can only sometimes see and in varying degrees. Just as the sun creates shadows on all that catches its light, the shadow can be further thought of as the darker, uglier, and evil side of life (for example, violence, wars, and tragedy, as well as that part of the person who commits such crimes). Further, the shadow is the side of the personality that most people would wish to disown or pretend did not exist. The opposite, or counterpart, to the shadow is the ego. The shadow is often portrayed in movies, books, and art of all kinds.

Persona is the archetype Jung referred to as the mask that we *all* wear at times. The persona is thought of as the mediator between the ego and the outside world. The concept of the mask suggests that we respond to the expectations of society by presenting ourselves in a certain light, even though the persona is not our true or complete self. In extreme instances, the mask, or persona, is represented in the person who cannot leave his or her professional identity aside. For example, the lawyer is always arguing a point; the preacher is always wearing his or her religious garb and reading from the Bible. The true personality, or person, of the lawyer or preacher is unknown to the people in their lives. A common example is that most of us have different roles in society, such as brother, sister, daughter, son, student, date, employee, and so on. We show different sides of our personality as we relate to others in those varying roles. The self archetype is that of wholeness and completion.

The self further refers to the ability of the conscious and unconscious to work together in order for an individual to be free to be her or his true self. The integration of all parts of the psyche allows the individual to live in a creative and symbolic fashion – to be truly an individual. The self archetype is the representation of individuation, which will soon be discussed. Another concept often compared and contrasted to

archetypes is that of the complexes (referred to in the section on consciousness). Jung suggested that there are many complexes in the psyche; unlike the archetypes that number is finite. However, like the archetypes they are neither all bad nor all good; rather they are a part of the psyche to be understood. The autonomy of the complex is such because the conscious mind does not regulate or control the information. In other words, information comes and goes on its own. The autonomous complex operates when there is enough energy to move information from the unconscious to consciousness. Even though the information is conscious it is only perceived, not known. The creative complex is one of the autonomous complexes. The autonomous complex is the *living* part of the creative process, the part that takes on a life of its own (which will be discussed in detail).

Individuation

The following section provides an overview of the concept of individuation including the concept of wholeness, the integration of mandalas, and the production of active imagination. The process of individuation is key to understanding Jung's theory of creativity. Individuation further includes the integration of the conscious mind, the personal unconscious, and the collective unconscious.

The cornerstone of Jungian, or analytic, psychology is individuation. The *process* of individuation, likened to his description of the creative process, is the road of integration between parts of the self that are conflicted – again, the notion of opposites. Bringing into harmony the parts of the psyche, both conscious and unconscious, that are at odds is the goal. In addition to the internal work required for individuation is the external work of increasing one's individuality. Thus, individuation includes both internal and external movement. Full individuation can never be reached, instead Jung believed that it was best to approach it as a lifelong process. Importantly, not everyone chooses or is able to travel down the road of individuation.

The *purpose* of individuation is to bring about wholeness in the individual. Wholeness suggests that one is able to fulfill one's destiny and vocation. Wholeness allows the individual to be authentic in the world, thereby avoiding using only the persona, or the mask. Being aware of one's own internal reality is at issue, *not* getting rid of a part of the self that is disliked. Coming to terms with the darkness and the painful images in the unconscious is a necessary part of individuation. Also included in the process is greater awareness of the collective unconscious and the collective world around each individual, thus avoiding isolation. A sense of wholeness further encompasses the spiritual aspect of life.

Through the process of individuation, with the hope of reaching wholeness, is the production of images, archetypal images. These images allow psychic material from the unconscious to become conscious, in varying degrees, thereby freeing difficult material in the collective unconscious. In the case of the artist, moving further along the path of individuation with the production of art subsequently provides the viewer or reader of the art with a similar experience – that of individuation. One form in which individuation may be expressed is through the making of mandalas, which are a symbol of the

psyche's center, or the self. The self, an archetype, is reflective of both conscious and unconscious parts of the psyche. The creation of mandalas was for Jung a tremendous experience of integration within himself, of unconscious and conscious experience. The mandala is a circular drawing usually divided into fourths, or derivations of four or eight. Mandalas are actually used in the East as a form of meditation, although at the time Jung began making them he was not aware of this historical element. He considered this work to be in the realm of religion as opposed to art.

Others have considered the mandala to reside equally within the realm of art. The argument is that a work of art is also an integration of the inner world of the artist and the external world in which the artist lives – again, a representation of the unconscious and the conscious parts of a person. Another route to individuation is through active imagination, a fantasy activity primarily used by Jung with his patients and with himself. Introspection or meditation is at the center of the activity. Active imagination allows the individual to have a dialogue between consciousness and the unconscious. Jung was not certain if the unconscious rules over consciousness or if consciousness rules over the unconscious during active imagination. The important note is the interaction between the two structures of the psyche, the conscious and unconscious, lead to a greater sense of wholeness and individuation.

The form of active imagination can take various shapes such as painting, drawing, writing, and so on. The end result is not what is of primary importance but rather the interplay in the psyche of the creator and the creative process. He found that during active imagination, people were able to tap into their unique creative potential. He did not regard this act as making art per se, but rather engaging in their own process of creation.

Artistic Creation

This section provides an overview of Jung's conceptualization of the source and process of creativity, as well as his perception of the artist who creates. Jung was very cautious in his understanding and interpretation of artistic creativity, and he was primarily interested in literature, although he made references to all of the arts. He did not offer a complete theory of art primarily because he wrote on so many other topics, and because of his desire to resist overanalyzing art. As such, he was careful to identify the limits of his psychological study of art activity. In fact, he probably would not have touched the topic if he did not consider making art to be in the realm of psychology, which he did. In general, Jung believed that the process of creation has a feminine quality and the creative work is that of the "mothers," an archetype, within the collective unconscious. As previously stated, much of Jung's theory emphasizes the role of obtaining balance regarding the opposite poles within the individual. The making of art follows through with this idea. When the artist is out of balance psychically, the archetypal image rises to the surface to restore harmony in the individual and, in turn, society, thus keeping in line with the concept of individuation.

Jung made a distinction between the artist and the actual work of art. Artwork may provide inklings to the artist's life but

not reveal the unique qualities of the person who created it. Just as the artist's life may provide clues to understanding the work but not shed light on the meaning entirely, Jung felt strongly that psychology can never fully understand the causality of any work of art, largely because the creative urge originates in the unconscious. A reductionist approach to understanding art was contrary to Jung's position. (A reductionist approach to art is attempting to trace all the elements of a work of art to the artist's past.) He was in favor of experiencing a work of art (poetry, paintings, literature, etc.) on its own terms instead of looking for the psychological reasons, or causes, of art. Even though the material of the work can be linked, or traced, to the artist's past, this does not allow others to then understand the actual meaning of the work. In this way, Jung saw the artist as quite separate from her or his creative work. In other words, a work of art in some cases transcends the person and is thus a separate entity. Jung was primarily interested in this type of work, later referred to as type two, or visionary, work.

Types of Artwork

Work that transcends the artist and work that does not was further described by Jung in the following typology. He identified two types of art: one derived from the conscious mind and the second from the unconscious mind. The first type of art is controlled, conscious, and made with a specific intention. Jung later referred to this type of literature as psychological in nature. Psychological, in this case, refers to work that is derived from consciousness such as stories of love, family, crime, and society. These works are easily understood. Artwork of this type, whether literature or painting, is deliberate in that the artist knows exactly what he or she is intending to create. The artist and the creation are one; there are *no surprises*.

In contrast, the second type of art is unconscious, uncontrolled, and amazes the artist. The work produced takes on its own form and structure. Whereas the first type of literature is thought of as psychological, the second type is thought of as visionary. (Visionary does not exclude the psychological quality; rather it goes beyond the personal psychology into the suprapersonal realm). Visionary works are those that are unfamiliar, strange, gigantic, and superhuman. These works speak to the depths of the human psyche and the beginnings of our existence, holding ideas that transcend the words or images set forth. They are symbols of something unknown. Darkness surrounds them. Visionary works are primordial, or archetypal, experiences and not personal experiences. The origins of the creative process are the primordial experiences, but the mythological figures give the work conformation. The primordial images, or archetypal images, are too dark (e.g., demons, spirits). The mythical figures bring lightness to the dark by appearing less frightful or intense and thus bringing harmony to the imagery in a way that is digestible for the current times. These works are extremely important because they originate in the collective unconscious and bring a message for future generations. Positive or negative, the message is ultimately of value. The artist who produces the second type of work is astonished almost to the point of disbelief. In this experience the artist feels as if someone else has created the work. She or he must allow the process to

occur, but not at his or her control. The artist is the vehicle for which the creative process transcends. The artist and the creative process are separate; there are *always surprises*. A further distinction is made between the first and second type of artist. The distinction rests on the type of *activity* set forth by the artist. The first type of creative activity is thought to be introverted and sentimental.

Here, Jung borrowed from the work of Johann Schiller in his conceptualization of sentimental and naive. Intraverted refers to Jung's idea that the artist consciously shapes and controls the art work. On the other hand, the second type of creative activity is extraverted and naive. Extraverted refers to the idea that the artist allows the work to control him or her. In other words, the artist's unconscious takes over.

The action of the unconscious is thought to be the creative urge or impulse that may, in a sense, take over the person. The creative urge arises out of the psyche and is extremely powerful. At times, the urge is so strong that everyday life goes by the wayside in order to create. The creative urge is different for all people and varies depending on the type of work produced. The ability to *understand* both types of work is also different. The first type of work is intentional and comprehensible. The second type of work goes beyond our understanding to the same degree that occurred while the artist was in the process of creating it. The image, the poem, or the story can only be understood through intuition and always provides multiple meanings. However, within one piece of work there can be both types of expression. Further, the second type of art produces a symbol or symbols. A symbol is an expression of an idea that cannot yet be discussed or stated in another, clearer way.

The verbal expression is nonexistent. Works that are symbolic are difficult to understand and the meaning is not clear. They are challenging and stimulate the viewer or reader's thoughts and feelings. In contrast, the first type of creative work tends to be more appealing because it is complete, compared to the second type of work. Symbols are produced for the culture and the spirit, according to Jung. They are a product of the collective unconscious. They are based on intuition and are never planned. Symbols allow for society and the individual to move energy from the psyche into valuable accomplishments found in art and science, among other disciplines. Examples of symbolic, or visionary, art are found in the work of Paul Klee, Wassily Kandinsky, Carlo Carra, and Piet Mondrian. These artists were led by visionary images of their inner world that were indescribable.

The inner world is secretive, even to the artists themselves. These artists brought art making to a new level, that of the mystical and the spiritual, though not of a religious order. The manifestation of the spiritual and mystical visions were found in paintings, collages, and unusual figures made from stone, wood, metal, and glass. The tracing of these prominent artists reaches to the time of pagan religions. A very dark nature permeated and was pushed into the unconscious psyche of humankind. Pushing away the darkness created more ugliness and evilness manifested in the form of obsessions, addictions, and so on. Artwork of the beginning of the 20th century (e.g., Kandinsky, Klee, Carra, and Mondrian) brought about a positive resurgence of the primordial spirit in the form of archetypal images.

The *part* of the unconscious where art originates was important to Jung. He believed that art derived from one's personal unconscious was more a symptom of a problem or situation rather than a symbol manifested from one's collective unconscious. Conversely, art, great art, that is produced from the collective unconscious, or with archetypal images, has a tremendous effect on the viewer. Our own collective unconscious is stirred up through the form and shape of the artist's work. In this way, art continues to revitalize our connection to the past in a way that is understood by today's culture. Jung believed that this effect revealed the social significance of art and held the artist in high regard. Thus, the creative process is the artists' abilities to manifest archetypal images from the depths of their collective unconscious (which is essential for the process of individuation to take place).

In this way the creation of art is what Jung referred to as participation mystique, which is the mystique, or veil, of great art. This movement is in the realm of the collective unconscious. Asking an artist to explain his or her work is unnecessary (largely because great art is beyond explanation), and learning of her or his life is inconsequential and nonexplanatory to the creation. However, he did write the following brief summary about attributes of the artist.

The Artist

Jung saw the artist as an extraordinary human being, one that is granted the benefit and the tragedy of creative vision. Those who create only, or primarily, from their personal experiences are *not* of this lot. They are expressing a symptom of their experience, as referred to earlier. In contrast, artists who are producing great art must transcend the personal and move into the realm of the collective unconscious, thereby speaking to the mind and heart of humankind. Jung saw the artist as a medium for producing work that speaks for all. He or she does not have conscious control to create or not create but rather is propelled by the collective force to create. The artist does not have a choice.

Not only is the artist a creator but also a human being with wants and desires for everyday happiness and experiences. Jung saw the artist as wrought with conflict if these opposing forces – existence as a human being and as an artist – are not reconciled. Primarily the creator who does not acquiesce to the divine power of creativity that has been granted to him or her will be quite conflicted. The creative force is so strong that there is little energy to do much more in life, namely the simple pleasures of the average person. The artist is laced with a burdensome existence, often resulting in a selfish, helpless, infantile, egotistical way of being in the world.

The following analysis of Picasso serves as one, if not the only, analysis of visual art written by Jung.

Picasso

Jung reluctantly and briefly approached the subject of Picasso's artwork, and stayed close to the psychology of his art rather than critiquing his art from an aesthetic point of view. He did so looking chronologically at Picasso's work. Overall, Jung described Picasso's work as nonobjective art, originating from inside, or from his unconscious (earlier referred to as type two artwork). There were a few exceptions, as will be illustrated.

Again, work from consciousness, or outer experiences, produces images that are recognizable. The objects may be distorted but not to the degree that they are incomprehensible. Artwork created from the inside takes on a symbolic form, often producing works that are strange, unusual, and not understandable.

Jung viewed four periods of Picasso's work from the blue period to the post-Harlequin period. Picasso's blue period was described as objective, from consciousness. He then moved into a different period, which Jung described as moving into the unconscious, the inside. This period is very dark, characterizing the ugliness and evilness of life. Picasso's work then changed into another form and shape, that of the Harlequin, a tragic and ancient god – a very primitive image. The Harlequin image was disturbing to Jung. The period that followed was Picasso's unconscious attempt at conquering his internal conflict – that of opposing forces. The use of piercing, relentless color reflects the strength of the unconscious to handle conflicts of violence.

Summary

Carl Gustav Jung provided a wealth of information to the field of psychology and the process of creativity. From his early days he was ever present to the subtle nuances of the world in which he lived. He was keenly able to integrate his own experiences with those of people around him, from his biological family, to his clients, to his created family. From the beginning he was astonished, amazed, and excited by the duality of life – the secrets of a world of opposites. This dualism continued to plague and interest him for the duration of his life, and through his own experiences, both internal and external, he developed a complex theory of the human mind. Certainly his theory of the unconscious, with the division of the personal and the collective, was one of his greatest achievements. He has provided a legacy of imaginative, challenging, and intriguing ways of looking at oneself, especially in light of the creative process. In his work, Jung provided a theoretical structure of two types of art. The first type is conscious, controlled, and within the realm of the personal. The second type is without limits and truly the work of the collective unconscious, or the archetypes. The second type of art was the focus of Jung's interest because it is the work of the primordial. The images that arise from the collective unconscious are symbolic. Symbolic images are the magical images that the viewer relates to with great emotion although not really understanding why. It is through this process that Jung's theory of individuation comes into play, both for the artist and for the viewer or reader. Again, bringing into play archetypes in the collective unconscious, giving them a voice, and allowing others to experience the transcendence into their own collective unconscious is the stuff of great art.

Jung held great regard for the artist. He believed that the artist was chosen, that the artist did not choose to become a creative agent. The artist's life was wrought with conflict over the unbearable creative urge, on the one hand, and the desire to live an everyday life, on the other hand. Jung believed the artist was a true visionary.

In closing, Jung believed that the creative process was central to having a sense of wholeness within oneself. The sense of

wholeness provides the individual with an ability to be a true individual. The process of individuation is achieved through a number of different means with the end result, which is never wholly attainable, being that of an increased sense of self.

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Frida Kahlo 1907–1954

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Frida's Early Years

Magdalena Carmen Frieda Kahlo y Calderon was born on 6 July 1907, in Coyoacan, a suburb of Mexico City, now part of Mexico City proper. According to Hayden Herrera, her first biographer, Frida changed her birth date to 1910 when she entered high school in 1922; she wanted to be associated with the Mexican Revolution. With this, her first political statement of a connection to the people (*la raza*), Frida began to make an indelible mark as an artistic, political, and cultural icon.

Her father was born Carl Wilhelm Kahlo in Pforzheim, Germany. Though the family maintained their ancestry as Hungarian-Jewish, records state he was Lutheran German. Frida's father sailed to Mexico in 1891 when he was nineteen years old and changed his first name to the Spanish equivalent, Guillermo. He was known as one of Mexico City's foremost photographers.

Matilde Calderon y Gonzales, Frida's mother, was of mixed Spanish and indigenous Mexican ancestry and a devout Catholic. Guillermo and Matilde were married shortly after his first wife died during the birth of their second child. Their marriage was quite unhappy, yet they did have four daughters. Frida was the third. Her father was surrounded by women and Frida was his favorite child.

Frida was born and lived most of her life in Casa Azul (The Blue House), in Coyoacan with her parents and four sisters and two step-sisters from her father's first marriage. Casa Azul is currently the home to the Frida Kahlo Museum. Her parent's marriage was marred by the death of Guillermo's first wife and Matilde's grief over her lost son. The family's legacy was shrouded by death, and created a family dynamic that strongly influenced her development and creative process.

Frida had vastly different relationships with her parents. Frida's mother was still in deep grief over the loss of her baby son when Frida was conceived. Matilde may have suffered from postpartum depression and she was unable to breast-feed baby Frida. Soon after Frida's birth, her mother became pregnant with her sister Christina. This may have deepened her mother's depression and overwhelmed her. Frida felt unloved and abandoned by her mother and became competitive with Christina.

Matilde could seem cold, self-involved, distracted and by many accounts depressed. When a mother is depressed, the child is often left unattended physically and emotionally: this inadequate mothering can leave a child unable to metabolize her experiences. Fortunately, from an early age, Frida had her

art. She also had childhood's natural connection to imagination through play and the arts. Her fantasy and imagination allowed her to create the images she needed to metabolize these painful experiences.

Her life was interlaced with tragedy. Frida contracted polio at the age of six and her left leg was less developed. During this period, Frida had an imaginary friend who lived in the interior of the earth and was always available to her when she was alone in bed. Her friend was her opposite, who could dance, and did not limp. She poetically describes her friend in her diary. As an adult, this imaginary friend was transformed into a series of unprecedented self-portraits, a form of empathic mirroring, the most famous of which was 'The Two Fridas' (1939).

Fortunately, she had a positive and close relationship to her father. Guillermo Kahlo suffered from epilepsy and was a distant father: intellectual and introverted and solitary within his family, with the exception of Frida. Guillermo adored Frida and she, in turn idealized him, identifying with his creativity, intellect, and physical vulnerabilities. During her period of confinement with polio, he encouraged her to be physically active, to pursue art and education and overcome her disability, a style that would remain with her throughout her life.

Many scholars, including Emily Tobeck, assert that Frida's paintings and journals reveal evidence of incest with her father, emotional and/or literal. This hypothesis could provide an understanding on her later behavior: sexual acting out in adolescence; her marriage to an older man, Diego Rivera; and her numerous bisexual affairs. The surreal painting of 'What the Water Gave Us' (1938) and her poetic journal entries are interpreted as evidence of this. Enacted incest, emotional or literal, seemed to create a paradox, one of possible suffering and the other as a creative source.

As an adolescent identifying with her father, she often dressed as a male, portraying a sense of androgyny. She was her father's daughter and this had a mixture of consequences. Frida adopted her father's attitude towards her mother – devaluing and considering her mother stupid. Her father turned his attention toward Frida, and away from his wife. Frida was resented by her sisters and she could have later re-enacted these triangulated relationships with her love affairs. Yet she also had the world of men opened to her, especially as she pursued her education with her sharp wit and superior intelligence.

In 1922, Frida entered the National Preparatory School, which offered the best education in Mexico. It was also the center of post-revolutionary ideological and political ferment,

and the center of the search for a Mexican identity. In an attempt to promote an identity founded on Mexican culture, the school hired painters like Diego Rivera (Frida's future husband), Jose Clemente, and David Alfaro Siqueiros to decorate the walls of the school with murals of Mexican history and culture. The faculty consisted of the best Mexican scholars of the time. In the middle of this milieu, as one of 35 girls in a student body of 2000, considered the most intelligent students in Mexico, Frida stood out. She was a brilliant student who rarely studied and chose a premed course of study. An avid reader and a gifted writer, she worked on the school newspaper. Frida was part of a primarily male high spirited rebellious group called the Cachuchas. She was often the ringleader of pranks, especially toward the fat, flamboyant muralist, Diego Rivera. She would challenge him, especially in front of his wife, Lupe Marin. Frida came to watch Diego work so much that she enraged Lupe. She reportedly said she wanted to have a baby by him someday.

Frida had a boyfriend at the time, Alejandro Gomez Arias, an outspoken student leader and orator. Frida seemed attracted to politically outspoken men. Over their three-year relationship, Frida's letters to him trace her development from child to passionate young girl, and then to a long-suffering woman. While involved with Arias in high school, she was also said to have bisexual affairs with both students and teachers according to another biographer, Martha Zamora.

The Accident

There are particular moments that can change the course of one's life. Frida had such an experience at the age of eighteen. In September, 1925, on her way home from school with Alejandro, the bus she was riding collided with a trolley car. Frida sustained grave injuries, including a broken spinal column, broken collarbone, broken ribs, broken pelvis, 11 fractures in her right leg, a crushed and dislocated right foot and a dislocated shoulder. Worst of all, a broken handrail entered her left hip and came out through her vagina. Frida often joked it was in this accident she lost her virginity. She suffered her entire life from the physical wounds of this accident, especially around her fertility. During the accident, her clothes were torn from her body, the handrail impaled her, and a sign painter on the bus had a container of gold-leaf paint that spilled during the crash and covered her bloody body. Many passersby called her 'la bailarina, la bailarina,' the dancer. With the truly Mexican sense of the macabre, her body, in a dancer-like pose, was golden and bloody, thus symbolizing the relationship she would have with her body for the rest of her life. Alejandro found the terribly wounded Frida, pulled the rod out of her, and pleaded with the doctors to operate and not give up on her.

Frida spent a month encased in a full-body plaster cast that made her look like a mummy. She spent a year in bed recovering from these injuries. Told she would never walk again, Frida remained determined, and did regain her ability to walk, but lived the rest of her life in constant pain, and eventually had 35 surgeries, mostly on her back and right leg and foot. Frida, a Catholic, identifying with Jesus' horribly bloody death, called this accident her Calvary. She lived in constant suffering for next 29 years.

The prior health issues of polio and a possibly undiagnosed congenital spina bifida, a malformation that occurs when the lower spine does not close during fetal development, can lead to progressive trophic ulcers on the legs and feet, eventually causing Frida additional suffering. In her later years, she would have her foot amputated due to the long-term effects of the accident and these ulcers.

The family experienced a decline in upper middle-class status due to a decrease in Guillermo's photographic business after the revolution, combined with the huge financial burden of Frida's medical expenses. Frida felt guilty and powerless to help her family. She first began to paint more out of boredom, and then in an effort to develop a home-based income. Frida's mother helped her by ordering a special easel that allowed her to paint while lying on her back. Her father allowed her to use his special brushes and paints. The loyal family offered themselves as models. Frida painted everything, even her plaster-cast corsets and herself.

For Frida, the near-death accident seemed to collapse life into a liminal space in which all is stripped away and she had to search anew for meaning, purpose, and rebirth. Frida wrote to Alejandro that she was reborn by this accident, "as a mature, sad woman who life had lost its color." In one of her metaphoric utterances, she told him "death danced around my hospital bed at night." Abandoning the goal of a medical career, she was reborn and her true essence emerged as a colorful Mexican painter. Symbolically, the accident birthed her as an icon of the wounded, triumphant feminine that her art and life holds for many women today.

Self Portraits

Having an essentially captive model, Frida drew and painted herself: 55 of her 143 paintings are self-portraits, which are among her best-known works. At first, her pieces were gifts to her boyfriend and friends so they would not forget her. This seemed to have been her way of ensuring their interest and love for her. In the early self-portraits, she represented her face in a serene and impassive way. Frida appeared to be denying the overwhelming feelings of helplessness and despair she felt. As she had done earlier, when she fell ill with polio by creating an imaginary double, she attempted to convey a sense of invulnerability, strength, and transcendence over her body's limitations. Through her early attempts at this artistic empathic mirroring, she begins to start metabolizing the horror she has experienced as well as expressing her inquisitive, irreverent, and intellectual spirit.

Self-taught, these first pieces were stylistically European, influenced by Botticelli from the Italian Renaissance and Modigliani's elongated figures. When Frida became involved with Diego Rivera, she turned to a deliberately naïve and flattened form of Mexican folk art that he loved, and she ceased painting in an aristocrat Renaissance style. Now, she wore pleasant blouses, Mayan beads and colonial earrings, representing herself as a Mexican girl full of self-possessed spunk. Following Rivera's style, she depicted herself and other subjects in a more Gauguin or Henri Rousseau raw, native style. She painted bold colors to honor the flowering of postrevolutionary Mexico. Her attention to detail

showed a tender interchange between artist and model, and between artist and self. In both her early and middle styles, there is none of the emotional tension found in her later self-portraits.

During her travels with her husband, Frida's work began to show the tension of dualities which she believed were the foundation of life. In her painting 'Self-Portrait on the Border Line between Mexico and the United States' (1932), she shows us the paradox of then-current reality, living in the United States while longing for Mexico. We also see her political leanings and her sense of power and androgyny. Here seems to be a painting in a more Cubist style. As her work matured, she starkly painted her pain, creating sometimes shocking images of her numerous operations, painful miscarriages, and her troubled marriage to Diego Rivera, symbolically depicting her physical as well psychological wounds.

As her individuation process deepened, her art changed. Her paintings became replete with bright colors and indigenous Mexican imagery and culture, and her self-portraits increasingly reveal her cultural embrace. The thorns, in 'Self-portrait with Thorns' (1940), pierce her neck as her face is surrounded by nature. She starkly paints her suffering while embraced by Mother Earth in this piece, as she does in many of her later self-portraits.

Frida provokes us with her metamorphosis on her canvases. In 'Roots' (1943), she gives fertility to the earth. In the transformative 'Broken Columns' (1944), Frida is no longer lying down as she was in life, but is upright and gazing into a reality that is beyond the personal, into the very nature of existence, an archetypal reality. During this later period near the close of her life, her self-portraits took on a surrealist bent, reflected as well by her poetry found in her journals. Accidents are made into art, a metaphor for Frida's life. Color and images are fragmented, distorted, and reassembled.

In the pieces created in the 3 years before her death, Frida's physical suffering increased dramatically. Her internal terrain changed as did her self-portraits. She related more to the archetype of life as depicted in nature. Her self-portraits, her empathic mirroring, and her imaginary friend were now fruit, foliage, and animals, the archetypal source of life. As we can witness in the piece, 'Sun and Life' (1954), her paintings fill with life. On the shadow side, her paintings were said to be 'over-exuberant,' due to her addiction to pain medications. It can be said, however, they also reflect the intensity one can feel about life with the approach of death.

Frida painted her painful inner experience through realism, symbolism, and surrealism always laced with her indigenous Mexican culture. She never liked these labels and often said she painted her own reality. She used art to reveal her internal experience and to heal and find meaning in her life.

Her Marriage to Diego Rivera

Frida Kahlo and Diego Rivera's lives intersected in many ways even before they fell in love. Frida was a budding artist and politically active before her accident. She had a high school crush on Diego, and taunted him while he was painting a mural at her high school. She would call him fat and then run and hide to see his reaction.

After the accident, her friend, Tina Modotti, an Italian photographer, actress, and leftist activist, introduced her to the inner circle of Mexico City's art and political leaders, of which Diego Rivera was a member. Their lives wove into each other's again. After meeting him at party at which Diego shot the phonograph, Frida became attracted to his untamed and unpredictable manner, perhaps one that matched her own. Though a tiny woman, Frida's personality was large, loud, vibrant and extroverted and could match his personality, if not his size. Her compensatory style of defiance became stronger after the accident. She would hide her vulnerability and pain with a strident, loud, and adventuresome persona.

At the age of 21, she fell fully in love with Diego Rivera, who was also affiliated with the Communist Party. As she sought his counsel on her paintings, their relationship flowered. He admired her work and began to spend time in her home, Casa Azul. Her parents had mixed feelings about Rivera. Her father understood her opportunities to marry were limited as she had massive current and future medical debts. Guillermo was more in favor of the marriage and realized Diego could help Frida as an aspiring artist. Matilde did not like Diego. According to her, he was too old, too fat, and a communist. Matilde thought it would be a marriage 'between a dove and an elephant' and said he looked like a frog. Many of these stories were recorded in a dual biography of Frida and Diego by Isabel Alcantara and Sandra Egnolff.

Nothing could deter Frida. They were married on 21 August 1929. She borrowed her maid's clothes and dressed like a regional Tehuana woman. Her appearance was unconventional; she declined to remove her facial hair and was known for her unibrow, small mustache, and for her flamboyant Mexicana-styled clothes: long, colorful skirts, peasant-style embroidered blouses, large beaded jewelry, all of which became her style of dress till her death.

At first, Frida tried to be a traditional Mexican wife, bringing Diego lunch and painting like him. She ignored his infidelities, and hid her own with men and women. Years later, she painted this aspect of their relationship in, 'Diego and Frida on their Wedding Day' (1941), depicting herself as small and child-like in contrast to the larger-than-life painter. His wife was his most trusted artistic critic. Soul mates and lovers, theirs was a turbulent relationship. Twenty years her senior, with a demanding and successful career, Diego was repeatedly unfaithful to Frida, with one of the most hurtful encounters occurring between Diego and her sister, Christina. Diego may have had this affair to retaliate for Frida persuading Diego to return to Mexico from the United States, where he had been commissioned to paint a number of now-famous murals.

Our relationship with our parents can influence our choice of spouse. Perhaps Frida and Christina enacted the family secret through their competition, triangulation, and betrayal by the affair with Diego. After she learned of the affair, she chopped off her long hair, which Diego loved, in an act of defiance. Reflecting her sardonic humor, at the top of this painting, 'Self Portrait with Chopped Hair' (1940), are the words of a popular song: "Look, I used to love you, it was because of your hair, now you're pelona (bald or shorn), I don't love you any more." She also used the cutting of her hair as a symbol of her rage, attempting to sever her attachment to Diego. Her fury is palpable in her ugly men's clothes,

mutilated hair, and angry expression. Frida's femininity had been sacrificed at Diego's altar of infidelity. Yet Frida never entirely severed her relationship with her husband.

After this betrayal, she became more blatant about her affairs. The most famous was with Leon Trotsky in 1937. Diego and Frida divorced in 1939 and were remarried in 1940 while both had affairs simultaneously. Their passionate, stormy relationship survived these infidelities, her seriously dangerous miscarriages, their divorce, remarriage, and her faltering health.

Frida suffered tremendously with her inability to birth a child due to the accident. In many of her pieces about miscarriages and abortions (e.g. 'Henry Ford Hospital' and 'Caesarian Section' both in 1932), she depicts her inner horror of being unable to bear a child. Through her art, Frida transforms pain into beauty and truth and then penetrates into our inner loneliness, universally bridging our experiences with hers.

Diego and Frida's relationship was very complex. On one level, he offered an arena for the enactment of her relationship with her father: the adored child, the triangulation and later betrayal as well as the positive artistic mentoring of her father. She had a sense of the enormity of his influence on her as she would say she had two grave accidents in her life: the street car accident and Diego. This paradox symbolically gave her life, death, and rebirth.

Diego indirectly influenced her to abandon her early European style and adopt a more Mexican, retablo style. Initially, she absorbed his cultural embrace along with his political idealism. As her journey of individuation matured however, her culture, politics and sense of style increasingly reflected the deeper sense of her true self.

Diego was her muse and supporter artistically. In his autobiography, Rivera said that Frida's canvases revealed an unusual energy of expression, precise delineation, character, and true severity. They showed none of the tricks in the name of originality that usually mark the work of ambitious beginners. They convey a fundamental honesty and an artistic personality of their own. They communicated a vital sensuality, complemented by a merciless yet sensitive power of observation. It was obvious to him that this girl was an authentic artist. He often said she was a better painter than he was.

Diego and Frida were comrades and bound by their commitment to Communism as well as art. In several self-portraits, she holds Diego in mind and heart, 'Diego in My Thoughts' (1943). They seem to complete each other, which is clearly evidenced in 'Painting of Diego and Frida' (1944). From a different perspective, they may have found in each other what they longed for in themselves, and hold the paradox of the masculine and feminine; anima and animus in the other.

The Psychological, Cultural Political, and Archetypal Symbols in Frida's Creative Process

Death and Death Masks

Symbols of death are replete in Frida's art. They reveal psychological, ancestral, and cultural roots from her life. In a number of paintings of family, she paints both the living and dead members. The death of Guillermo's first wife and her baby brother greatly influenced the family dynamics and she unflinchingly painted this reality.

The Mexican culture's Day of the Dead appears throughout her paintings. In this mythos, one has a close relationship with the spirit world. The spirits return to be fed when the veil is lifted between life and death on November 2nd of each year. Mexican author Octavio Paz said Mexicans have no qualms about getting close and personal with death. In 'The Four Inhabitants of Mexico' (1938), the Day of the Dead Skeleton is primary along with the worker, the indigenous child and Aztec goddess. In self portrait, 'Girl with Death Mask' (1938) she paints herself as a little girl with a death mask, while at her feet is a monster's mask, a paradox of how life and death exist simultaneously for everyone. Her piece, 'The Dream' (1940), she lies under her canopy with the Day of the Dead skeleton reclining on top of the canopy. Her life, her dreams, and her art are full of the acceptance of death.

Symbols of Mother: Dead and Archetypal

Frida painted how she imagined her birth in 'My Birth' (1932) created after her own mother's death, where she illuminates the suffering she endured in her relationship with her mother. In this painting, the baby is birthing herself from a dead mother, alone and unaided. On the wall is an image of the Virgin of Sorrows pierced by thorns, bleeding and weeping. This image seems to hold birth and death simultaneously. The mother wears a death's shroud and the baby emerges with a face of anguish.

The collective mother in 'My Nurse and I' (1937) gives Frida the nurturance she needed. Frida was not nursed by her own personal mother, but is nursed by the great mother of Mexico, forced to find the Great Mother by digging deep within her culture. Frida started to create the goddess and the mother she longed for. However, the nurse in this painting looks austere and has a pre-Hispanic death mask instead of a human face. Nurturance and life are laced with death and suffering while the baby Frida appears insecurely held.

In Frida's art, there are many Aztec and Mexican symbols of gods and goddesses. Frida's art seemed guided by the Aztec goddess, Coatlique/Coatlicue (pronounced kwat-lee-kweh), the Mother of the Gods, the goddess of life, death, and rebirth, the Lady of the Skirt of Snakes. She is the Aztec goddess of death, dismemberment, and destruction as well as life. She was created in the image of the 'unknown,' the mystery created by the decorations of skulls, snakes, and lacerated hands. Coatlique is the archetypal symbol of death like the Hindu goddess Kali. With skeletons and hearts in her paintings, Frida found a way not to fear Coatlique but to embrace her, thus finding meaning beyond suffering. With the help of this cultural icon, Frida came to understand symbolic death culturally as well as personally.

Paradox of Culture and Politics

This goddess's influence is best seen in the paradox of the 'Two Fridas' (1939): The European and the Mexican Frida. She becomes her imaginary friend and companion again as the two Fridas hold each other hands. Frida is painting her psychic pain, her exposed and wounded heart. She holds the duality of existence: the observer and the observed. This was also a death and rebirth in her art: the death of the European feminine, and a rebirth as a Mexican icon. Frida's eventual transformation

from a personal into an archetypal image stems from her rebirth as Mexican feminine icon.

Her painting of political paradox was first evidenced in 'On the Border between the United States and Mexico' (1932). In her 1945 piece, 'Moses,' her most mural-like piece, she attempts to depict the paradox of fear: the fear, of life and the fear of death. This piece is interlaced with spiritual and political imagery. Later, Frida even more poignantly declaims capitalism's superficial values and praises Marxism as the cure for the world's ills in 'Marxism Will Give Health to the Sick' (1954). In this piece, Frida no longer needs her crutches as they fall away. Marx is touched by the peace dove, and the United States eagle is surrounded by a red atomic explosion. Frida valued three things in life: Diego, her art, and communism. Frida used her culture and political beliefs as universal symbols, which C. G. Jung, founder of analytic psychology, called archetypes. They laid a foundation for her becoming an icon, an archetype herself in flamboyant Mexican attire, and her vivid use of color in her paintings

Her Later Years

Throughout their marriage, Frida and Diego traveled a great deal, mostly to the United States. Diego loved the United States while Frida always longed for Mexico. During their marriage they lived in small apartments and in two major houses, Casa Azul and the San Angel, joined homes designed by the famous Mexican designer, Juan O'Gorman. They separated many times and were divorced and remarried. When they remarried in 1940, her later years, Frida lived in Casa Azul and Diego would reside with her frequently while still maintaining his O'Gorman home. Frida became more accepting of Diego's ways and attended to him as if he were her baby, which is best reflected in her painting, 'The Love Embrace of the Universe, the Earth, Me, Diego and Xolotl' (1949). In this piece, Frida cuddles a baby Diego while she is held by the Aztec goddess Xolotl.

With a history of heavy drinking and smoking, which complicated her consistently poor health, Frida deteriorated even more throughout 1941. She was exhausted, losing weight, depressed after her father's death and in constant, extreme pain. Medical procedures and all kinds of corsets to support her back became a way of life. Frida now became manipulative with her true ailments in an attempt to secure Diego's attention, especially when another woman was on the scene. Many of her operations were said to be elective.

In 1943, Frida began teaching and developed a following of students who came to be called Los Fridos. She was an unorthodox and respectful instructor. Her instructions would be to go out in the street and get acquainted with life so they could better understand how to paint it. She held court with her students at Casa Azul.

In these later years, Casa Azul changed from a happy gathering place for artists and important people traveling through Mexico, to a home of intense suffering visited only by a small group of friends. In 1946, Frida painted two pictures, 'The Little Deer,' and the 'Tree of Hope Stand Fas,' symbolizing her hope that the pain would cease from a new operation to be done in New York. However, she did not improve. She suffered from mood swings, from euphoria to

depression, even paranoia. Periodically she became violent, was drinking heavily and was increasingly dependent on her pain medication. She became obsessed with her ailments and eventually entered psychoanalysis. Psychiatrist, Simon Grimberg explored her analysis in his books on Frida's life and noted she was the first in Mexico to do so. In 1950, a bone graft failed miserably, and she spent nine months in the hospital, yet continued to paint. Frida began a diary in 1944 that chronicles her physical and emotional suffering in poetic verse and drawings. When Frida was forced to have her right leg amputated below the knee, she grew more despondent, writing in her diary and capturing her gallows humor momentarily with "Feet, why do I want them if I have wings to fly?"

Diego sponsored her second solo show, though it was only her first solo show in her homeland, in 1953. This project lifted her spirits, but all were unsure if Frida would be able to attend. Following her doctor's orders, she did not leave her bed: instead she had her bed, with her in it, loaded into a truck and was escorted by motorcycles to the gallery. There is a very famous photo of Frida in her canopied bed greeting guests. It was macabre and theatrical, and entirely her style.

In that last year, Frida painted very little with the exception of still life of fruit, like 'Viva la vida,' (Long live life) (1954) her last self-portrait. Some of her hospitalizations were suspected suicide attempts. Her last public appearance was at a political rally on a rainy day, and she subsequently developed bronchial pneumonia. According the death certificate, Frida died of a pulmonary embolism. However, her death might have been by suicide or an accidental overdose of drugs and alcohol.

In her last piece in her diary is sketched a black angel with the words "I hope for a happy exit and I hope never to come back." Diego felt his soul was cut in two; he lost his best friend and the most wonderful part of his life. Frida was laid to rest, dressed and bejeweled with braided hair, at the Palace of Fine Arts in Mexico City. Five hundred mourners walked behind her hearse on the next day to pay respects before her requested cremation. The Internationale was played, and then Diego gathered her ashes in a silk scarf and took her home to Casa Azul.

Recognition Today

Diego Rivera was the first to preserve Frida Kahlo's artistic memory. One year after her death Diego bequeathed her home, Casa Azul, to the Mexican nation as a museum. It contained her Tehuana dresses, jewelry, her painting utensils, her letters, diary, books, and most importantly, her art, the most intimate aspects of her life. In July, 1958, four years to the month after death, her home was opened to the public as the Frida Kahlo Museum. In death's silence, her home illustrates a life of art, color, and passion.

For many years, she was only recognized as Diego Rivera's wife. She was not recognized widely as the singular artist as she is now for decades, till the 1980s when the Neomexicanismo movement began, where the values of contemporary Mexican culture were finally recognized and prized. In the 1980s, Frida Kahlo became a household name in Mexico. In 1983, a Mexican movie about her was a huge success. The next year, Mexican government decreed Frida's art a national treasure. Hayden Herrera published her seminal biography on Frida, which

became a worldwide seller. Many other books about Frida surfaced after this. She became recognized as Mexico's greatest woman artist, and by many, as Mexico's greatest artist.

In 2001, she became the first Hispanic woman to be honored with a US postage stamp. A year later, the American film *Frida* was released, based on the Herrera book. In 2006, her self-portrait 'Roots' (1943) set a Latin American record when it was auctioned at (US) \$5.6 million.

Her greatest recognition is among women as a symbol of the wounded but triumphant feminine. She persevered against all odds: physical injury, psychological wounds, and a culture that did not value small, intimate easel paintings or women's art. Frida is also seen as a political heroine as she demonstrated with the example of her life her love for *la raza*, the people. For the ill, oppressed and grieving, her art, with its open revelation of pain, sorrow and distress, ironically offers hope and life.

Two small excerpts from her diary may serve as coda:

I had smiled nothing more. But clarity was in me and in the depth of my silence.
He followed me. Like my shadow, irrefragable and light.
In the night he wept a song. . . .
He followed me.
I ended up crying, forgotten in the entrance of the Parish church
Produced by silk shawl, which soaked up my tears

And:

Mine is a strange world
Of criminal silences
Of strangers' watchful eyes
Misreading the evil.
Darkness in the daytime . . .
Was it my fault?
I admit, my great guilt
As great as pain
It was an enormous exit
Which my love went through

See also: Art and Aesthetics; Women and Creativity.

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- <http://www.museofridakahlocasaazul.org/> – Frida Kahlo museum at Casa Azul.
- <http://www.fridakahlo.com/> – Resource for information on Frida Kahlo.
- http://en.wikipedia.org/wiki/Frida_Kahlo – Wikipedia biographic entry on Frida Kahlo.

Knowledge

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Glossary

Case-based/experiential knowledge structures A knowledge structure in which information is typically organized in terms of causes and goals.

Conceptual combination Combination or reorganization of unique and abstract features of concepts relevant to the problem.

Creative thought The generation of original, high-quality, and elegant solutions to novel, complex, and ill-defined problems.

Divergent thinking Generation of many different responses or perspectives to a problem, a process often used in creative problem solving.

Elegance An element of creativity that is indicated by flow, refinement, and focus in problem solutions.

Idea evaluation Evaluating and refining ideas relevant to problem solving.

Idea generation Developing and contextualizing ideas that may be valuable in problem solving.

Mental model A formal representation of a problem which influences thinking, actions one takes, and prediction of events.

Problem definition Establishing a clear perspective of what the exact problem is.

Schematic knowledge structures A knowledge structure in which information is organized in terms of underlying principles or key features that structure entities or events.

Introduction

The stereotypic view of creativity has held that knowledge, or expertise, typically inhibits creative thought. Underlying this view is an assumption that undue reliance on available knowledge would inhibit generation of the new ideas that have been found to be the hallmark of creativity. In recent years, however, it has become clear that creative thought is a form of performance involving the generation of original, high-quality, and elegant solutions to complex, novel, ill-defined problems. Although creative thinking, the generation of solutions to these problems, involves multiple processing operations, effective execution of all these processes, problem definition, information gathering, concept selection, conceptual combination, idea generation, idea evaluation, implementation planning, and monitoring, is held to depend on knowledge or expertise.

Accordingly, in the present effort we will examine the role of knowledge in creative thought. We will begin by examining what is meant by the terms knowledge and expertise. Subsequently, we will examine the available evidence pointing to the importance of knowledge and expertise in incidents of creative problem solving. We will then examine the critical operations involving knowledge in incidents of creative thought. Finally, we will examine how different types of knowledge influence creative problem solving and how people acquire the knowledge held to be required for creative problem solving.

Knowledge

Knowledge Structures

Knowledge may be defined as information bearing on an event stored in memory. Memory of information, and recall of this information from memory, has been shown to be related to many forms of problem solving including creative problem solving. The impact of information on problem solving arises

from the guidelines provided by this information for understanding the nature of the problem and generating viable problem solutions. Accordingly, mechanisms, such as accessibility of information in memory, working memory capacity, and salience of the information recalled *vis-à-vis* the problem at hand have all been shown to influence problem solving including the solutions provided to creative problems.

Knowledge, however, is not simply a matter of information retrieved from memory. Knowledge is typically held to involve a set of structures for organizing and storing the information contained in memory. Studies contrasting people who have more knowledge (experts), as opposed to less knowledge (novices), about a given domain indicate people typically store, and recall, knowledge based on relevant conceptual structures. Thus knowledge is held to be reflected not only in the amount of information available but also the structure applied to organize this information. Better organizing structures have been shown to facilitate the recall and application of information drawn from memory in incidents of problem solving including incidents of creative problem solving. Thus in problem solving people often recall concepts (e.g., birds) working with typical exemplars of this concept (e.g., robins) in generating problem solutions.

The importance of these organizing structures has two noteworthy implications for understanding the application of knowledge in incidents of creative problem solving. First, different types of information may be structured or organized in different ways. Schematic knowledge structures are typically organized in terms of underlying principle, or key features, that structure entities or events. Thus birds fly, have wings, and lay eggs. In contrast, experiential, or case-based, knowledge is typically organized in terms of causes and goals. For example, to get a raise on my job (a goal), I must work harder (a cause). These differences in organizing structures, in turn, imply that different types of knowledge being applied in creative problem solving may make different demands and may be applied in different ways.

Second, the organizing structures applied to different kinds of information are not necessarily constant across domains. Thus the key concepts involved in physics (e.g., forces, retention of energy) are not necessarily similar to the key concepts involved in psychology (e.g., rewards, affect). This point is of some importance because it implies that knowledge is a domain specific phenomenon. The principle of domain specificity, in turn, implies that knowledge acquired in one domain cannot be readily transferred to other domains.

Knowledge and Creativity

This thumbnail sketch of knowledge, and knowledge structures, in turn, broaches a fundamental question. More specifically, is there reason to suspect that knowledge contributes to creative thinking? Answers to this question are not necessarily straightforward. On the one hand, knowledge refers to known information. On the other hand, it has been found that in creative thinking people must work with and restructure this knowledge in such a way as to generate novel problem solutions. In fact, the available evidence points to the importance of knowledge as a basis for creative thought. Broadly speaking, four types of studies, (1) product, (2) experience, (3) group contrasts, and (4) psychometric, all point to the importance of knowledge in incidents of creative thought.

Creative thought involves the production of high value, original products. Accordingly, one way the influence of knowledge might be assessed is by examining the role of knowledge in the production of a creative product. In one study of creative products, the television comedy *All in the Family* was contrasted with a perspective British 'parent,' *Till Death Do Us Part*, and other American comedy series being aired at the same time. Content comparisons examined attributes such as controversy, idea refutation, and insults. The findings obtained indicated that in *Till Death Do Us Part*, extant knowledge provided a basis for development of the creative product, *All in the Family*, although *All in the Family* added new elements to extant knowledge such as a moral. Other work also indicates that transformations of extant knowledge are critical to the production of creative products in the arts such as Picasso's *Guernica*. Still other work indicates that knowledge transformations are also critical to creative achievement in the sciences.

Not only does the analysis of creative products stress the importance of knowledge, examination of how creative people develop over the course of their careers also points to the importance of knowledge. In a qualitative study of the Beatles as a creative enterprise, it was found that despite early mediocrity, the Beatles eventually produced creative products through continuous improvement and ongoing learning resulting in the acquisition of knowledge and expertise. Similarly, in a study of eminent achievers, people producing recognized creative products, it was found that extensive practice, practice contributing to the acquisition of knowledge, was critical to creative performance.

An alternative to examining creative products or gains in creativity with practice in a domain, is to contrast people who have more or less experience (experts versus novices) working in a domain under the assumption that greater experience will result in more knowledge. In one study along these lines,

professional knitwear designers (experts) were contrasted with student designers (novices). Think aloud observations were obtained as experts and novices worked on tapestry and rug designs. The findings obtained, following content coding, indicated that experts, as opposed to novices, were more likely to base designs on roles of the product. Notably, knowledge of product roles is typically acquired with experience working in a domain. Similarly, studies examining expert-novice differences in scientific reasoning have found that experts were more likely to produce creative products – often applying unique concepts, and approaches, in generating problem-solutions.

Still another way one might examine the influence of knowledge on creative thinking is by obtaining measures of knowledge. In one study along these lines, 110 army officers reviewed a list of 70 leadership tasks and then grouped these tasks into categories. These category sortings were then used to appraise knowledge structures bearing on leadership with knowledge structures being assessed for complexity, comprehensiveness, organization, use of principles, and theoretical accuracy. Additionally, study participants were asked to complete measures of intelligence and divergent thinking and they were asked to provide solutions to a military leadership problem calling for creative thought. It was found that knowledge structure attributes were related to production of creative problem solutions ($R=0.50$). More centrally, knowledge was found to contribute to divergent thinking ($\beta=0.27$) as well as both idea generation ($\beta=0.26$) and idea implementation ($\beta=0.14$) activities during creative problem solving. Thus expertise and knowledge appear to contribute to the execution of a number of critical activities involved in creative problem-solving – divergent as well as convergent thinking.

Taken as a whole, the studies examined above indicate that knowledge, or expertise, contributes to creative achievement and creative problem solving. The effects of knowledge, or expertise, on creativity, moreover, hold across methods. Thus stable effects are observed in studies examining product production, experience, expert versus novice comparisons, and direct measures of knowledge. Furthermore, the effects of knowledge on creative thought appear sizable. In the following section we will examine the mechanisms by which knowledge influences creative thinking.

Influences of Knowledge

Content

If it is granted that knowledge, or expertise, is critical to creative thinking a new question comes to fore, what aspects of the content of knowledge contribute to creative thought? Traditionally, it has been held that the availability of more diverse content will contribute to creative thinking. In recent years, however, it has become clear that the use of knowledge in creative thinking is more goal directed.

In a study along these lines 137 undergraduates produced solutions to two creative problems. One problem involved development of a new advertising campaign while the other involved a public policy management problem. Solutions to both these problems were scored for quality and originality. Participants were presented with a series of electronic cards presenting different types of information that might be used

in problem solving and the time spent encoding each type of information was recorded. It was found that people who produced creative problem solutions spent more time encoding information bearing on key facts and anomalies. Thus creative people appear to focus on critical factual information and incongruent information when generating problem-solutions.

Some support for the proposition has been provided in a more recent study in which participants generated solutions to a series of social innovation problems. It was assumed that the knowledge applied in solving social innovation problems was case-based or experiential knowledge. Prior to beginning work in solving these problems, participants were given training intended to help them identify critical causes (e.g., causes exerting large effects, causes exerting multiple effects). It was found that this training resulted in the production of higher quality and more original solutions to social innovation problems. Thus, again, it appears that a focus on key facts, in this study knowledge of critical causes, contributes to creative thinking.

In addition to critical facts, or critical causes, and anomalies, another aspect of knowledge content that appears critical to creative thinking are restrictions or constraints. It has been argued that multiple different types of constraints might be embedded in knowledge structures – goal constraints, source constraints, task constraints, and subject constraints. In a qualitative analysis of paintings produced by Max Beckman and Philip Guston, it was found that goal constraints which preclude routine solutions and promote novel solutions contributed to artistic creativity. Moreover, other constraints were embedded within these goal constraints. Thus creative people will rely on knowledge of constraints and restrictions in generating high quality and original problem solutions.

Another type of knowledge content that appears to be used by creative people are organizing concepts. In an analysis of how people solve insight problems, one type of creative problem, it was argued that a diverse and diffuse set of connections exist among various pieces of knowledge. Recognition of concepts that may be used to organize these diverse pieces of information gives rise to insight and thus the generation of creative problem solutions. Given the fact that knowledge structures are based on organization of discrete facts, it seems plausible to argue that creative people will expressly seek to identify and apply these organizing concepts in incidents of creative thought. These organizing concepts not only provide an efficient system for organizing the information embedded in knowledge structures, they may also provide an effective basis for adaptation and extension of extant knowledge.

Related to the concept of organizing structures, people may work with different types of information in relation to these organizing concepts. Information, or events, embedded under an organizing concept are referred to as exemplars. Exemplars of organizing concepts, however, differ in the degree to which they are typical or atypical of the concept at hand. Thus robins are typical birds while ostriches are atypical birds. In a study along these lines, undergraduates were presented with a series of conceptual combination problems where key concepts (e.g., birds, sporting equipment) were defined either by typical or atypical exemplars of the organizing concepts. Participants were asked to combine these concepts, label the concept, generate additional exemplars, and write a story involving this concept. Concept labels, exemplars produced, and stories

were scored for quality and originality. It was found that when people worked with atypical exemplars more creative products were obtained especially when relatively similar organizing concepts were presented. Thus creative people appear to use atypical exemplars or unusual bits of knowledge when generating problem solutions.

Our foregoing observations are noteworthy because they suggest that the knowledge employed by creative people is distinctly pragmatic, albeit openly pragmatic, in nature. This pragmatic origination is evident in the fact that creative people use key facts and causes, attend to restrictions, and apply organizing concepts. Their openness, albeit pragmatic openness, is evident in their use of anomalous observations and atypical exemplars. Thus creative people appear to rely on unusual knowledge elements applying these atypical elements to identify critical causes, restrictions, and organizing concepts. In fact, this patterning of knowledge content appears to underlie discovery of the Hepatitis B vaccine.

Operations

Of course, if one only had extant knowledge to work with it is difficult to see how creative people could generate novel problem solutions. Thus operations must be applied to knowledge to generate new knowledge and the production of novel problem solutions. Broadly speaking, three distinct operations appear to underlie people's use of knowledge in the generation of creative problem solutions. More specifically, these operations involve conceptual combination, elaboration and exploration, and contextualization.

Conceptual combination refers to the combination and reorganization of knowledge structures. With elaboration of these new concepts or conceptual relationships, new knowledge is created. This new knowledge, in turn, provides a basis for generation of the new ideas that are held to provide the basis for creative thinking.

In a study examining the operations involved in the combination and reorganization process, 155 undergraduates were presented with four examples of each of three conceptual categories. Participants were asked to combine these concepts to generate a new concept. They were then asked to generate exemplars of this new concept which were scored by judges for quality and originality. In the experimental conditions, participants were asked to search for typical features (e.g. birds have feathers) or atypical features (e.g. birds lay eggs), map typical or atypical features across categories, and then elaborate, or not elaborate, additional features of this new category. The findings obtained in this study indicated that feature search and mapping operations, along with elaboration, contributed to the production of higher quality, and more original, exemplars of the new concept.

A series of extensions of this study confirmed this basic set of operations and provided findings pointing to three critical extensions of this basic set of operations. In the first study, undergraduates were asked to solve a conceptual combination problem and list emergent features of this new concept. These new features were scored for emergence or originality. The findings indicated that new features emerged from conceptual combination with emergent features being observed more frequently when the material being worked with in conceptual

combination involved unique and anomalous elements. In the second study, individuals were asked to draw aliens. It was found that the alien drawings displayed more unique features when people were asked to think in an abstract fashion. In the third study, participants were asked to work on a conceptual combination problem where exemplar accessibility was manipulated through a pretask rating intervention. It was found that while primed exemplars were used more frequently, people, in conceptual combination, tended to rely on typical exemplars.

This series of studies is noteworthy for five reasons. First, it suggests that people rely on typical exemplars in conceptual combination. Second, use of abstract features leads to more effective conceptual combination efforts. In keeping with this proposition other studies have found that when people are asked to work with less closely related concepts in conceptual combination they often employ metaphors (e.g., birds fly and flight represents freedom). Third, more new concepts emerge when people work with atypical exemplars in conceptual combination. Fourth, the new features emerging from conceptual combination provide the new knowledge which promotes idea generation. Fifth, because emergent new features are ill-defined, creative thinking to generate new knowledge requires exploration or extensive elaboration of these emergent features.

What should be recognized in this regard, however, is that conceptual combination gives rise to the production of new knowledge, not necessarily new ideas. Thus people must explore the implications of new concepts emerging from conceptual combination. Put another way, idea generation requires knowledge about how to apply new concepts.

In a series of studies intended to test this proposition, people were presented with preinventive forms – for example, a triangle and a hooked stick. People were asked to combine these preinventive forms, or concepts, to construct a new form. Notably, when people were asked to think about the applications of these new forms more creative new tools were generated. This finding is important because it suggests that knowledge about applications may be important in incidents of creative thought especially when new knowledge arising from conceptual combination is to be used to generate new ideas. Thus creative thinking, at least in part, depends on real-world knowledge.

In addition to real-world knowledge, however, another form of knowledge may be involved in creative thought. People rarely generate a single idea. However, given the time and effort required for development and implementation of new ideas, it is clear that people must evaluate ideas. In keeping with this proposition, it has been found that idea evaluation skills are positively related to generation of creative problem solutions.

What should be recognized here, however, is that knowledge is also likely to play a role in idea evaluation. In a study examining the influence of knowledge in idea evaluation, 148 undergraduates were asked to assume the role of an advertising executive responsible for developing a new advertising campaign. The campaigns proposed were evaluated for quality, originality, and feasibility. Prior to starting work on these advertising campaigns, participants were presented with either high quality or high originality ideas. In appraising these ideas, and suggesting revision to these ideas, people were asked to apply either efficiency standards (e.g., short term gains) or innovation standards (e.g., business development). One set of

findings indicated that the use of compensatory approaches in idea evaluation, for example attempting to improve the quality of an original idea, contributed to the production of more creative advertising campaigns. By the same token, however, these findings also pointed to the importance of both knowledge of the idea and knowledge of the standards to be applied in idea appraisal and revision. Thus knowledge bearing on appraisal standards may prove critical to effective idea evaluation.

Types of Knowledge

Operations

Our foregoing observations bear on the role of knowledge as a general phenomenon in creative thought. However, it should also be recognized that multiple different types of knowledge structures exist which might be applied in creative thought. For example, creative thinking might be based on associational knowledge, conceptual or schematic knowledge, case-based or experiential knowledge, spatial knowledge, or mental models. These different types of knowledge structures contain different content and are organized on different bases. Thus case-based knowledge structures are highly complex with cases including information bearing on causes, goals, outcomes, actions, actors, and restrictions where cases are organized on the basis of typical cases plus commonly encountered exceptions. In contrast, conceptual or schematic knowledge structures are organized hierarchically with respect to basic principles where exemplars of these principles are graded in terms of typicality. Associational knowledge structures are organized in terms of network structures where relationships are established based on the frequency and salience of event pairings.

These differences in the content and organization of knowledge structures are noteworthy for two reasons. First, they suggest that different types of knowledge may be applied in addressing creative problems arising in different domains. Thus, it has been argued that case based knowledge is critical in solving social innovation problems. In contrast, it has been argued that mental models are critical in solving creative problems arising in science and engineering. Second, differences in the content and organizing structures applied to different types of knowledge structures imply that differences will be observed in how people work with knowledge in generating creative problem solutions.

In this regard a related study is noteworthy. In the study, 190 undergraduates were asked to assume the role of principal of a new experimental school and formulate a plan for directing this school. These plans were evaluated for quality, originality, and elegance by judges. Notably, a curriculum planning task was used because such problems can be solved using either schematic or case-based knowledge. Prior to developing these plans, participants were presented with either case summaries or key concepts, schema, drawn from the literature on cooperative learning techniques. Some participants were presented with schema, or principles, and were asked to apply conceptual combination operations – feature search, feature mapping, and elaboration. In contrast, other participants were presented with cases and were asked to apply a different set of operations in conceptual combination – analysis of critical case attributes, identification of case strengths and weaknesses, and forecasting.

The number of cases, or associated concepts, presented was also manipulated. It was found that application of both schematic and case-based operations in conceptual combination gave rise to production of higher quality, more original, and more elegant problem solutions. Notably, however, when more material was presented application of schematic knowledge resulted in production of more creative solutions. When, however, cases were presented, use of fewer cases, due to the complexity of case-based knowledge, resulted in the production of more creative solutions. Thus different types of knowledge structures imply different operations. And, the available knowledge is employed in different ways.

Content

These observations with regard to the effects of knowledge on the operations involved in creative thought broach another question. Is there reason to suspect that use of different types of knowledge would contribute to greater creativity? This issue has been addressed in a recent study.

In the study Hunter 247 undergraduates were asked to generate ideas for solving an educational creative problem-solving task and propose solutions to this problem. Problem solutions were appraised by judges for quality and originality while idea generation was appraised with respect to the number of ideas produced. Prior to generating ideas and problem solutions, participants were given a set of training interventions intended to encourage application of associational, schematic, or case-based knowledge along with various combinations of these knowledge structures. The obtained findings indicated that use of associational knowledge promoted idea generation. However, creative problem solutions were more likely to be observed when schematic or case-based knowledge was employed.

Thus it appears that different types of knowledge structures have different implications for the production of creative products – ideas versus problem solutions. Moreover, recent findings have indicated that use of associations, even when coupled with the use of schema or cases, tended to inhibit the production of creative problem solutions. Although these effects can be attributed to the diffuse, disorganized nature of associational knowledge, which inhibits production of problem solutions, they also suggest that a complex set of interactions may be observed when multiple different types of knowledge are applied in incidents of creative thought.

Acquiring Knowledge

Practice

Our foregoing observations indicate that creativity is strongly influenced by knowledge or expertise. However, the effects of knowledge on creative thought may be more complex than is commonly assumed. For example, the knowledge structures applied influence the operations involved in creative thought, and certain aspects of the content of a given knowledge structure appear particularly important to creative thought. Although further research is required to more fully delimit these relationships, these observations, nonetheless, broach a fundamental question. What actions can be taken to improve the application of knowledge in creative thinking?

Although different types of knowledge are acquired at different rates, associational knowledge is acquired quickly and automatically, while schematic knowledge is acquired slowly and with conscious analysis. One way knowledge is acquired is through practice on solving problems within a domain. Thus, recent studies have provided evidence indicating that creative thinking improves with practice in a domain. What should be recognized here, however, is that incidents of real-world creative achievement typically require substantial practice – 10 000 or more hours of practice on the kind of real-world problems where creative thinking is valued.

The need for extensive practice, however, appears to be linked to three key attributes of the nature of knowledge as it is applied in incidents of creative thought. First, as noted earlier creative thinking depends on the availability of well organized knowledge structures which are based on organizing concepts. However, the available evidence indicates that critical organizing concepts are acquired rather slowly, primarily as a function of contrasting successful and unsuccessful incidents of problem solving. This observation, in turn, implies that structured practice intended to provide critical organizing concepts is likely to prove especially useful in enhancing creative thinking.

Second, in most real-world incidents of creative problem-solving multiple knowledge structures will be involved. Thus people, in generating creative problem solutions, often apply associational knowledge, case-based, or experiential, knowledge, and mental models. Given the recent findings pointing to inhibitory interactions among certain knowledge structures, extensive practice may be required to offset these inhibitory interactions. In other words, extensive practice may allow for synchronous operation of multiple, potentially competing, knowledge structures.

Third, it is not only the content of knowledge structures that is of concern in creative thinking, the operations applied in working with this knowledge, procedural knowledge, are also important. In fact, a meta-analysis of creativity training programs found that training interventions intended to provide more effective procedures for working with knowledge in problem solving were particularly effective. By the same token when one considers the complex nature of creative thinking operations, and the complex nature of the relevant knowledge structures, it seems reasonable to expect that substantial practice will be required to promote creative thinking.

Of course, one way to minimize practice demands is through formal educational and training interventions. Education can provide core organizing concepts, it can provide schematic principles, and, through exercises, it can provide cases-based knowledge. Thus there is reason to suspect that education will contribute to knowledge acquisition and creative thought. In keeping with this proposition, one study administered creative thinking tests, measures of divergent thinking skills, to first, second, and third grade students. It was found that creative thinking improved with education, especially on verbal tasks. Thus education does appear to contribute to creativity in part by providing students with requisite knowledge structures.

In this regard, however, the nature and complexity of the knowledge structures involved in creative thought should be borne in mind. For example, while it is useful for educational systems to provide organizing concepts and key facts or critical causes, such interventions are only likely to prove of value in

enhancing creative thinking if anomalies are examined and atypical exemplars are provided. Moreover, educational interventions that provide students with experience in solving creative problems may also prove useful by providing students with case-based knowledge, procedural knowledge, and associational connections. Along similar lines, educational interventions that clearly articulate relevant mental models for understanding phenomena operating in a domain may prove useful.

Practice Conditions

In educational interventions, and practice, it is important to bear in mind a critical point. Passive practice is likely to prove of limited value in acquiring the knowledge structures required for creative thought. Thus in the analysis of the creative achievements of the Beatles, it was found that active practice induced by team work and competition was critical to the acquisition of requisite expertise. The importance of active practice suggests that identification of anomalies, constraints, organizing concepts, and typical *and* atypical exemplars is likely to be promoted through ongoing analysis of problems and the outcomes of problem solving efforts. This active analysis may be induced through a number of techniques – reflection on the strengths and weaknesses in performances, team competition exercises, or illustration of real-world consequences. Regardless of the specific techniques used to induce active practice, the value of these techniques will depend on whether the individual uses this experience as a basis for constructing viable knowledge structures.

In this regard, however, it is important to bear in mind a set of observations arising from a series of studies. In these studies a distinction is drawn between a deliberative and implementation mindset. In implementation, cognitive analysis does not occur as people simply focus on execution. In a deliberative mindset, however, analysis of strategies, approaches, and knowledge is more likely to occur. Because this deliberation is critical to the acquisition of stronger knowledge structures, it appears that active practice is likely to prove beneficial only if it is associated with deliberation. In fact, there is evidence indicating that deliberative mindsets do contribute to creative thinking at least when people are seeking to identify critical causes through the case-based knowledge applied on social innovation problems.

Conclusions

Taken as a whole, our foregoing observations lead to some straightforward conclusions. Perhaps the first, and most important, conclusion flowing from the present effort is that knowledge, or expertise, is critical to creative thought. However, the present effort makes another important point. The importance of knowledge in creative thought arises because it is through the combination and reorganization of extant knowledge that people become capable of generating the new knowledge structures that provide a basis for subsequent idea generation and idea evaluation. Thus knowledge provides the foundation for creative thinking.

Not only is knowledge important to creative thinking, but certain characteristics of these knowledge structures appear to promote creative thinking. Knowledge structures that stress key facts, or causes, anomalies, restrictions, and are based on both typical and atypical exemplars all appear to contribute to creative problem solving. More centrally, however, well organized knowledge structures appear critical to creativity.

Although certain key content of knowledge structures contribute to creative thought, the influence of knowledge on creativity appears far more complex than one might at first think. Knowledge is domain specific. Moreover, multiple alternative knowledge structures may be employed in creative thought within a domain, schematic, case-based, associational, spatial, and mental model knowledge structures, and these knowledge structures appear to interact in complex ways. To complicate matters further creative thinking in idea generation and idea evaluation also appears to depend on real-world knowledge bearing on potential applications of knowledge and the standards to be appraised in evaluating ideas. Finally, people must have skill in applying this knowledge through operations such as conceptual combination, if they are to generate creative problem solutions.

The complex, multi-faceted ways in which knowledge influences creative thinking has an important implication. Creativity in real-world settings will often require substantial practice. By the same token, understanding how knowledge influences creative thought makes it possible to formulate a viable set of educational interventions for enhancing creative thinking. For example, educational programs that stress organizing concepts, key facts, constraints, and anomalies will prove of value especially when they encourage active and deliberative practice. We hope that the present effort will lay the groundwork for future efforts intended to provide people with the kind of knowledge that provides the basis for creative thought.

See also: The Beatles; Metacognition.

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Hans Adolf Krebs 1900–1981

Biochemist

Discoverer of the urea cycle and the citric acid cycle

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HANS ADOLF KREBS was a German-born biochemist who settled in England after the Nazi takeover of Germany in 1933. Trained in medicine, Krebs learned in the laboratory of Otto Warburg the methods and style of biochemical research that he later pursued with great success. Two years after beginning independent research, Krebs discovered in Freiburg in 1932 the ornithine cycle of urea synthesis that marked him as a rising star in his field. In England he spent 2 years in the biochemical laboratory at Cambridge, then moved to the University of Sheffield, where he discovered in 1937 the cyclic reaction sequence of oxidative carbohydrate metabolism, later known as the "Krebs cycle," for which he was awarded a Nobel Prize in 1953. Together with numerous other publications on metabolic reactions, these two major landmarks made him by the beginning of World War II one of the leading architects of the emerging subfield of intermediary metabolism. In 1945 he became director of a Unit for Research in Cell Metabolism, later transferred from Sheffield to Oxford University, which became an international center for research and training in this field. Maintaining a steady scientific productivity for the remainder of his long life, Krebs continued to be a leader in his field for nearly 50 years.



Hans Adolf Krebs, Nobel Laureate in Physiology or Medicine, 1953. Copyright © The Nobel Foundation.

The second of three children of Georg Krebs, a highly regarded otolaryngologist in the picturesque Hanoverian town of Hildesheim, and of Alma Davidson Krebs, whose family had been established there for many generations, Hans grew up in a comfortable, well-ordered, but strictly disciplined family. Hans deeply admired his father, a widely cultured, witty, but somewhat aloof figure in his life, who regarded Hans as less talented than his mathematically gifted younger brother, Wolf. Educated in the classical tradition of the humanistic gymnasium, Hans did well in all his subjects, but did not excel in any single area. Without close friends

outside his family, he industriously pursued crafts such as bookbinding, read widely (especially in history), and practiced the piano assiduously, even though he recognized early his limited musical ability. Both of his parents were Jewish, but because his father believed in assimilation as the best course for German Jews, Hans was raised without any formal religion. When he was about fifteen, Hans Krebs decided that he would enter medicine, assuming that he would eventually join his father's practice. Drafted into the army during the last months of World War I, he was released after receiving a few weeks of basic training, and immediately began his medical education at the nearby University of Göttingen. Following a longstanding German custom, he attended several other universities, including Freiburg, Munich, and Berlin, to hear the lectures of outstanding teachers in each of the basic science and clinical fields. Inspired by the discussions of their own scientific or medical discoveries that some of these teachers included in their lectures, Krebs became interested in the possibility that he too might go into research. At Freiburg he had an opportunity to carry out a project on the vital staining of cells, which led to a publication under his own name and reinforced his ambition to do further laboratory work. In emulation of some of his teachers, he envisioned that he might combine a clinical career in internal medicine with research in problems related to that field. After receiving his M.D. from the University of Berlin in 1923, Krebs performed his mandatory year of clinical service at the Third Medical Clinic in Berlin. There he was able to undertake, nominally in collaboration with his supervising clinician, an experimental study concerning the passage of various dyes from the circulation into the cerebral spinal fluid of dogs. Essentially unaided, he designed, carried out, and published the results of these relatively simple but soundly conceived experiments. Krebs then spent 1 year in a special course designed to teach chemistry to medically trained investigators.

Through chance personal connections, Krebs had an unexpected opportunity, at the beginning of 1926, to enter the laboratory of the eminent biochemist Otto Warburg as a paid research assistant. Spending 4 years there, Krebs learned the precise experimental techniques that Warburg had devised to study cellular metabolism quantitatively. Using an improved version of a micromanometer employed by physiologists since the beginning of the century to measure the rates of oxygen consumption and carbon dioxide formation in tissues, Warburg had found that thin slices of tissue placed in a fluid medium approximating that of their physiological environment could survive for several hours, maintaining their normal rates of gaseous exchange. Warburg applied these methods mainly to investigate the catalytic properties of what he called the *Atmungsferment*, or respiratory enzyme, and to compare the

respiratory properties of cancer cells with those of normal tissue. While working on problems that Warburg assigned him, Krebs had the idea that these methods could be readily applied to study also the intermediary steps in the metabolic reaction sequences that connect foodstuffs with the final excretory products of organisms. One of his teachers at Freiburg, Franz Knoop, had impressed on him several years earlier that a central goal of biochemistry was to establish unbroken connections between the starting and end points of these reaction chains. Warburg did not permit Krebs to carry out such an independent project, but Krebs kept the idea in mind until he was able to begin research on his own. Then it became the guiding force in his early career.

Because Warburg informed him late in 1929 that he must leave his laboratory by the end of the following March, and then gave him little assistance in finding another job, Krebs concluded that his mentor did not consider him capable of a research career. Whether this was the case or only a subjective impression, Krebs did a “great deal of heart-searching” about the kind of career he could manage. His own doubts about his scientific competence were counterbalanced by his strong interest in continuing what he had learned to do under Warburg. In a department of medicine in a hospital that encouraged research, he thought, he might be able to try for a research career, even while obtaining the clinical training that would enable him to fall back on medical practice if he did not succeed as an investigator. With the help of an older clinical friend in Berlin, he found a position at a municipal hospital near Hamburg. There he had time, despite heavy clinical duties, to begin his own research projects. One year later he moved to Freiburg, in a department of medicine headed by Siegfried Thannhauser. Here, too, he had clinical responsibilities, but entered a university environment conducive to basic research, where he had also the company of other able young scientists. In Freiburg Krebs took up an investigation of the synthesis of urea, using the methods he had learned from Warburg, that led him within 9 months to his first major discovery—the ornithine cycle (see Fig. 1).

This auspicious success gave him a self-confidence that never again faltered. His research career thrived in Freiburg,

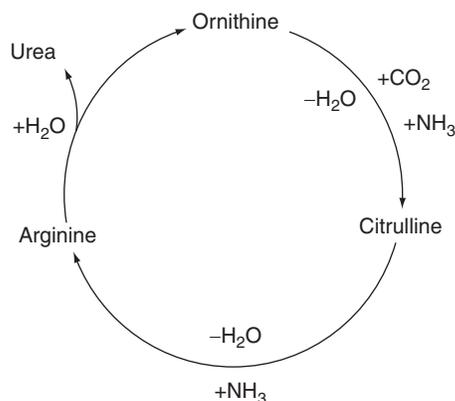


Figure 1 Ornithine cycle of urea synthesis. “The Discovery of the Ornithine Cycle of Urea Synthesis,” by H. A. Krebs, 1973, *Biochemical Education*, 1, p. 21. Copyright 1973, with permission from Elsevier Science.

where he soon began to attract a small group of young investigators, until it was abruptly interrupted by his dismissal, in April of 1933, under the terms of the Nazi Civil Service reform law that barred non-Aryans from university posts.

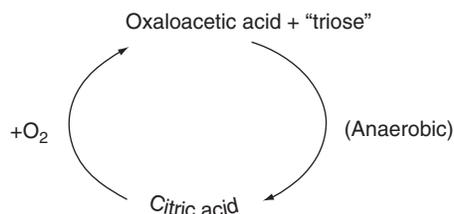
Invited by Frederick Gowland Hopkins to work in the biochemistry department at Cambridge, then one of the leading international centers of the field, Krebs was able to bring his manometers with him and quickly resumed his research where he had broken it off less than 3 months earlier. In England he did not reenter medicine. From then on he devoted himself tirelessly, 6 days a week, to his chosen science. After 2 years in Cambridge, he was offered a position as lecturer in the Department of Pharmacology at the University of Sheffield. Krebs left Cambridge for this much less prominent location largely because he anticipated that in Sheffield he would have sufficient laboratory space and other resources to begin to build a team of investigators. One year after settling there, he announced the discovery of the citric acid cycle (see Figs. 2 and 3). Many of the experiments were performed by his first graduate student, William Arthur Johnson. As Krebs’s reputation grew, students began to come also from other countries to learn the techniques and to benefit from the leadership that he was now exerting in the field of intermediary metabolism.

During the war, Krebs was able to maintain his metabolic research, but he participated also in war-related investigations of human nutritional requirements with conscientious objectors who volunteered to serve as subjects. At the end of the war the Medical Research Council selected Krebs as one of the promising scientists that it would support by establishing a research unit under his direction. The additional funding thus made available enabled him to expand his facilities to make accommodation for the increasing number of young scientists who gravitated to his laboratory.

Post-War Career

Much of the work that Krebs and his associates carried out in the postwar years involved further exploration of the scope and function of the citric acid, or Krebs cycle. It was now seen not only as the pathway of oxidative carbohydrate metabolism, but as the final common pathway for the degradation of all classes of foodstuffs, as well as the source of the carbon skeletons for many cell constituents. Beginning in the mid-1950s, Krebs turned his primary attention from the identification of metabolic reaction sequences to the regulation of their pathways.

In 1954 Krebs received an offer to become the professor of biochemistry at the University of Oxford. After negotiating to bring his Medical Research Council (MRC) unit with him, he accepted. At Oxford Krebs had responsibility, in addition, for the large existing department. Administrative duties and his efforts to introduce changes that would make it easier to attract and retain able scientists consumed much of his time, but he managed, with the support of his associates, to sustain his research productivity. Since the war, he had not personally performed experiments at the bench, but he kept in close daily contact with the students, technicians, and postdoctoral fellows who worked under his supervision. Unlike Warburg, Krebs also encouraged more experienced investigators to pursue relatively independent projects.



In this cycle "triose" reacts with oxaloacetic acid to form citric acid and in the further course of the cycle oxaloacetic acid is regenerated. The net effect of the cycle is the complete oxidation of "triose."

The conversion of citric into oxaloacetic acid passes through the following intermediate stages:

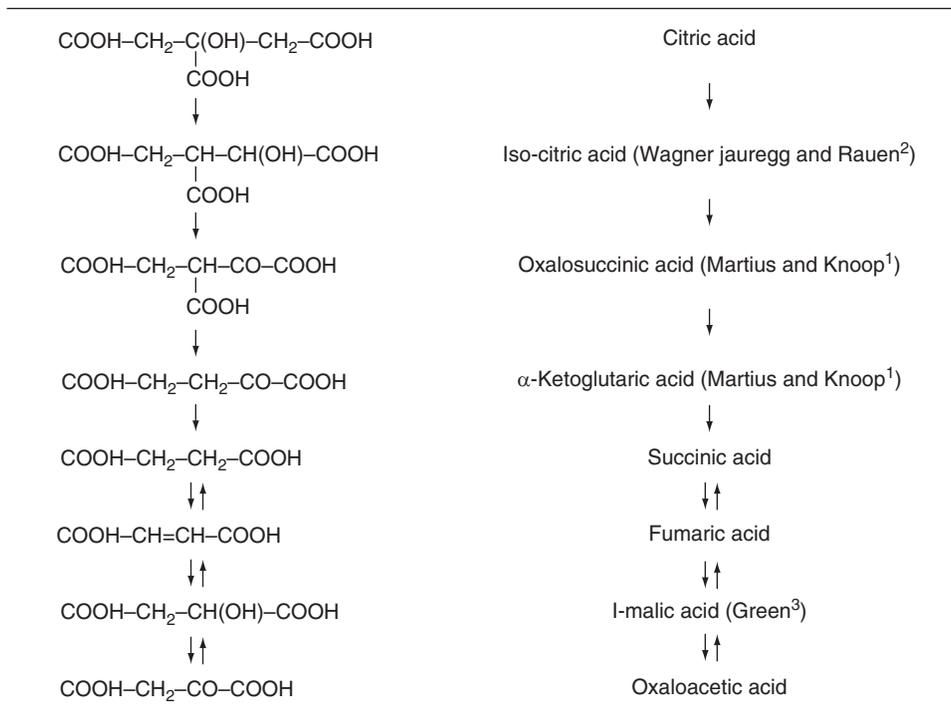


Figure 2 First schematic representations of Krebs cycle, redrawn from a sketch by Krebs in manuscript submitted to *Nature*, June 10, 1937. This paper was not published. A similar representation was published in 1937 in *Enzymologia*, vol. 4, pp. 153–154.

At the statutory retirement age of 67, it appeared that Krebs would be at last forced into research inactivity or else to leave England; but through the intercession of two prominent senior associates, he was able to obtain enough laboratory space at the Radcliffe Infirmary to continue, with the support of the MRC and a small core of his former research team. There he and his team followed the same lines of investigation that he had pursued for more than 30 years. Krebs stayed actively engaged in this work up until 2 weeks before his death, at the age of 81, in November 1981.

Patterns of Creative Activity

The general pattern of Hans Krebs's scientific activity displays characteristics that might appear at first sight disparate. Over the long trajectory of his career there were two peaks, attained during his first 7 years on his own, that tower over the field in

which he specialized. The first, the ornithine cycle, marked, in the opinion of the distinguished historian of biochemistry Joseph S. Fruton, the beginning of a new era in biochemistry. The second, the citric acid cycle was, according to the influential recent textbook of biochemistry of Alfred Lehninger, "the most important single discovery in the history of metabolic biochemistry." Together these two discoveries formed the basis for a more general conception of the metabolic cycle as a distinctive pattern of chemical reactions peculiar to life. To some observers, Krebs brought to the field a deep creative insight that has given shape to this area of biochemistry.

The research on which these contributions were immediately based took place within surprisingly short periods of time. From the beginning of his investigation of urea synthesis to the first publication announcing the outlines of the ornithine cycle, only 9 months elapsed. The broad problem of the oxidative metabolism of fats, carbohydrates, and several prominently identified intermediates occupied him

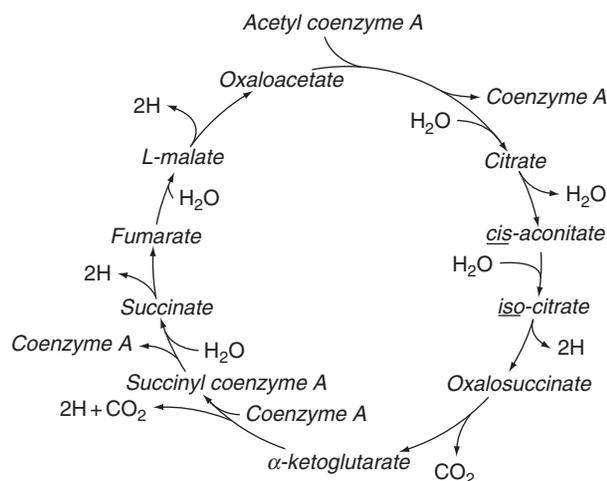


Figure 3 Krebs cycle as represented in *Energy Transformations in Living Matter* by H. A. Krebs and H. L. Kornberg, 1957, Berlin: Springer Verlag, p. 215. The cycle was at that time called the “tricarboxylic acid cycle,” rather than its original designation, “citric acid cycle,” because of doubts, later resolved, that citric acid itself lay on the main pathway.

intermittently for several years between 1933 and 1937. But after he obtained a crucial clue from a publication of Franz Knoop and Carl Martius in April 1937, it took Krebs less than 2 months to perform or direct the experiments and formulate the conclusions on which he based his proposal for the citric acid cycle.

These were not, however, isolated bursts of inspired activity. They were only highlights along a relentless course that Krebs pursued almost without interruption from the time he entered Warburg’s laboratory in 1926 until the end of his life. From Warburg he acquired the habit of performing two sets of manometric experiments daily, 6 days a week, 11 months of the year, year after year. In no year from 1925 onward did Krebs publish fewer than 15 papers on work he had either carried out or supervised. Along the way there were other significant discoveries, such as the synthesis of glutamine; some steps in the synthesis of uric acid; a modification of the citric acid cycle—the glyoxylic acid cycle—which replaces the former in certain microorganisms and plants; and in the later stages of his work, wide ranging explorations of the mechanisms that control metabolic pathways. There were also many papers that reported relatively minor refinements to the evidence for, or additional information on, the repertoire of problems with which he concerned himself.

An unbroken run of the laboratory notebooks in which Krebs kept the daily record of his experiments from the time of his entry into Warburg’s laboratory until beyond the publication of the Krebs cycle has survived. With these documents and from extensive interviews with Krebs during the last 5 years of his life, it has been possible to reconstruct his research pathway in fine detail through these years. The character of that pathway resolves the somewhat paradoxical contrast between the two summits of apparently extraordinarily creative activity that resulted in the two cycles that secured his fame, and the long stretches of strictly disciplined but

seemingly more ordinary activity that connect them and that followed them.

As with other great achievements in science, the powerful integrations provided by the ornithine and citric acid cycles obscured the earlier progress made in the areas in which these discoveries impinged. Later biochemists tended to equate the work of Krebs, along with a few other landmarks in the 1930s such as the Embden-Meyerhof pathway of glycolysis, with the origins of intermediary metabolism. Because previous knowledge seemed afterward rudimentary and fragmentary, the new discoveries appeared to have fewer precedents than they actually had. It is true that, except for the sequence of fatty acid decomposition reactions, known as β -oxidations, proposed by Knoop in 1904, no extended sequences of metabolic reactions were firmly established before 1930. There had, however, been extensive investigations of these problems beginning at the turn of the century. By the time Krebs entered the field, a series of organic compounds, such as pyruvic acid, acetic acid, and several dicarboxylic acids, had been identified as important intermediates; certain types of reactions, such as dehydrogenation, hydrolysis and decarboxylation had been supposed to occur repeatedly in metabolic reactions; and strong rules for the criteria that a potential intermediate must meet were accepted in the field. Although the pathways along which foodstuffs are degraded to end products had initially been assumed to be linear, by 1930 there was reason to expect that they would be interconnected and branching. There had even been a closed circuit of reactions proposed during the 1920s to account for the oxidation of carbohydrates and fatty acids that received prominent attention. Some of its constituent reactions had been shown to take place enzymatically, whereas one critical step eluded efforts to confirm it.

Krebs came to these problems armed with the methods of Warburg, which enabled him to subject such proposed reaction sequences to critical, quantitatively rigorous scrutiny. His own training in organic chemistry was, on the other hand, too limited to allow him to reason as deeply as some of his contemporaries about possible reaction mechanisms. Consequently, he developed a style of research in which he kept closely in touch with current and recent literature in the field, seeking ideas that he could test in his experimental system.

The characteristics of his system—that he could perform many experiments quickly, with precise results that either encouraged or ruled out a given hypothesis—proved admirably suited to this style. Not given to long-range planning, he decided each evening what experiments to carry out the next day. When he became bogged down in one problem he quickly shifted to another.

Such an approach can easily lead to nothing more than the verification of existing views or the closing down of one possible lead after another. One can find many stretches along Krebs’s investigative pathway that appear to be heading toward nothing very exciting or original. His style and methods were, however, well suited to notice something unexpected and to exploit with flexibility every hopeful lead. In the case of the ornithine cycle, it was his response to the unexpectedly large increase in the quantity of urea formed in a liver tissue slice when he added a combination of ornithine and ammonia to the medium that turned a routine investigation into a major discovery. In the case of the citric acid cycle, there was no single result so dramatically unforeseen, but there was a flexible

approach in which his ideas were fluid, and fluctuating, and he tested a large number of current ideas before hitting on the fruitful ones that brought him quickly to a historic resolution of one of the central problems in his field. Neither the ornithine cycle nor the citric acid cycle were revolutionary in the sense of breaking with existing norms, overthrowing current views, or introducing dramatically novel principles. They represented, in fact, the fulfillment of quests on which Krebs's predecessors and contemporaries were already engaged. He had not brought a new perspective or profound original insights to the field, but he had persevered, with a powerful method, great discipline, and commitment, further along the same general pathway that others had followed and were following. His creativity was not of the type that ranges far ahead of his times in lonely ventures. Rather, it resided in the quality of his responses to what turned up along his route. His optimistic temperament enabled him to keep going when nothing did seem to turn up, to try out many ideas without worrying about those that failed, and to exploit with great resourcefulness the breaks that came his way.

The peaks in Krebs's research career are, however, far less than a full measure of his creative achievement. Too often scientific progress is measured only in prominent discoveries, especially in those for which Nobel Prizes are bestowed. The most remarkable aspect of Krebs's scientific pathway is the persistence with which he pursued, for half a century, a set of problems largely delineated within the first decade of his independent research, and the fact that over so long a time these problems never ceased to yield for him and his associates fresh increments of knowledge and understanding. No one did more over this whole period to shape the complex picture that we can see summarized in the intricate metabolic maps that frequently adorn textbooks of biochemistry or walls of biochemical laboratories.

Lifetime Productivity

Dean Keith Simonton and others have recently focused attention on the lifetime contours of scientific creativity and productivity. Simonton has shown that there are characteristic curves of productivity as functions of creative potential and of the length of time in which one has pursued a particular field of creative activity. It is interesting to examine Krebs's life work within such a general analytical framework. Even without subjecting his output of publications to mathematical analysis, it is easy to see that Krebs's early productivity conforms in a general way with Simonton's curves. There is a rapidly rising output during the first 5 years and a further rise in the next decade. The "best work," the appearance of the Krebs cycle, comes at age 37, after 12 years of research activity, well within the ranges indicated by Simonton for the type of field within which Krebs worked. The most striking anomaly from the perspective of Simonton's analysis is that, whereas his curves predict a gradual decline in productivity from the point of best work to "last work," Krebs not only maintained but increased his productivity during that long phase of his career. Two dips in his output, between 1940 and 1945, and between 1955 and 1960, can be attributed, respectively, to wartime conditions and to the diversions

attendant on his move to Oxford. Between the age of 60 and 65 he produced, or closely supervised, 33 papers, compared to 30 during the 5-year period in which he produced the citric acid cycle. After his official retirement, he produced at an even higher rate: 55 papers between 1965 and 1970, and 46 papers during the next 5 years. As his former associates and biographers, Hans Kornberg and Derek Williamson, have pointed out, the 100 papers published between his retirement and his death represent "a significant contribution to the field of physiological biochemistry. ... Impressive is the range of subjects studied. ... Here was no eminent retired scientist ploughing a well-trodden path but an active brain seeking the answers to new questions."

How did Krebs evade the more standard trajectory of declining productivity? His own answer would be that he avoided the temptations that befall most eminent senior scientists to divert their energies in other directions. Although, like other Nobel laureates, Krebs too responded to some of the demands made on him by that accolade, he refused to allow himself to be drawn away from his laboratory. All the way until the final illness that preempted the last few days of his life, Krebs continued to show up at his laboratory every morning at the same early hour, just as he had been required to do in the laboratory of Otto Warburg as a young apprentice. Although he eventually allowed his associates to work a 5-day week, he himself was still at the time of his 80th birthday putting in an additional half day at his laboratory on Saturday. His mentor Otto Warburg had also worked regularly in his laboratory until the end of a long life, but Warburg had ended in isolation, pursuing old ideas and prejudices that were no longer acceptable to his younger colleagues.

How did Krebs keep himself in closer step with changing times? Unlike Warburg, Krebs tempered his selfassurance with sufficient humility to realize that his ideas required control by the criticism of others. Impatient as he was with criticism that he considered ill founded or superficial, he nevertheless recognized also that he could only remain competent to carry on scientific research by keeping in touch with the views and the advice of the many colleagues to whom his distinction gained him access.

Long after he had discovered the ornithine and citric acid cycles, Krebs pondered over their meaning and over the question why organisms utilized such complicated pathways when shorter, linear reaction chains might appear to yield chemically equivalent results. During his 80th year, a chemist, Jack Baldwin, suggested to him that one reason for the necessity of a cyclic pathway for the final stage of oxidative metabolism was that acetic acid cannot be dehydrogenated without first combining with another molecule. That idea started Krebs on a quest to understand not only the citric acid cycle but other metabolic pathways, on the assumption that they could survive in evolutionary competition only if they provided the most efficient means available to perform their particular metabolic functions. At two symposiums held that year in honor of his 80th birthday, Krebs invoked these ideas to illustrate why he felt the deep satisfaction that he derived "from creative work" still far outweighed the pleasures that he might receive from the leisure time that he would gain if he were to retire. Krebs enjoyed his preferred form of satisfaction to the end of his life.

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Akira Kurosawa 1910–1998

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Glossary

Group artistic creativity The efforts of many resulting in a single creative product.

Literary adaptation Literary adaptation is the adaption of a literary source (e.g., a novel, short story, poem) to another genre or medium, such as a film.

Rashomon effect The Rashomon effect is the effect of the subjectivity of perception on recollection, by which observers of an event are able to produce substantially different but equally plausible accounts of it.

World cinema Films and film industries of non-English-speaking countries.

Akira Kurosawa was born on 23 March 1910, in a suburb of Tokyo, the youngest of three older brothers and three sisters. His father, Isamu Kurosawa, had a moderate military career before Akira's birth, and in his later years worked as an athletic director at a junior high school affiliated with the Japanese military. Though his father was steeped in Japan's traditional family and military values of the day, he nevertheless believed in the benefits of Western culture. Indeed, he ensured Akira was exposed to American and European movies, even as the Japanese government gradually introduced restrictions on these imports. Kurosawa later credited his early interest in film to his father's influence.

Kurosawa identifies his first important creative influence as Seiji Tachikawa, an art teacher at the primary school he attended. Tachikawa taught Kurosawa that creativity stems from creating something new, not copying something that already exists. This broke with traditional forms of art education of the day that emphasized mastering and flawlessly duplicating the techniques of others. In 1927, about the time he completed middle school, Kurosawa enrolled in the Doshusha School of Western Painting and intending to embark on a career as a painter. He had early initial success, placing two paintings in exhibitions, but found it difficult to support himself through his art. Nonetheless, this early training in art brought a powerful sensibility to Kurosawa's films once he began directing, giving him a keen appreciation of the visual and emotional impact generous space can have around whatever objects are in the frame – a use of space deeply embedded in traditional Japanese art. During this period Kurosawa also started to explore Western literature. His main vehicle for this was as a member of the Japan Proletariat Artists' Group. His participation in the group was less about Marxist theory than about expressing personal resistance to the increasingly conservative and militarist Japan of that era. Though this group Kurosawa encountered the works of Tolstoy, Turgenev, and Dostoevsky, with Dostoevsky remaining an important influence, eventually resulting in his film adaptation of *The Idiot* (*Hakuchi*) in 1951.

Kurosawa was particularly close to his older brother Heigo, who was the brother closest to him in age. Heigo made his living as a *benshi* (narrator of silent films) whose speciality was foreign films. He would regularly bring Akira with him to the theater, to Japanese vaudeville, and to films, widening his younger brother's appreciation of performance and cinematic art. Heigo's relationship with their father was fraught with

tension and disapproval, with Akira often finding himself in the irresolvable middle. When sound came to movies in Japan, Heigo found it increasingly difficult to find work. He committed suicide in 1933, at the age of 27, for reasons that have never been entirely clear. But what is clear is that Kurosawa credited Heigo as a major influence in his life, and his death as a loss from which he never quite fully recovered.

In 1936, Kurosawa joined P.C.L. Studios (which evolved into Toho Studios) as an assistant director trainee. The successful applicant out of 500, he gradually advanced up the Toho production ladder, mentored and tutored by the director Kajirō Yamamoto. By 1941 Kurosawa had moved from support roles as a third assistant director and a first assistant director, to directing the second unit Yamamoto's 1941 film *Uma* (English title, *Horses*). Kurosawa's solo directorial debut was in 1943 with *Sugata Sanshirō*, based on a novel by judo master Tsuneo Tomita. The theme was the spiritual and athletic development of a student by the master, into a skilled martial artist. The film did well at the box office in wartime Japan, and while not explicitly political, fitted in well with the tenor of the times. Politics aside, it was the innovative balletic action sequences that caught the attention of other film makers and the public, and laid the early groundwork for martial arts action sequences by generations of subsequent film directors in the United States, Europe, and Asia, from 'Crouching Tiger, Hidden Dragon' to 'The Matrix.'

Concerning his work during the war, Kurosawa pointed out that, like most of his compatriots, he did not resist the currents of the times, but instead found ways to survive and continue working. This was a skill that continued to be applicable in the early post war years under the watchful eyes of the American occupation of Japan (1945–1952). Japanese films had to get past American censors, who dutifully suppressed any works it deemed sympathetic to Japan's militarist adventures or its feudal past. This was the fate of Kurosawa's first film, released just after Japan surrendered in 1945, and produced while the country was still at war. *Tora no o wo fumu otokotachi* (*The Men Who Tread on the Tiger's Tail*) was the tale of a servant and samurai who must switch roles in public in order for both to survive. It was reflexively banned by the American authorities – seemingly less out of ideological concern than a simple knee-jerk reaction to any Japanese film produced during wartime. It was finally released in Japan in 1952, and distributed in the United States in 1960, to a modest response.

The late 1940s through the 1950s saw a great explosion of commercial and artistic creativity in Japan, against a backdrop of postwar reconstruction for industry and disillusionment with Japan's government amongst artists and intellectuals. Those who had been mute during the war could now find their voice. This period was the golden age of Japanese cinema, and Kurosawa produced a string of artistic successes that brought him international recognition and paved the way for a commercial global cinema that extended beyond North America and Europe for the first time. For Kurosawa, his key creative moment came with *Yoidore tenshi* (Drunken Angel, 1948), which he considered the picture where he finally discovered himself as an artist. This was also the first Kurosawa film to feature the actor Toshiro Mifune. The Kurosawa–Mifune collaboration was an intense yet highly productive working relationship that survived into the mid-1960s and resulted in 16 films, many of which are now considered classics.

Lifetime creative output rarely yields an unbroken string of multiyear successes throughout a career. Rather, it is the constant engagement in the creative process that yields results spaced throughout time. Success may come as single works interspersed with less successful works or in temporal clusters, as in Kurosawa's case. His first cluster was *Rashômon* (1950), *Ikiru* (To Live, 1952), and *Shichinin no samurai* (Seven Samurai, 1954). The second cluster occurs in his sixties and seventies, a run of international cinematic achievement that included the Soviet coproduction and Oscar winner *Dersu Uzala* (1975), the period drama *Kagemusha* (1980), and the reworking of Shakespeare's *King Lear* into *Ran* (1985).

International recognition came first to Kurosawa through *Rashômon*, which won the Golden Lion for best film at the Venice Film Festival in 1951. It opened in Japan the previous year to unfavorable reviews and indifferent box office, and seemed destined to disappear without a trace. Serendipity intervened in the form of Giuliana Stramigioli, then the Japan representative for Italiafilm. Her interest in the film resulted in its official entry into the festival. The honors *Rashômon* won at Venice carried over to the United States in that same year, where it won the Academy of Motion Picture Arts and Sciences' Honorary Award for best foreign film.

It is useful to take a close look at *Rashômon* because it captures essential elements of many of Kurosawa's later successes. As with several of his other important films, it was part adaptation, part amalgamation, and part pure invention. It draws on two unrelated short stories by the early twentieth century Japanese writer Ryunosuke Akutagawa. Kurosawa uses Akutagawa's *Rashômon*, published in 1915 in *Teikoku bungaku* (Imperial Literature) to frame portions of the movie, particularly its interest in moral ambiguity. *Rashômon* (literal meaning, the Rashô Gate) was a gate that stood as an entrance to Japan's ancient capital Heian Kyo (modern day Kyoto), and was traditionally a place where unclaimed corpses were left – a setting whose moral power would have been instantly recognizable to his Japanese audience. For the film's narrative Kurosawa then draws heavily on Akutagawa's *Yabu no naka* (In a Thicket) to develop his overarching theme – that truth and morality are egotistical notions held by each individual, that the very notion of reality is a questionable concept we use to comfort ourselves, that images themselves are untrustworthy, with it all resulting in judgments and justice

that can by its very nature be little more than arbitrarily designed to fulfill our social, spiritual, and political conventions.

The movie explores four different accounts of a criminal event – the murder of an aristocrat and the rape of his wife. The accounts are those of the accused, the wife, the murdered noblemen told through the voice of a medium, and the story's narrator. All accounts, including that of the narrator, cannot free themselves from bias. The bias is made plain when an equal weight is given to each character's presentation. Though a quintessentially Japanese film, it fits rather well with Western notions of existentialism and post-modernism. This talent, to combine cultural elements in novel ways to produce intercultural major cinematic works with international appeal, defines Kurosawa's creativity throughout his career.

The influence of Kurosawa's *Rashômon* extends well beyond cinema. The *Rashômon* Effect has been written about in scientific research, and similar narrative devices have been introduced into Western films in the decades that followed its release. *Rashômon*-like is a term in itself, to suggest relativity of truth and evidence. Few films, especially foreign language films, have seen their titles converted into adjectives of common expression.

Though the film would have played to only limited art house audiences outside of Japan at the time, it introduced Kurosawa's work to western audiences and decisively launched his international career, which in return earned him renewed respect in Japan. It also created a dynamic that haunted and helped Kurosawa for the rest of his career – his work was often better received outside Japan than in it. This was partially a result of the way in which live action films were categorized in Japan throughout his career. They were either *jidaigeki* (period pieces) or *gendaimono* (contemporary). Kurosawa's films with period settings were sometimes seen by critics within Japan as pandering to Western audiences that wanted to experience Japan and Asia as odd and unusual. His films with contemporary settings were also criticized within Japan for their 'Western style' plotting and pacing. Yet outside of Japan, he was viewed as a uniquely Japanese director whose work crossed over to appeal to non-Japanese audiences. What is missed in all of this controversy is that his films always dealt with contemporary concerns and themes, regardless of their setting, and presented universalist themes that had the capacity to transcend the specifics of national culture.

Kurosawa's next great accomplishment was the 1952 *Ikiru* (To Live), one of his most humanistic works and considered his first fully realized masterpiece. At one level it is the story of Watanabe, a man with a terminal diagnosis of stomach cancer. He is a petty city bureaucrat in a Tokyo ward office in a ramshackle district who has done nothing with his life, and now faces death with the knowledge he has done nothing significant. With the little time left to him, he chooses to make a difference by pushing through permission and funds to build a park in a polluted, poor, and industrially chaotic part of town. This is not just about wresting personal meaning in the eleventh hour of life. It is also a tutorial on the meaning of democracy, as promoted by the American occupying forces of the time. In this model, bureaucrats are to become public officials who serve the public good, not isolated and unresponsive authority figures who specialize in nonaction in the face

of dire public need. The Watanabe character, diagnosed with an incurable illness that cannot but result in death, stands in as a metaphor for Japanese society, where prewar and wartime beliefs and norms must die, and in their place new democratic norms must be established. Yet, as Watanabe embodies, this must be done not by someone else, a new group of individuals, but by the very individuals who were responsible for the old system.

Shichinin no samurai (Seven Samurai, 1954), is the most well known of all Kurosawa films and is critically acknowledged as among the greatest action movies ever made. It is one of the four films Steven Spielberg tends to watch whenever starting a new project, the other three being 'Lawrence of Arabia' (1962), 'It's a Wonderful Life' (1946), and 'The Searchers' (1956). It had a direct influence on the American western when it was remade by John Sturges as 'The Magnificent Seven.' The highly kinetic nature of the action sequences helped to internationally revolutionize the action movie genre, while its nihilist tendencies, further developed in *Yojimbo* (The Bodyguard, 1961), laid the foundations for Clint Eastwood's 'Man with No Name' in Sergio Leone's spaghetti westerns. This highlights the fluid interchange between these genres – the American western and the Japanese samurai drama – where heroes exist on the fringes of a normal society they can never join, and align themselves with this very normalcy in a fight against villains. The thematic and cinematic achievements of the 'Seven Samurai' places Kurosawa on a plane with other great directors and their epics, such as David Lean and 'Lawrence of Arabia' (1962) and Sergei Eisenstein's 'Battleship Potemkin' (1925). It took a year to complete the 'Seven Samurai,' and when it was 'released, it was the most expensive picture ever made in Japan, all this at a time when Japan was still struggling to recover financially from its disastrous war effort and defeat.

In a move similar to most independently minded film directors, Kurosawa established his own production company in 1960 to gain greater creative and financial control over his output. However, this development never brought Kurosawa or his projects the financial stability he hoped for. His films in the immediate aftermath of founding his production company were mostly entertainment pieces, culminating in *Akahige* (Red Beard) in 1965. Parenthetically, 'Red Beard' was the last time Kurosawa and Toshiro Mifune worked together, Mifune no longer willing to withstand the exacting demands of Kurosawa. In the years that followed, Japanese studios fell into economic difficulties, making it increasingly difficult for Kurosawa to bankroll his projects, which in any case were always expensive by Japanese standards. His attempts to work with Hollywood producers were similarly unsuccessful. He reached a low point in 1968 when he began working with 20th Century Fox on 'Tora, Tora, Tora!,' a film about Japan's attack on Pearl Harbor. He was taken off the project by the American producers who feared increasing cost overruns and found Kurosawa difficult to work with.

Kurosawa's next completed project was *Dodesukaden* (1970), his first full color feature and an attempt to return to films with serious themes. It is a story about slum dwellers, with a mentally challenged boy at the center, and it was a financial failure that led to a serious period of personal and professional despondency, made worse by a painfully persistent undiagnosed ailment, later discovered to be gallstones. This culminated in a

suicide attempt on 22, December 1971, in which Kurosawa slashed his neck six times and his arms eight. Throughout his career there were rumors of other suicide attempts, perhaps as many as 13, but they have never been confirmed.

As Kurosawa recovered, he began working on 'Dersu Uzala' (1975), a production put together through the Soviet Union's Mosfilm and shot almost entirely on location in Siberia under extremely challenging weather conditions. It was based on the 1923 book of the same title, written by the Russian explorer Vladimi Arsenyev, about the friendship between a Russian explorer and a Manchurian hunter who lives in close rhythm with nature. As with *Rashômon*, we see Kurosawa returning to the literary adaptation as a formula for success. 'Dersu Uzala' garnered seven awards internationally, as a Soviet film, and was the beginning of another period of acclaimed work by the director.

Kurosawa's next project was the period drama *Kagemusha* (The Shadow Warrior, 1980), to be followed by the last of his great achievements, the reworking of Shakespeare's King Lear into *Ran* (1985). *Kagemusha* tells the tale of a petty thief chosen by the leaders of a clan as a look alike, to impersonate their feudal chief killed earlier in battle. *Kagemusha's* final scene, in which samurai from one clan, armed with bow and arrow and pike, are massacred by another clan's use of muskets, is one of the greatest and most poignant action sequences of Kurosawa's career. His next film, *Ran*, was set in sixteenth century Japan and adapted from Shakespeare's King Lear. This film, produced achieves a scale, intensity, and intelligence that Kurosawa had been aiming for throughout his career. 'Dreams' (1990), *Rhapsody in August* (1990), and *Madadayo* (1993) were the last three films he made and while 'Dreams' was visually stunning, none of these films captured the great energy of his earlier work.

In 1989, at the age of 72, Kurosawa was awarded an Oscar for Lifetime Achievement, "for accomplishments that have inspired, delighted, enriched, and entertained audiences and influenced filmmakers throughout the world." For his part, Kurosawa noted that, "To be an artist means never to avert one's eyes."

Combinatory Freedom, Predigital Sampling, and Creativity

Kurosawa's adaptations from the West – Shakespeare's Macbeth into *Throne of Blood*, King Lear into *Ran*, Dostoyevsky's *The Idiot* into *Hakuchi* and Gorky's *The Lower Depths*, demonstrates the creativity that can result when cultural material is absorbed and altered by individuals working from outside the cultural context of those materials. As Henry Seaton has noted:

"Ran is the embodiment of the 'otherness' in the playing of Shakespeare. Not only was this film directed by a Japanese director, Akira Kurosawa, not only was the film produced in a country on the other side of the world, not only is the language of the text 'foreign', not only is the setting for the action alien to the world of Shakespearian England, not only is the costume historically and geographically 'other' than English, not only are many of the characters different in gender to those in Shakespeare's text, and not only is the medium in which the text is encoded a twentieth century phenomenon, specifically bearing an oriental signature, but also . . .

the Fool-figure is played by a Japanese transvestite pop singer.” (Seaton H. (2000). ‘All licensed fool’: all licensed film: Akira Kurosawa’s *Ran*. Solihull College, Solihull, UK)

Kurosawa’s use of combinatory freedom in the analog age is a precursor to the digital age where sampling infuses, guides, and enriches so much of the creative process today. The characteristics of digital sampling – where works are taken out of context, trimmed, and transposed to suit the needs of the creative individual and the creative project, then combined in ways the original artist or culture never envisioned – are all found in Kurosawa’s way of working with the material on which he based some of his most famous and powerful works. He performed the same function when adapting material and techniques from Japanese culture, freely drawing on the texts, stylings, and actors training in the areas of *noh* and *kabuki*

Kurosawa is a complex figure whose body of work is both rooted in its Japanese and Asian cultural, economic, spiritual, institutional, and historical context, and transcends it. His work is notable for its capacity to thoroughly embody Western forms of representation, while using essential Japanese elements and extending them in new directions. Kurosawa is bound to neither Japanese or Western forms of imagery and film making, and used this freedom to create novel forms of expression that moved back into the world of film outside of Japan, and drove innovation on an international scale. It is a multidirectional phenomenon. Kurosawa’s admiration for the work of John Ford and his westerns combines with his knowledge of Japanese history and the Seven Samurai results. This, in turn, creates new story elements and styles and is taken up by the director John Sturges as *The Magnificent Seven*, which becomes a staple of American popular culture.

This open sampling, borrowing, and rewriting of cultural ideas raises issues about the nature of creativity itself, blurring the lines between creativity’s authorship and creativity’s production. It also challenges the implicit idea that true creativity is somehow a Western phenomena, which can be emulated or copied by others, but not exceeded. The twentieth century Japanese model of creativity – one where sampling, unconstrained borrowing, and a lifting of cultural artifacts from their cultural context and reintroduction in completely new and novel contexts – itself constitutes creativity, and a creativity that took root in the Western world several decades later. In short, combinatory freedom allows for artistic innovation and renewal, and a fresh merging of process and inspiration, in ways now supported by twenty-first century digital sampling, but it was a cultural and artistic form in Japan in preceding decades.

Indeed, as Lubart and Sternberg suggest, one of the significant limitations of the literature on creativity is its tendency to focus on Western cultural models. While creative models can be seen as traditionally different in the Asian and Western models, it is a position which conflates broad notions of cultural similarity across an Asia that is, in fact, highly diverse in its approach to creativity. Moreover, anecdotally, it is clear that individual creativity is not a Western phenomenon, any more than group creativity is an exclusively Eastern phenomenon. In addition to directors such as Kurosawa there are, and have always, significant and genre-breaking creatives

working in all areas of the arts and industry throughout Asia. In Japan alone, creativity has captured a global audience, from its industrial design, advanced robotics, management and manufacturing innovation, to modern art, and fashion. South Korea, Taiwan, and China also have their own energetic innovations and creative output. The literature on creativity is poised to capture these broader examples of international and non-Western achievement in the years ahead. One example of how this is already taking place is through the notion of group artistic creativity.

Group Artistic Creativity and Lifespan Productivity

Kurosawa conceived of, and made his films, in a highly individualistic yet collaborative manner. He initiated most of his own films, rather than having them handed to him by the studio. As his nickname, *Tenno* (The Emperor) suggests, he attempted to exercise an exacting control over his productions. Kurosawa’s ground-up experience with the process of film making allowed him to gain greater control over his final product than generally possible for other Japanese directors. While filming, his technical skill as an editor allowed him to edit together the rushes of each day’s scenes, so by the last day of shooting he already had a first draft of his entire film. He was also well known for his perfectionism. When a scene in ‘*Throne of Blood*’ (1957) called for Toshiro Mifune’s character to be pierced by arrows, Kurosawa insisted Mifune wear a protective vest and be filmed while shot at with real arrows. Evidence of his control over his creative process is also found in the fact that he was the primary editor on 19 of the 31 films he directed between 1943 and 1993. He also sustained an active dedication to writing, with 69 writer’s credits to his name, writing or cowriting the majority of scripts he used to make his films. He was deeply involved with the set up of his cinematographer’s cameras, with costume and prop design, and though no composer, known for conceiving of the music that would accompany his scenes as he wrote them. He did all of this while working energetically to maintain artistic autonomy from the studios that allowed him to work in the first place.

Yet, a hallmark of film making is its inherently collaborative nature. The theory of the auteur, where a film is the product of a single creative mind working through others, certainly has value when considering Kurosawa’s career, but even he was careful to point out the group nature of his filmic endeavors.

You know how I work? Talk, talk, talk – that’s all I do. Get the writers together and talk about the script. Get the actors together and talk acting. Get the camera crew together and talk production. I spend my life talking.

This is consistent with Dean Keith Simonton’s point, that the making of commercial films is inherently an example of group artistic creativity – or collaborative aesthetics – in which the efforts of many result in a single creative product. Simonton also suggests the basic variables that contribute to a film’s success: direction, male and female leads, male and female supporting roles, screenplay, art direction, costume design, make-up, cinematography, film editing, score, song, visual effects, sound effects editing, and sound. Moreover, given that film production is inherently a temporary work system, in

which crews of actors, technical specialists, managers, financiers, and workers come together for intense yet brief periods to produce a cinematic product, the need for collaboration and reliance on the skills and dedication of others increases, particularly in the production phase, where large crews are needed and divided into subgroups with distinct yet interdependent responsibilities.

An additional aspect of Kurosawa's career that bears special mention is his lifespan production and creativity. Lifespan creativity in terms of critical praise for film directors generally follows an inverted U, where success increases after their first film, followed by a decline in ratings in later films. Yet Kurosawa's career followed a multiple wave pattern, with international success in the 1950s – generally considered Japan's golden age of film – followed by disappointing results until the mid-1970s, and a surge of creative accomplishment in the 1980s, followed by smaller, less praised productions toward the end of his life. It is noteworthy that throughout his life, Kurosawa's films were realized with relatively modest budgets by Hollywood standards. This lends weight to the observation that creativity, critical and commercial, and success are not directly correlated with large budgets. Creativity in popular film is especially problematic, since it is a creative field that is intrinsically bound with commerce. The need for commercial success can be paramount for a director since this factor, more than any other single factor, can determine whether he or she get to make another movie in the future. In the case of Kurosawa, his distinctive yet evolving style, and his capacity to move between period dramas (*jidaigeki*) and modern works (*gendai mono*), likely aided the longevity of his career, suggesting that both creativity and adaptability were crucial elements in his lifetime productivity. Indeed, the more closely a director can link creativity with commercial success, the more likely they are to continue working and developing their creative style and voice.

Kurosawa's reputation as a film maker has increased since his death in 1998, and the globalization of film and film talent has increased exponentially since *Rashômon* was first screened at the Venice Film Festival in 1951. He worked within the specifics of his Japanese context, but with a thorough command of the international language of drama, literature, and action that gives his work a powerful universalistic appeal.

See also: Art and Aesthetics; Film.

Filmography of Akira Kurosawa (Japanese Release Dates)

Madadayo (1993), English title: 'Not Yet.'
Hachi-gatsu no kyôshikyoku (1991), English title: 'Rhapsody in August.'
 'Dreams' (1990).
Ran (1985).
Kagemusha (1980), English title: 'The Shadow Warrior.'
Dersu Uzala (1975).
Dodesukaden (1970), English title: 'Dodes'ka-den.'
Akahige (1965), English title: 'Red Beard.'
Tengoku to jigoku (1963), English title: 'High and Low,' also as 'Heaven and Hell.'

Tsubaki Sanjûrô (1962), English title: 'Sanjuro.'
Yojimbo (1961), English title: 'The Bodyguard,' also as 'Yojimbo the Bodyguard.'
Warui yatsu hodo yoku nemuru (1960), English title: 'The Bad Sleep Well.'
Kakushi-toride no san-akunin (1958), English title: 'The Hidden Fortress.'
Donzoko (1957), English title: 'The Lower Depths.'
Kumonosu-jô (1957), English title: 'Throne of Blood.'
Ikimono no kiroku (1955), English title: 'I Live in Fear,' also as 'Record of a Living Being.'
Shichinin no samurai (1954), English title: 'Seven Samurai.'
Ikiru (1952), English title: 'To Live.'
Hakuchi (1951), English title: 'The Idiot.'
Rashômon (1950).
Shôbun (1950), English title: 'Scandal.'
Nora inu (1949), English title: 'Stray Dog.'
Shizukanaru ketto (1949), English title: 'The Quiet Duel.'
Yoidore tenshi (1948), English title: 'Drunken Angel.'
Subarashiki nichiyôbi (1947), English title: 'One Wonderful Sunday.'
Waga seishun no kuinashi (1946), English title: 'No Regrets for Our Youth.'
Asu o tsukuru hitobito (1946), English title: 'Those Who Make Tomorrow.'
Zoku Sugata Sanshiro (1945).
Tora no o wo fumu otokotachi (1945), English title: 'The Men Who Tread on the Tiger's Tail.'
Ichiban utsukushiku (1944), English title, 'The Most Beautiful.'
Sugata Sanshiro (1943), English title: 'Sanshiro Sugata.'

Awards Received by Akira Kurosawa

- 2001 Japanese Academy, Best Screenplay for *Ame Agaru* (1999), *posthumous*.
- 1999 Japanese Academy, Lifetime Achievement Award, *posthumous*.
- 1999 Association of Tokyo Film Journalists (Blue Ribbon Awards), Special Award for his body of work, *posthumous*.
Mainichi Film Concours, Special Award, *posthumous*.
- 1998 Nikkan Sports Film Awards (Japan). Special Award, for Lifetime Achievement.
- 1992 Directors Guild of America, Lifetime Achievement Award.
- 1990 Academy Award, Oscar for Lifetime Achievement.
- 1987 British Academy (BAFTA), Best Foreign Language Film, *Ran* (1985).
London Critics Circle Film Awards, ALFS Award, *Ran* (1985).
- 1986 Academy Award, Oscar for Best Director, *Ran* (1985).
Amanda Award (Norway), Best Foreign Feature Film, *Ran* (1985).
Association of Tokyo Film Journalists (Blue Ribbon Awards), Best Film, *Ran* (1985).
David di Donatello Awards (Italy), David Award, Best Director, Foreign Film, *Ran* (1985).

- Directors Guild of America, Golden Jubilee Special Award.
Mainichi Film Concours, Best Director and Best Film, *Ran* (1985).
National Association of Film Critics (Denmark), Bodil Award, Best European Film, *Ran* (1985).
San Francisco International Film Festival, Akira Kurosawa Award.
- 1985 Los Angeles Film Critics Association Awards, LAFAA Award, Best Foreign Film, *Ran* (1985).
National Board of Review (USA), NBR Award, Best Director, *Ran* (1985).
San Sebastian International Film Festival (Spain), OCIC Award, *Ran* (1985).
- 1981 British Academy (BAFTA), Best Foreign Language Film, *Kagemusha* (1980).
Association of Tokyo Film Journalists (Blue Ribbon Awards), Best Film, *Kagemusha* (1980).
Cesar Awards (France), Best Foreign Film, *Ran* (1985).
David di Donatello Awards (Italy), David Awards (2) for Best Director and for Best Foreign Film, *Kagemusha* (1985).
Italian National Syndicate of Film Journalists, Silver Ribbon, Best Director for Foreign Film, *Kagemusha* (1980).
Mainichi Film Concours (3), for Best Director, Best Film, and Readers' Choice Award, *Kagemusha* (1980).
- 1980 Cannes Film Festival (France), Gold Palm, *Kagemusha* (1980).
Hochi Film Awards, Japan, Best Film, *Kagemusha* (1980).
- 1979 Moscow International Film Festival, Honorary Prize, For Contributions to Cinema.
- 1978 French Syndicate of Cinema Critics, Critics Award, Best Foreign Film, *Dersu Uzala* (1975).
- 1977 David di Donatello Awards (Italy), David Award, Best Director, Foreign Film, *Dersu Uzala* (1975).
Italian National Syndicate of Film Journalists, Silver Ribbon, Best Director, Foreign Film, *Dersu Uzala* (1975).
- 1976 Academy Award, Oscar for Best Foreign Language Film, *Derzu Uzala* (1975).
- 1975 Moscow International Film Festival, FIPRESCI Prize and Golden Prize, *Derzu Uzala* (1975).
- 1966 Association of Tokyo Film Journalists (Blue Ribbon Awards), Best Film, *Akahige* (1965).
Kinema Junpo Awards (Japan), Best Director and Best Film, *Akahige* (1965).
Mainichi Film Concours, Best Film, *Akahige* (1985), English title: 'Red Beard.'
- 1965 Venice Film Festival, OCIC Award, *Akahige* (1965), English title: 'Red Beard.'
- 1964 Mainichi Film Concours, Best Film and Best Screenplay, *Tengoku to jigoku* (1963), English title: 'High and Low,' also as 'Heaven and Hell.'
- 1959 Berlin International Film Festival, FIPRESCI Prize, *Kakushi-toride no san-akunin* (1958), English title: 'The Hidden Fortress.'
- Berlin International Film Festival, Silver Berlin Bear for Best Director, *Kakushi-toride no san-akunin* (1958)
Association of Tokyo Film Journalists (Blue Ribbon Awards), Best Film, *Kakushi-toride no san-akunin* (1958), English title: 'The Hidden Fortress.'
- Jussi Award (Finland), Diploma of Merit, *Shichinin no samurai* (1954), English title: 'Seven Samurai.'
- 1954 Berlin International Film Festival, Special Prize of the Senate of Berlin, *Ikiru* (1952), English title: 'To Live.'
- Venice Film Festival, Silver Lion, *Shichinin no samurai* (1954), English title: 'Seven Samurai.'
- 1953 Kinema Junpo Awards (Japan), Best Film, *Ikiru* (1965), English title: 'To Live.'
- 1951 National Board of Review (USA), NBR Award, Best Director, *Rashōmon* (1950).
Association of Tokyo Film Journalists (Blue Ribbon Awards), Best Film, *Rashōmon* (1950).
Venice Film Festival, Golden Lion, *Rashōmon* (1950).
- 1949 Kinema Junpo Awards (Japan), Best Film, *Yoidore tenshi* (1948), English title: 'Drunken Angel.'
- Mainichi Film Concours, Best Film, *Yoidore tenshi* (1948), English title: 'Drunken Angel.'
- 1948 Mainichi Film Concours, Best Director, *Subarashiki nichiyobi* (1947), English title: 'One Wonderful Sunday.'

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- <http://www.imdb.com/name/nm0000041/> – Internet Movie database for Akira Kurosawa.
- <http://kirjasto.sci.fi/kuros.htm> Books and writers – Akira Kurosawa.

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Leadership

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Glossary

Concept selection Choosing relevant or critical concepts to focus on.

Conceptual combination Combination or reorganization of unique and abstract features of concepts relevant to the problem.

Creative thought The production of solutions to novel, complex, and ill-defined problems.

Idea evaluation Evaluating and refining ideas relevant to problem solving.

Idea generation Developing and contextualizing ideas that may be valuable in problem solving.

Implementation planning The extensive use of forecasting and development of backup plans.

Information gathering Seeking information that is relevant to solving the problem.

Problem definition Establishing a clear perspective of what the exact problem is.

Solution monitoring Monitoring progress of solution implementation and changes resulting from implementation.

Leadership

The stereotypical image of the creative person is of an individual working alone to develop and gain acceptance for a new idea. Although this image appears appropriate in some cases, for example, Albert Einstein, in most cases new ideas, and new products, are rarely the result of an individual working alone. Illustrations of this point may be found in DuPont's development of polymer chemistry and the development of nuclear power systems. Both of these efforts involved hundreds, if not thousands, of people. If one grants that creative work often occurs in teams, then a series of new questions comes to the fore. How do teams influence the character and success of creative work? How do organizations influence creativity? And, how do leaders influence the nature and success of creative efforts?

In the present effort we will attempt to provide an answer to this latter question – How do leaders influence the nature and success of creative efforts? To answer this question we will address two key issues. First, we all consider how leaders influence others involved in creative work. Second, we will examine how leaders think about the problems posed by creative work. We believe the evidence bearing on these issues suggests not only that leaders are a powerful influence on the success of creative efforts, but also that leaders necessarily think about the problems posed by creative efforts in unique ways.

Leading Creative Efforts

Context

Leadership, ultimately, involves the effective exercise of influence. The effective exercise of influence, however, does not refer to the social outcomes of influence attempts – both Roosevelt and Hitler were leaders. Rather, this effective exercise of influence involves others reactions, reactions for good or ill, to the leaders influence attempts. In this sense, leadership can be viewed as a form of performance albeit an unusually complex form of performance.

As a complex form of performance, a number of variables have been found to affect the success of these influence attempts. These variables include leader traits, such as intelligence, extraversion, and achievement motivation, as well as the behaviors evidenced by leaders in the exercise of influence such as consideration, initiating structure, participation, and change management. Leaders, moreover, may exercise influence through the relationships formed with followers, the followers' identification with the leader, and the induction of affect by the leader. Although multiple mechanisms exist by which leaders can exercise influence, the mechanisms that prove most effective depend on the context in which the leader operates.

Despite the many mechanisms through which leaders can exercise influence, the influence attempts made by leaders do not always affect the performance of teams. Instead, leaders' exercise of influence makes a difference with respect to team

performance only under certain conditions. More specifically, leaders' exercise of influence makes a difference when teams, or followers, are confronting crisis conditions – conditions where risk/rewards are imbalanced, the issue at hand is in conflict, approaches for addressing this issue are not clear, and this problem at hand is novel. Recognition of the point that complex, novel, ill-defined problems with high risk/high rewards typically characterize most creative problems led Mumford, and colleagues to argue that leadership would be critical whenever people working on creative tasks.

Influencing Others

The observations, in turn, bring to the fore a new question. How should leaders exercise influence attempts to enhance creativity and innovation? Mumford and his colleagues have identified several ways influence can be exerted by leaders in such a way as to enhance creative and innovative efforts: (1) technical skills; (2) evaluation and direction; (3) mission definition; (4) planning and structuring; (5) motivation; (6) support climate; and (7) team formation.

In one study on leadership in research and development teams, specifically Andrew and Farris' 1967 study, appraisals of scientists with regard to the behavior exhibited by the leaders of 21 teams were obtained. It was found that leader technical skills ($r=0.53$) were better predictors of creative production than other leader behaviors such as motivating others and autonomy granted. In another study along these lines, Barnowe in 1975, examined the production (e.g., publications, patent awards) of 963 chemists in 81 research and development teams. Leaders were assessed by team members with respect to support, participation, closeness of supervision, task emphasis, and technical skill. He found that technical skill ($r=0.40$) was the best predictor of innovation on the part of team members.

Clearly, the leaders of creative groups must possess expertise in the field, or domain, in which creative work is being pursued. One reason why expertise is critical for leaders pertains to how influence is exercised with respect to creative people. Creative people tend to be autonomous and draw identity from the work being done. As a result, appeals to authority or rewards are unlikely to prove effective. Rather, it is only through appeals to expertise and definition of work requirements that leaders can exercise effective influence. Indeed, the use of expertise as a key influence mechanism is consistent with the tendency of creative people to identify with the profession as opposed to the leader or the organization.

The importance of the exercise of influence *vis-à-vis* expertise is related to another key set of skills that must be possessed by the leaders of creative teams. In 1972, Farris examined the communication patterns of more and less creative people working in research and development teams. He found that creative people were likely to communicate with team leaders under two conditions: (1) when initially defining or structuring the problem to be approached in their work; and (2) when seeking evaluation of work conducted with regard to its implications. These findings, of course, suggest that people doing creative work rely on leaders to support problem definition and idea evaluation activities.

In 2000, other work by Mumford, and coworkers point to the importance of problem definition and idea evaluation by leaders. In this study, the creative problem-solving skills of army officers were assessed, using a modified think aloud protocol, to provide assessments of problem definition, information gathering, concept selection, conceptual combination, idea generation, idea evaluation, implementation planning, and solution monitoring – all key processing skills involved in creative thought. In comparing more junior to more senior leaders with respect to these skills, it was found that more senior leaders, as opposed to more junior leaders, evidenced particularly high scores on problem definition and idea evaluation skills.

What should be recognized here, however, is that problem definition and idea evaluation must be executed by leaders with respect to other people and their work. Thus in 2004, Loneragan and colleagues presented advertising ideas to people assuming the role of managers in a marketing firm. Ideas were appraised with respect to different standards and feedback provided. It was found that the most creative advertising campaigns resulted when leaders provided feedback intended to improve the quality of original ideas and feedback intended to improve the originality of high quality ideas. Hence leaders in evaluating ideas, and providing feedback with regard to work on these ideas, must provide feedback intended to compensate for deficiencies. Thus leaders of creative efforts must possess exceptional problem definition and idea evaluation skills.

Leader's appraisal of problems and ideas, however, must ultimately be referenced against a set of technical objectives. The technical objectives being pursued in a creative effort are commonly referred to as a mission. A mission is similar to a vision. It differs from the visions discussed in theories of transformational and charismatic leadership in that emotionally evocative personal identity is not invested in a mission. Indeed visionary leadership, while motivating, may undermine creativity. Missions, however, by defining a significant technical and professional problem capitalize on, and activates, the professional orientation of creative people serving as a framework for formation of the shared mental models that promote team creativity and participation in the production of new ideas. In keeping with these observations, qualitative studies of successful leaders of research and development teams have found that mission definition and ongoing articulation of the mission was critical to successful leadership of research and development teams. In another study along these lines, Dunham and Freeman in 2000, found that mission definition and articulation was critical to the success of play directors.

With regard to mission definition and the articulation of this mission, however, three variables appear critical to leader performance. First, the technical, or professional, importance of the mission must be defined and articulated. Second, the room for creative contributions in achieving this mission must be articulated. Third, this mission must be used to appraise ideas and address the various crises that arise in virtually all creative efforts.

Missions are noteworthy because they provide a background for another way in which leaders exercise influence on creative people. Creative efforts by virtue of their novelty and ill-definition are uncertain ventures. As a result, the mental

simulation of the outcomes of various efforts, planning, is critical for the success of creative efforts, in part, because it promotes recognition of emergent opportunities, and, in part, because it promotes adaptive responses.

In keeping with this observation Arvey and coworkers found, in 1976, that planning and goal clarity were the principle dimensions underlying scientists' evaluation of their supervisors. More recently, in 2005, Marta and colleagues obtained measures of leader planning skills on a team creative problem-solving task. They found that leaders planning skills were strongly, and positively, related to team members' creative production, in part because these plans provide a basis for group structuring activities. Thus leaders planning behavior *vis-à-vis* mission accomplishment is a critical mechanism by which leaders influence creative people.

Not only must leaders define a mission, formulate plans, and appraise ideas with respect to this mission, they must also motivate their followers. In fact, many theories of leadership view this motivational function of leaders as critical. In the case of creative people, however, motivation is typically high due to the influence of professional involvement and the personal dispositions of creative people. Thus the problem confronting leaders is not building motivation but rather directing motivation toward the creative mission at hand.

One way leaders may influence motivation for creative work is by building followers' feelings of self-efficacy with regard to the creative work at hand. Thus, in 2002, Tierney and Farmer developed a model of creative self-efficacy. They found that creative self-efficacy was positively related to subsequent creative achievement. In another study along these lines, Jaussi and coworkers, in 2007, obtained self-report, survey, measures of creativity. They found that measures examining the creative self-efficacy and creative identity were positively related to creativity. These findings are noteworthy because they suggest that actions taken by leaders to build creative self-efficacy and creative identity *vis-à-vis* the mission being pursued, for example, expressing appreciation for the creative achievements or noting the unique skills the person brings to the mission, will enhance follower creativity.

Although leaders may exert direct effects on creative motivation indirect effects on creative motivation may also be exerted through climate. The climate contributing to creativity has long been of interest to scholars interested in creativity. Recently, in 2007, Hunter and colleagues conducted a meta-analysis of the relationship between measures of climate perceptions (e.g., perceptions of autonomy granted, support for creative work, and challenge) and subsequent creative performance. They found that climate measures were strongly positively related to subsequent creativity.

What should be recognized here, however, is that leader behavior is one of the critical variables shaping climate perceptions. In 2004, Amabile et al. provided evidence bearing on this ability of leaders to shape these climate perceptions. In this study, 238 knowledge workers assigned to 26 project teams were asked to complete a work diary. Peer ratings were used to assess each worker's creativity. Subsequently, these diaries were content analyzed to identify leader behaviors associated with environmental appraisals and affective reactions that might contribute to creativity. The obtained findings indicated that leader behavior was a critical variable shaping appraisals of

creative climate and affective reactions. These environmental perceptions and emotional reactions were, in turn, found to influence subsequent creative performance.

Not only can leaders influence peoples' perception of the climate for creativity, but also leaders exert indirect effects on climate through the team they establish to work on various aspects of a mission and the procedures they use in managing these teams. For example, leaders emphasis on intellectual problem-solving by teams, effective communication among team members, and exploration of the implications of ideas have all been found to contribute to team creativity. Leaders, however, may have another, perhaps more basic, effect on team creativity. More specifically, leaders identify the skills needed to exercise a mission and recruit individuals possessing these skills. Given the various studies indicating that team composition is a critical influence on creativity, leaders, by selecting and recruiting team members displaying a certain set of skills, may exert a profound influence on team creativity.

Influencing Organizations

Our foregoing observations have focused on how leaders exercise influence on creative people. Leaders, however, work in a boundary role position where they must manage relationships with the broader organization. In this case of the leaders of creative efforts, management, really leadership, with respect to the broader organization is of particular concern because organizations, based on costs, risk, and potential disruption tend to have an ambiguous, perhaps somehow negative, view of creative work. This observation led Mumford and colleagues in 2008 to argue that the effective leadership of creative efforts requires both an inward focus, a focus on the group, and an outward focus, a focus on the organization and the field.

Creative work in organizations is expensive and, without requisite resources, creative efforts tend to die. Because resources in organizations are allocated by top management teams, it is not surprising that Dougherty and Hardy found, in 1996, sustained top management support was critical to the success of creative efforts in the information technology industry. More centrally, in 2003, Hong, and coworkers found that top management support for creative efforts depended on engagement and contact. Thus the leaders of creative efforts must establish and maintain contact with top management teams taking actions intended to insure their engagement in creative efforts.

One implication of these observations is that leaders must 'sell' creative efforts to top management teams. This top management support is often obtained through project championing. In 1988, Howell and Higgins found, that the recruitment of project champions, politically skilled senior managers who are vested in the success of a project, is often critical to success of creative efforts. Thus the leaders of creative efforts must be capable of recruiting project champions and often will need to act as project champions.

In 2004, Howell and Boies examined, the key capabilities characterizing project champions. They obtained in matched pairs of champions and nonchampions involved in one, or more, of 28 technological innovations. Interviews with these champions and nonchampions bearing on their activities in

the innovative effort were content analyzed. Subsequent analysis indicated that project champions must both package and sell ideas. The basis for idea packaging and selling, however, lay in contextual knowledge and normative knowledge of the organization.

The Howell and Boies study is noteworthy for three reasons. First, it suggests that leaders of creative efforts must be effective sales representatives for the creative effort. Second, effective sales are based on a broader knowledge of the organization, its strategy and competitors, as well as the key leaders in the organization and their concerns. Third, leaders of creative efforts will need not only technical expertise but also expertise with regard to the organization and its mode of operation.

Not only must leaders of creative efforts have an understanding of the strategic and operating environment of the organization, creative work must be integrated within the organizational environment. The integration of creative work into the environment of organizational operations implies that leaders of creative efforts must be able to think strategically about the implications of work in their field for the effectiveness and success of the organization. This observation, in turn, implies that the leaders of creative efforts must be able to engage in strategic planning.

In 2008, Mumford, Bedell-Avers, and Hunter examined the key requirements involved in the strategic planning called for in the leadership of creative efforts. Broadly speaking, their conclusions indicate that a key activity required of leaders is the identification of the fundamentals to be pursued in creative efforts. The term 'fundamentals' refers to basic issues applying in a technical field which provides a vehicle for guiding creative work. Ultimately, the leaders of creative efforts must identify the fundamentals to be pursued with these fundamentals being used to develop expertise and absorptive capacity on the part of the organization. Thus the leader of DuPont Chemical Research Unit identified seven to ten fundamentals to be pursued by DuPont. What should be recognized, however, is that this identification of viable fundamental requires an understanding of both the technical field at hand and the organization as it operates with respect to this field. Thus the identification of viable fundamentals on the part of leaders will require integrative thought.

The need for leaders of creative efforts to identify viable fundamentals points to another skill likely to be critical for leadership of creative efforts. In 2001, Souitaris examined how the use of different information sources has related to new product development and fielding in manufacturing firms. He found that firms seeking various sources of external information (e.g., customer feedback, supplier feedback, competition monitoring, and technology monitoring) were more likely to both adapt and introduce new products. Thus the leaders of creative efforts must be engaged in ongoing environmental scanning – scanning that takes into account both the 'business' of the organization and developments within the technical field.

The leaders of creative ventures must not only identify fundamentals, but they must also make decisions about which creative efforts are to proceed to further stages of development. What should be recognized here however is that evaluation criteria differ as projects progress through different stages of development. Thus initial exploratory efforts may be

evaluated *vis-à-vis* knowledge produced while late stage fielding efforts are often evaluated with respect to product success. This observation is noteworthy because it implies that the leaders of creative efforts must be able to apply different evaluation strategies in decision-making depending on stage of development and the direct and indirect costs associated with the creative effort. Thus the leaders of creative efforts must not only possess requisite decision-making skills, decision-making taking into account organizational considerations, but they must also be able to apply these skills in a flexible fashion.

Our foregoing observations bring us to a final skill that must be possessed by the leaders of creative efforts. As projects move through different stages of development different problems will be encountered. Often these problems will arise from organizational blockades or constraints placed on creative efforts. At times, however, these constraints may arise from technical considerations. What should be recognized here is that when encountering blockades or constraints, creative people will look to leaders in attempts to remove these blockades. Under these conditions, the leaders of creative efforts must be able to find ways of working around these externally imposed constraints. In other words, they must be 'fast on their feet' bringing to bear adaptive, 'work arounds,' to blockades encountered. Thus the leadership of creative efforts will require leaders evidencing substantial adaptive capacity as well as the ability to recognize restrictions which can, and cannot, be worked around.

Leadership Capability

Taken as a whole, our foregoing observations indicate that certain actions taken by the leader with respect to creative people, an inward focus, and certain actions taken by the leader with respect to the organization, an outward focus, influence the success of creative ventures. By the same token, the complex set of actions required of leaders, they must define missions and they must sell, they must make decisions and provide compensatory evaluative feedback, and they must create a supportive climate and they must apply technical skills, suggests that the leadership of creative efforts is an inherently difficult and demanding venture. These multiple, conflicting demands, in turn, broach a new question – must leaders be creative?

At one level it is clear that creativity and leadership represent distinct phenomena. For example, creative people are often introverts. Leaders, in contrast, are often extraverts. Creative people are motivated by professional achievement. Leaders, however, are motivated by organizational achievement. Despite these manifold differences leadership does seem to require one critical aspect of creativity – leaders must be able to think creatively. Accordingly, in this section we will examine what is known about leader creative cognition examining points of similarity, and points of departure, from the literature on leader cognition.

Creative Thinking

Perhaps the most traditional method for appraising creative thinking is a person's performance on divergent thinking tests.

In 1998, Mumford, et al. administered a consequences measure of divergent thinking (an example question asks individuals to list what might happen if gravity was cut in half) to 1818 army officers serving in leadership roles ranging from second lieutenant (responsible for 30 individuals) to colonels (responsible for 2000 individuals). Responses to these questions were scored on domain specific performance attributes and attributes relevant to leadership, such as long-term consequences, positive consequences, and negative consequences. It was found that these domain specific measures of divergent thinking produced correlations in the 0.40 range with measures of leader performance such as attained rank, critical incident performance, and awards received (e.g., medals). Thus divergent thinking, at least when scored with respect to the performance domain at hand, seems to be related to leader performance.

Divergent thinking of course represents a measure of one process involved in creative thought. In a second study in 2000, Connelly, et al. used a modified think aloud procedure to obtain measures of the other creative thinking processes: (1) problem definition; (2) information gathering; (3) concept selection; (4) conceptual combination; (5) idea generation; (6) idea evaluation; (7) implementation planning; and (8) monitoring. Again, these measures were administered to army officers. It was found that effective process execution was positively related ($r=0.40$) to attained rank, critical incident performance, and awards received. Moreover, these processing skills evidenced growth throughout leaders' careers. Thus the critical processing skills held to enhance creative thought all appear to contribute to leader performance.

In still another study, by Vincent and colleagues in 2002, the researchers used this sample of army officers to examine the effects of intelligence, divergent thinking, and expertise on effective execution of these processes. Process execution was found to influence leader performance. Intelligence, divergent thinking, and expertise, however, influenced effective process execution. These findings are noteworthy because they indicate creative thinking processes influence leader performance even when other capacities are taken into account.

Creative thinking processes, however, may be executed based on a number of different knowledge structures – associational, schematic, and case-based or experiential. In 2007, Mumford et al. argued that leader cognition is typically developed from case-based knowledge. Case-based knowledge is particularly useful for leaders because cases provide models that guide action. By the same token, case-based knowledge structures are highly complex including information bearing on goals, causes, outcomes, restrictions, and contingencies. The complexity of case-based knowledge is noteworthy because it implies that the strategies employed in working through leadership problems may be different than those applied in other fields. As a result, while creative thinking is required of leaders, the strategies used in creative thinking may be specific to this domain.

Creative Thinking Strategies

In 2002, Mumford examined the cognitive strategies that contribute to creative thinking by leaders. These initial studies, primarily qualitative in nature, examined the thinking strategies employed by leaders responsible for historically

noteworthy social innovations such as Benjamin Franklin (e.g., public libraries, nonsectarian universities) and Frederick W. Taylor (e.g., efficiency studies, business management). Broadly speaking, the findings obtained in these qualitative studies indicated that creative thinking by leaders is often founded in case-based knowledge. More centrally, however, the findings emerging in these studies indicate that at least four unique strategies are evident in the creative thinking of leaders: (1) causal analysis; (2) forecasting; (3) network exploration; and (4) opportunistic integration.

In complex social systems critical causal variables guiding action are uncertain. Thus, analysis of causes embedded in cases and identification of causes to be manipulated is likely to be critical to effective leadership and creative thought. In a 2007 study intended to examine the influence of causal analysis to the solution of leadership problems, Marcy and Mumford trained undergraduates in causal analysis strategies likely to improve leader performance. For example, undergraduates were trained to think about causes having large effects or causes influencing the attainment of multiple goals. They found that causal analysis training resulted in the production of high quality and more original solutions to six social leadership problems (e.g., a bank merger, change in marketing strategy, and reorganization of a research and development unit). It was found not only that causal analysis training contributes to the production of higher quality and more original solutions to these leadership problems, but also that the effects of training were moderated by task conditions, for example, a deliberative versus implementation mindset, held to moderate causal analysis.

In another study along these lines that is currently in press, Marcy and Mumford asked undergraduates to work on an online leadership simulation task – decisions made as a university president. Objective performance scores were obtained as they worked on this task along with other measures reflecting attributes commonly held to underlie leader performance. Again, study participants were given training in causal analysis. Not only was it found that causal analysis training contributed to performance on the simulation task, but also such training resulted in the acquisition of stronger mental models for understanding the demands imposed by the leadership task.

One reason causal analysis is important to the creative thinking of leaders is that it permits better forecasting of the outcomes of various actions taken as a leader. However, forecasting also provides a basis for revising action plans – thus proving particularly important to leaders. In an initial study examining the impact of forecasting on creative problem-solving, Byrne, Shipman, and Mumford (in press) asked undergraduates to assume the role of marketing director developing a plan for advertising a new product. Participants were asked to generate ideas, forecast the implications of these ideas, and provide a marketing plan. Responses to the forecasting question were content analyzed by judges with respect to 27 variables (e.g., specificity of outcomes, considering obstacles, anticipating changes in restrictions). It was found that the extensiveness of forecasting contributed to the production of higher quality and more original advertising plans.

In another study along these lines, also currently in press, Shipman, and coworkers asked undergraduates to assume the role of principal of a new experimental school. They were

asked to prepare a speech to be given to students, parents, and teachers describing their vision for this new school under the assumption that effective vision articulation is critical to leader performance. Forecasts were obtained from an exercise presented prior to vision formation. It was found that the extensiveness of forecasts was positively related to the production of higher quality, more original, and more evocative vision statements.

One way leaders appraise their analysis of causes and their forecasts is by obtaining feedback from others. The need for feedback, however, implies that effective leaders may capitalize on their network of social relationships. In other words, they know the right person to talk to at the right time. These findings have led scholars to argue that the strategies leaders use in thinking about and exploiting social networks will also influence the quality and originality of the solutions they produced to leadership problems.

A fourth, although certainly not the final strategy, that might contribute to leader's creative thinking is opportunistic integration. Leaders encounter a variety of rapidly unfolding problems in the course of their day-to-day work. Accordingly, it seems plausible to argue that an explicit search for shared elements of these problems in an ongoing, opportunistic, fashion may represent an important influence on creative thinking by leaders. Although direct experimental evidence bearing on the merits of opportunistic integration in leaders' creative thinking is not available, qualitative studies provide some support for the potential value of this strategy. For example, in 2002, Mumford conducted a qualitative study of Franklin's social innovations. In many of these cases, for example, the establishment of fire departments, one sees a careful delineation of key causes. These causes, however, were events that Franklin encountered in his role as a newspaper editor. Thus it appears that the idea of establishing volunteer fire departments arose from opportunistic integration of these prior life events.

Conclusions

When one considers our foregoing observations with regard to the nature of creative leadership and the leadership of creative efforts two clear conclusions emerge. First, to lead effectively people must possess creative thinking skills. What should be recognized here, however, is the knowledge structures leaders apply in their creative thinking may not be identical to those employed in other domains. More specifically, leaders rely on case-based, or experiential, knowledge in solving problems that call for creative thought. Leaders' use of case-based knowledge, in turn, gives rise to a unique set of strategies that contribute to leaders' creative thinking. Clearly, research is needed to produce a more thorough analysis of these, and other, strategies that might contribute to leaders' creative thinking. In part, such research is useful because it might provide needed guidelines for the development of leaders' creative thinking skills.

Second, leadership does appear to make a difference with regard to the success of creative efforts. Leaders exert influence on these efforts through two mechanisms. One set

of mechanisms, technical skills, evaluation and direction, mission definition, planning and structuring, motivation, climate definition, and team formation, reflect a focus on the group doing creative work. The other set of mechanisms, championing, strategic planning, scanning, decision-making, and conflict management, reflect an outward focus where leaders must manage relationships with the organization.

What should be recognized here, however, is that leaders cannot treat inward and outward foci as separate, distinct, tracks. Rather inward and outward leadership activities must be integrated for leaders to exert positive effects on others' creativity. The need to integrate these inward and outward foci imply that creative thought will be required of those who lead creative efforts. We hope that the present effort will provide an impetus for a more thorough analysis of creative thought by those who lead creative work – for these are the individuals who will shape the world we all live in, not just today, but tomorrow.

See also: Birth Order; Business/Management; Eminence; Genius and Greatness.

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Life Stages of Creativity

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Glossary

Effective productivity A subset of the total number of things created by an individual that have, according to some selective criteria, been assigned important intellectual or other value.

Novice effect The phenomenon in which entering a new discipline by changing fields appears to provide an individual with a new burst of creativity.

Persister A continuously creative individual or one who continues to be creative within a discipline beyond the usual age of other people in that discipline.

Polymath An individual who displays creative ability in multiple disciplines.

Swan song The final and often benchmark work created by an individual.

Ten year rule The observation that it takes about ten years of training before an individual can contribute creatively to a discipline.

Total productivity The total number of things created by an individual over a given period of time.

Worldplay The invention in play of an imaginary world, which a child or adolescent may document in multidisciplinary manner, thereby developing a wide range of creative skills.

Introduction to Life Stages of Creativity

Mathematician Leonard Euler, one of the most important and prolific mathematicians who ever lived, discovered his gift for mathematics when he was just a few years old and spent the rest of his life exploiting his talent. Amadeus Mozart and Pablo Picasso also discovered and developed their artistic talents at very young ages and focused their abilities single-mindedly on their professions thereafter. Conversely, Hans von Euler-Chelpin went to college to become an artist, got captivated by the science of color theory, switched majors to physical chemistry and became a Nobel prize-winning chemist. Fellow Nobel laureate (in Physiology or Medicine) Harold Varmus completed college as an English major and editor of the university newspaper before a trip to a scientific conference with a scientist friend opened his eyes to the possibilities of biomedical research. Having succeeded as a scientist, he switched gears again to become a successful politician, heading the National Institutes of Health. Yet another Nobel laureate, Roger Guillemin, traversed the opposite path, training as a physician, switching to physiological research, becoming captivated by the artistic potentials of early computer visualization programs, and finally leaving science to become one of the founders of electronic art. The engineer John R. Pierce managed his multiple interests concurrently instead of serially. Pierce invented satellite communications at Bell Labs while establishing a simultaneous career as a successful science fiction writer under the pseudonym 'J. J. Coupling.' In addition, he produced the first computer-synthesized music and, when he retired from Bell Labs, moved to Stanford University as Professor of Electronic Music.

These exemplars suggest that creativity may be expressed exclusively or dominantly in one way throughout an individual's life or in many different ways at different stages of an individual's life. Surprisingly little is known about life stages of creativity other than the waxing and waning of productivity within a single profession with age. This essay reviews the creativity-and-aging literature but also attempts to outline

how creativity (both personal and professional) may wander productively and effectively among and between disciplines over the course of a lifetime.

Types of Creative Productivity

It is easiest to study how a person's creativity changes over time within a single discipline, so we begin with this aspect of creative life stages. Creativity productivity, at least within specific professions, tends to vary with age in reasonably predictable ways. Two different types of productivity are often measured, one being 'total productivity' and the other 'effective productivity.' Total productivity is defined as the total number of professional creations a person generates during any given period of time. These creations can be books or articles published, paintings painted or exhibited, musical pieces composed, sculptures completed, novel processes patented, or widgets manufactured. The assumption underlying the measurement of total productivity is that every creation is of roughly equal value or importance as an indicator of creative thinking and energy. Effective productivity, in contrast, employs selective criteria to rate the value of the products. Not every painting by an individual is as good or as important (to the individual or to the art community) as every other, and a similar statement can be made of individual creations in every field. Effective productivity is a measure of the most important contributions an individual makes, and thereby separates the metaphorical wheat from the chaff. Effective productivity can be measured by varied means including number of historical references to a creation, whether it is still exhibited, performed, or used (i.e., whether it has stood the test of time), its 'impact' (e.g., how many people cite the work over a given period of time), and so forth.

The kind of contribution, as well as its quality, is also important in considering creative productivity. The creative process has many facets and an individual may be active in

one facet at one time in her career and switch to another facet later on. A composer, for example, may invent a new musical form or a new tonal scale early in his career (the innovation) but produce the most developed piece using that innovation only late in his career (the exemplar). Thus, it can be important to distinguish between the age at which some types of creativity (such as problem-recognition and inventiveness) are manifested and the age at which other types (such as applications or the production of exemplars) come to the fore.

Various trends in total productivity and effective productivity characterize different disciplines. Those in mathematical fields such as physics and economics are often told, with some justification, that if they have not made an important contribution by the time they reach age thirty, they never will. The mathematical sciences are, it is said, a young person's game. The same is said to be true of music and poetry.

Experimental and experiential disciplines, however, often have a very different age profile. Among experimental biologists and empirical economists, for example, major contributions are most often made during a person's fifties. While the invention of new musical forms and new types of art are usually made by young artists, the greatest works of most composers, playwrights, and painters are usually among their last. These observations suggest that there is a difference between creativity that is highly rule-bound and involves mainly theoretical or conceptual insight and creativity that involves acquisition of experience and extensive integration of facts and ideas.

Age and Creativity

Nearly all of the literature that exists concerning creative productivity, whether total or effective, as a function of age agrees on several basic points. First of all, children are often personally creative, but very rarely professionally creative. Mozart, it is true, began composing before he was ten, but it has recently been demonstrated that his pre-teen compositions are mainly copies, sometimes with small modifications, of the compositions of other musicians. They have little or no originality. Picasso certainly produced many drawings and paintings as a child (as do many children), but none of these break with traditional subjects, materials, or forms. What set Picasso's artwork apart from that of the average child was the range and excellence of his technical mastery.

All creative individuals must acquire technique and achieve content mastery. Creativity, in this regard, tends to be discipline-specific. Chase and Simon suggested that content mastery requires, in general, about a ten-year apprenticeship before significant contributions can be made by an individual (a concept later termed the 'ten year rule' by Hayes, Weisberg, and others). Children and adolescents are usually, though certainly not always, exposed to many possible creative activities that range from arts and music to literature, poetry, acting, dancing, crafts, sciences, and mathematics. Depending on opportunity, temperament, and reinforcement, they may choose to explore some or all of these within formal and/or informal educational environments or as part of organized or self-choice play. Creative skill sets developed through education and play often influence the choice of one or more professions. Because

childhood and adolescence are periods of creative exploration, most people do not begin serious training for a creative career until they are young adults, with the result that disciplinary creativity is seldom demonstrated until maturity. The major exception are prodigies, children with developed talents at near-adult levels. The younger people begin formal training for a profession, the earlier they are likely to be able to contribute to a field. For this reason, prodigies such as Mozart and Picasso had a jump on other people who begin to learn their discipline at a later age. There is no evidence, however, that learning a discipline at a later age alters the probability that an individual will make a creative contribution. Indeed, most prodigies do not become creative contributors to their disciplines and numerous 'late bloomers' exist (see below).

Because there is an extended period of skill and knowledge acquisition in every field, creative productivity, in the sense of effectively novel innovations, begins in nearly all disciplines no earlier than the teens and twenties. Total creative productivity within individual professions rises to a statistical peak sometime between the thirties and fifties for most individuals in most disciplines. Productivity then declines with age. Overall, the form that creative productivity takes can best be described by what is often known as a 'normal' or 'Poisson' distribution (see Figure 1).

Women have, historically, been less productive than men in terms of professional activities – undoubtedly due to social and cultural factors – but the productivity of women as they age follows exactly the same trend as that observed in men. Indeed, choice of discipline has a greater influence on productive aging than gender. People in the arts and literature have longer effective careers than the typical person in the sciences, for example.

The most comprehensive study of these phenomena was undertaken by Harvey Lehman in his 1953 book *Age and Achievement*, which remains a classic. Lehman focused most of his attention on effective, rather than total, productivity. Most studies subsequent to Lehman's have validated his general findings.

Lehmann clearly demonstrated that although the effective productivity curve is similar for nearly all creative endeavors, it begins, peaks, and tails off at different ages by discipline. On the one hand, he found that both mathematics and poetry are young peoples' games, with significant contributions beginning in early teenage years and peaking in the mid-twenties. Novel writing, playwrighting, and psychology, on the other hand, are the domain of more mature individuals, with effective productivity peaking in the mid-forties. Bridging these two opposing patterns, the productive pursuit of chemistry, as measured by the overall number of papers published and the most significant papers published, begins to manifest in the scientists' late teens, peak in their thirties, and tail off toward nil at around age 70. Similarly, productivity in the biological and medical sciences tends to begin in the early twenties, peak in the late thirties or early forties and tail off more slowly thereafter. Peak total productivity is reached in art and architecture in the late thirties and early forties. In these fields a similar peak is seen in effective productivity, but because effective productivity tends to be spread out chronologically much more evenly than overall productivity, paintings by 45-year old artists and 80-year-old artists are about equally likely to be considered exemplary.

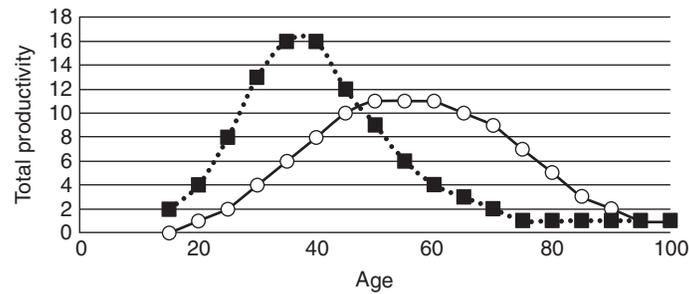


Figure 1 'Total productivity' is the number of things an individual creates (e.g., paintings, compositions, poems, mathematical proofs, scientific papers, etc.). Total productivity curves for all disciplines follow a general Poisson or normal distribution. In very few fields is it possible for an individual to make a creative contribution to the profession before the later teen years because it takes time to master content and skills. Some fields that are highly rule-bound with very clear criteria of excellence, such as mathematics, physics, dance, and poetry tend to have peaks at early ages, while other fields that rely more on experience and judgment, such as biology, playwrighting, history, and literature, tend to have peaks at middle age. For most people, total productivity declines with old age.

Lehmann looked at productivity measures in other disciplines such as business and politics as well, showing that peak incomes tend to be achieved at around age 60 and highest political office in a person's seventies. It is important, as Lehmann himself points out, to adjust all data concerning productivity at older ages for the increase in mortality that occurs with increased age. While mortality has little effect on productivity curves for disciplines in which the peak is reached very young, it has a very significant effect on disciplines in which the statistical peak is reached in later years. For example, the total number of 85-year-old millionaires is not much higher than the number of 25-year-old millionaires, but the probability that an 85 year old will be a millionaire is many times greater than that of the 25 year old simply because there are many 25 year olds in the population and few 85 year olds. Thus, an increasing number of studies have shown that *age-adjusted* productivity tends to remain reasonably constant in many fields. The phenomenon of apparently decreasing productivity with age can partially be accounted for by decreasing numbers of practitioners at older ages. Those who continue to create into old age tend to be very effectively productive. Those who are not effectively productive tend to leave the field altogether.

Indeed, Dean Keith Simonton, foremost expert on creativity and age, has noted what he calls the 'swan song' phenomenon among composers, which Lehman documented in other disciplines as well but without noting its importance. The swan song phenomenon consists of elderly individuals, often those facing death, who create their final gift to humanity. As with Mozart's *Requiem* or Beethoven's *Ninth Symphony*, this penultimate creative effort is more often than not remembered as the individual's most important. Lehman's and Simonton's effective productivity curves therefore show a significant upturn past the age of 70 in many disciplines. These works are rarely innovative, in the sense of introducing novel concepts or techniques, but often represent the best exemplars of a person's mature work.

Some loss of productivity with age appears, however, to be real. Studies of individual research careers in science and technology have clearly shown that total productivity peaks in the early decades and tends to diminish with age. Thomas Edison, for example, had his name on 1093 patents. He filed his first patent at the age of 20, reached the peak of his productivity at

the age of 35 when he filed some 50 patents in a single year, went through a period in which he filed no patents during his late forties, and then reached two plateaus at about 10 patents per year during his fifties and early sixties, with a handful of patents per year through his eightieth year. He filed his last patent at the age of 82. Edison's most important patents in terms of their long term impact on society fell mainly during the peak of his total productivity. Many studies have confirmed that Edison's career is typical of most scientists and inventors. Economists and policy makers are justifiably worried that as the general age of the scientific population increases over the next few decades, both real and effective productivity overall will drop.

Quantity of output is not directly related to quality, although limited evidence suggests that longer creative life-spans may result in a greater probability of producing important work. While Edison was the most prolific inventor in American history, and Picasso the most prolific artist in history, many prolific individuals are almost unknown. For example, the most published computer scientist in the world today has, according to citation analysis, never published a paper considered by his colleagues to be of any value. Georges Simenon published over a thousand novels, but only a handful are considered by critics to be worth reading. Similarly, the most prolific composer of symphonies – one Melchior Molitor (1696–1765) – left us 170 of these pieces (and hundreds of others), none of which are part of the modern orchestral repertoire. Franz Joseph Haydn, on the other hand, wrote 108 symphonies, many of which continue to be played today.

At the other end of the productivity scale, Joseph Heller, author of the classic *Catch 22*, experienced a 20-year period of writer's block following the extraordinary success of his novel. Borodin produced only a handful of orchestral and chamber works, yet all of these remain in the modern repertoire. Gregor Mendel's total output was a mere seven papers written in a ten-year period as a young man, yet these papers sufficed to create a revolution in genetics. Thus, effective productivity can almost be completely divorced from total productivity. In fact, one study of scientists demonstrated that most scientists have very little impact on their field as measured by citations to their papers; the impact of the remaining scientists was mainly limited to two or three papers published within a five year

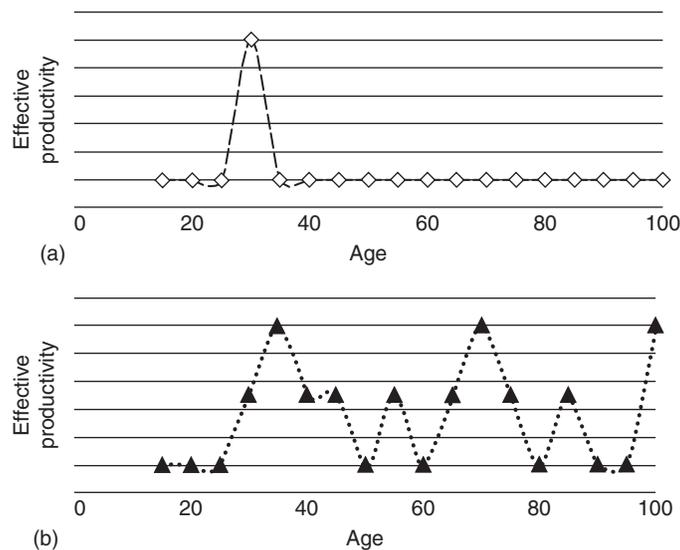


Figure 2 'Effective productivity' is the measure of the most important (measured socially or professionally) things an individual creates. Effective productivity is rarely correlated directly with total productivity (Figure 1). Most creative people have effective productivity profiles that look like A (the upper portion of the figure), in which there is a single spike of effective products appearing within a short space of time (a few years). 'Persisters,' polymaths, and field changers, in contrast, often have effective profiles more like B (the lower portion of the figure), in which effective products appear in short, repeated bursts as new styles, techniques, subjects, or fields are explored (see discussion of the 'novice effect').

period of time; while a very small minority of scientists, comparable to Haydn in music, maintained a very high output of very high impact papers throughout their careers (see Figure 2).

Not all creative people remain within a single discipline, however, which means that the stages they proceed through can differ significantly from those of people who do. Chemist-composer Aleksandr Borodin provides a good example. His total output in both fields was low, yet it was of uniformly high quality and impact. It is clear from reading his biographies that while each vocation interfered with the total productivity of the other, yet each activity in some ways also fed the other. This multidisciplinary interaction is particularly notable in the career of biologist Desmond Morris, who has successfully integrated three vocations: research ethologist, science popularizer, and Surrealist painter. Current approaches to measuring productivity would make Morris' career appear in any single vocation as a series of punctuated bursts of activity, whereas an examination of his total and effective productivity across all his activities shows it to be very high and continuous. The metamorphosis of the child-actress Shirley Temple into international ambassador Shirley Temple Black presents similar difficulties. Her productivity as an actress and as an ambassador are totally distinct in both nature and time, yet she was never uncreative. Further theoretical and empirical research will be needed to properly come to terms with such multifaceted people.

Exceptions to the General Trends

The examples of Borodin, Morris, and Temple Black lead to the conclusion that exceptions exist to the general lifetime productivity trends. As the Introduction suggests, such exceptions are fairly numerous and provide interesting insights into the trans-disciplinary factors at work in creative lives. The most notable

of these exceptions are prodigies, late-bloomers, 'persisters,' polymaths, and field-changers.

Prodigies are people who exhibit an unusually developed ability at an unusually young age. They are clearly recognized in fields characterized by very rigid rules or techniques such as musical performance and composition, chess, mathematics, logic, and sometimes poetry. Children excelling in these fields demonstrate technical mastery on a par with professional adults. Some prodigies also demonstrate productive mastery in the sense of creating new compositions or proofs even before reaching adolescence. The existence of prodigies in other fields such as art and literature is more controversial, especially where technical and/or productive mastery tends to be experience- rather than rule-based. Some consider Shirley Temple and Mickey Rooney to have been prodigious talents in the field of acting; they certainly performed with and for adults, as many musical and chess prodigies have done. It is less clear that early talents in the field of literature qualify as prodigies. Although more than a few people have written novels by the time they are sixteen, as both Jane Austen and Georges Simeon did, most of these remain unpublished juvenilia – without an adult audience and not competitive with adult creators. *Eragon* (2003), a fantasy novel written at age 15 by Christopher Paolini, is the rare exception. In general, literary writing, like great art, requires matured experience. For much the same reason, prodigies also seem to be absent from the experimental sciences, medicine, history, philosophy, psychology and other humanities in which the peak age for effective contributions is in middle age or later.

No matter the field of endeavor, status as a prodigy does not correlate with overall creative success. Lifetime productivity among prodigies ranges the gamut from extraordinary (e.g., Mozart, Herbert Spencer) to nearly nil. For example, in 1910 Harvard University was home to five undergraduates under the age of 16, all of whom had been recognized as infant prodigies

in music or mathematics: W. J. Sidis, A. A. Berle, Cerdric Wing Houghton, Roger Sessions, and Norbert Wiener. Sessions became an important and productive composer. Wiener, after many vicissitudes, moved from mathematics to writing and publishing and eventually founded the new science of cybernetics (feedback control systems) in middle age. Berle and Houghton went on to have unremarkable careers. And Sidis, a brilliant mathematician, became one of the youngest professors in the country – only to experience a total collapse shortly afterwards. He spent the vast majority of his life in penury, unable or unwilling to hold a job.

A more recent study of Science Talent Search winners, many of whom are extraordinary in publishing original scientific papers or obtaining patents as high school students, shows similarly diverse outcomes. Some of these young scientists go on (at unusually high rates) to become Nobel Prize winners, but over half leave science during college. Thus, in terms of their future *scientific* productivity, their early, near-prodigious work is actually of lower predictive value than is simply being a science major in college. Unfortunately, there have been no follow-up studies of Science Talent Search winners to determine whether those who move out of science end up being productively creative in other disciplines such as the arts, music, literature, etc., or whether these individuals opt for noncreative jobs.

Late-bloomers are at the opposite end of the age spectrum from prodigies. They are people who make a creative ‘splash’ during their middle or later years, not because they have struggled for decades to become successful, but because they do not begin a creative career until an unusually advanced age. Examples in the arts include Vincent Van Gogh and Paul Cezanne, who only took up art in their thirties and forties; Louise Nevelson, who came to sculpture in her forties after trying and abandoning half a dozen other arts; Grandma Moses, who did not take up painting until age 76 and continued to produce paintings till her death at 100; and Laurence Sterne and Edith Wharton, who began writing novels in their forties. Even in science a few late bloomers have risen to stardom, including two Nobel Prize winners, William Henry Bragg, who did his first original experiment at the age of 40, and Sir Francis Crick, who received his Ph.D. at the almost unheard of age (especially for a physicist) of 36! As would be expected in light of the ‘ten year rule’ – and given delayed start – the age at which late-bloomers begin to make substantial creative contributions to their discipline is usually significantly greater than colleagues who found their vocation at a younger age. Crick, uncharacteristically in this regard, was still a scientific novice working on his doctoral dissertation at the time he and Watson solved the structure of DNA.

Late-bloomer or not, Lehmann’s, Simonton’s, and Root-Bernstein’s research shows that most creative people tend to make their most important contributions in a single short burst of important work. ‘Persisters’ represent one of the most interesting exceptions to this general trend. Persisters make high-impact (effective) contributions to a discipline over an entire lifetime. Playwright George Bernard Shaw exemplifies the type. He died at age 94 having completed several well-known plays in his nineties. Stanley Kunitz, twice Poet Laureate of the United States, was also an enduring influence on his contemporaries, writing and publishing well-received work from the

1930s until 2005, the year before his death at nearly 101 years of age. Other examples include Pablo Picasso, who was still innovating in his eighties, and Guiseppe Verdi, who composed some of his best operas in his seventies and eighties. Dancer-choreographer Martha Graham, who came to dance at the relatively late age of 22, continued to perform her own dances up until the age of 76; over the next 20 years, she choreographed ten additional ballets, composing her last piece at the age of 95. Similarly, Felix Horowitz was still performing virtuoso piano pieces in his nineties, as was jazz pianist Eubie Blake. The Romanian pianist Cella Delavrancea (1887–1991) gave her last public recital at the age of 103. And Elliot Carter, mentioned in the Introduction, is still composing at 101.

Persisters also exist in mathematics, the sciences, and engineering, subjects in which most practitioners lose both total and effective productivity by middle age. Henri Poincaré and Paul Erdos are unique among twentieth-century mathematicians in having made a major contribution to every major area of mathematics, an achievement that, not surprisingly, took them each a lifetime. Mathematician Donald Coxeter produced some of his greatest insights into the geometries of infinite spaces during his eighties and nineties, continuing to present original papers at conferences until he was 97. Perhaps the most amazing example of a scientific persister is the eighteenth century mathematician Leonard Euler, a man so prolific that his novel contributions were still being put to press for the first time 50 years after his death. His total output consists of more than 75 volumes of original mathematics.

Analysis of persisters in mathematics and the sciences has yielded the unexpected observation that such people tend to be either polymaths or field-changers. Polymaths excel in more than one field, often simultaneously; field-changers commit themselves with great intensity to one discipline at a time, but only for a decade or so before moving on to another. Several studies have shown that the concurrent activities pursued by polymaths increase overall individual productivity as well as the probability of achieving a high degree of effective productivity. Thus, scientists who work on several research projects concurrently, have multiple consulting jobs, and are actively engaged in one or more creative hobbies far outstrip their more focused colleagues in measures of both total and effective productivity.

Field changers also tend to have greater overall and effective productivity compared with individuals who stay within their area of expertise. Many very successful scientists have stated that they change fields regularly and on purpose to stimulate new ideas. Similar strategies are apparent in the lives of continuous innovators in the arts. Picasso changed styles or moved into new media such as linoleum prints, sculpture, lithography, ceramics, and so forth about every five years. In the sciences, Nobel laureate Luis Alvarez took the unusual step, after an extended period during which he had no interesting research ideas, of apprenticing himself to two of his graduate students in order for *them* to teach *him* the intricacies of a newly emerging field about which he knew nothing. As he recounted in his autobiography, creative energy and creative ideas both returned. This phenomenon has been termed ‘the novice effect.’

The principle behind the novice effect is that a person is ‘allowed’ only one fundamental innovation or conceptual

insight per area of expertise or per artistic style and that this insight is most likely to occur within a decade of entering the field. The novice effect therefore helps explain why mathematicians must make a breakthrough by the time they are thirty or lose all hope of doing so. It also helps explain why major innovations in the arts, such as Arnold Schoenberg's 12 tone scale or Wassily Kandinsky's nonrepresentational art, are usually made by youngsters while exemplary works are the products of maturity.

The novice effect has its corollary: the fact that a person has made a creative breakthrough does not predict future creativity *within the same field of endeavor*. Past creativity demonstrates only that a person has the *ability* to discover or invent. Indeed, analysis of the careers of scientists who made a notable contribution in one area and stayed within that specialty for the rest of their careers showed that these individuals never made another significant breakthrough as measured by peer evaluation or citations to their work. This failure to be *continuously* effectively productive occurred even for scientists whose total productivity remained high and despite the receipt of awards such as Nobel Prizes that gave them high professional visibility. Only scientists who had multiple, concurrent research projects, or who regularly changed fields, showed continuous *effective* creativity (see Figure 2).

Toward a Typology of Creative Life Stages

One of the problems facing those who study the life stages of creativity is how to integrate the various types of data summarized above. Such an integration requires taking into account the 'ten year rule' for acquisition of skill and knowledge before creativity is likely to be manifested; the observation that both total and effective creative productivity obey Poisson distributions that peak at representative ages dependent on the profession and the conceptual or empirical nature of the work; and the various exceptions to these general rules that involve the

novice effect, persists, late bloomers, polymaths, and other unusual manifestations of creativity. We suggest a typology consisting of six more or less distinct trajectories through a creative lifetime: (1) early specialization, single mature focus; (2) early breadth, mature focus; (3) early breadth, mature breadth; (4) early specialization, mature breadth; (5) early specialization, serial mature foci; (6) early breadth, serial mature foci (see Figure 3).

1. *Early specialization, single mature focus.* Early specialization followed by a single mature focus is a common pattern for creative people. Euler, Mozart, and Picasso provide examples. Each was recognized as having a great deal of talent early in childhood, was given very focused education to develop that talent, and chose to remain throughout his creative career within the discipline for which he had been trained. This type of focused education and professionalism is very common among dancers, composers, musical performers, mathematicians, and other practitioners of disciplines with well-defined content, rules and techniques in which prodigies can be identified.
2. *Early breadth, mature focus.* Many creative people do not manifest early talent, finding their true calling only after exploring several possibilities. Composer Elliot Carter is a good example. Although he began playing an instrument as a child and displayed an active interest in composing, he went to university as an English major. Even after obtaining his Ph.D. in music and a job as a composer for an opera troop, he took a position as a professor at St. Johns College in Annapolis teaching math, physics, and Greek literature as well as music. Only in his early thirties did he devote himself fully and completely to musical composition. A similarly broad-to-narrow path characterized the life of Lejaren Hiller, Jr. as well. Hiller found himself torn between music composition and chemistry, taking courses in both during college. Even while obtaining his doctorate in chemistry, he took music composition classes with eminent

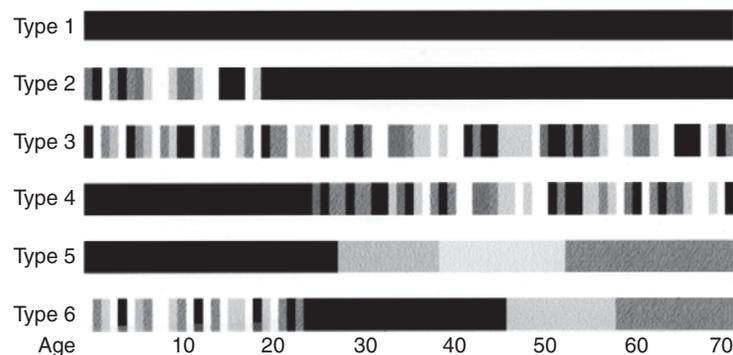


Figure 3 Six typologies of creative life stages. These typologies are generalized abstractions based on schematic representations of real creative production records first published by Root-Bernstein, Bernstein, and Garnier (1993). The different shades of black, white, and gray represent different types of creative activities that may be spread across a variety of arts, music, literature, sciences, etc. Type 1 represents people who specialize in developing one major talent early in life (e.g., prodigies) and successfully exploit that talent exclusively for the rest of their lives. Type 2 individuals explore a range of different creative activities (e.g., through worldplay or a variety of hobbies) and then settle on exploiting one of these for the rest of their lives. Type 3 people are polymathic from the outset and manage to juggle multiple careers simultaneously so that their creativity pattern is constantly varied. Type 4 creators are recognized early for one major talent (e.g., math or music) but go on to explore additional creative outlets, diversifying their productivity with age. Type 5 creators devote themselves serially to one creative field after another. Finally, Type 6 people develop diversified creative skills early and then, like Type 5 individuals, explore these serially, one at a time. Note that each of these patterns represents very successful types of people. No value judgment is intended by the ordering or numbering of these types or in the ways that they are represented.

composers such as Milton Babbitt and Roger Sessions. His first job as a dye chemist for Dupont involved modeling chemical processes with the first industrial computers; he soon began computer modeling of musical composition as well. Cultivating this unique combination of interests as a professor of chemistry at the University of Illinois, he also earned a masters degree in music. At the age of 34 he finally quit chemistry and, as founder of the Experimental Music Studio at the University of Illinois, committed himself fully and exclusively to music. He is now recognized as the inventor of computer-generated composition.

Many creative people have had to make the kinds of choices Elliot and Lejaren made. The Nobel prizewinning physicist Max Planck was torn in college between becoming a professional pianist, an economist, or a physicist. He gave up economics and kept music as his avocation. Similarly, the internationally prominent writer Vladimir Nabokov evinced an equal passion for literary art and for the study of butterflies. Early in his career he actually worked at the Harvard Natural History Museum classifying Lepidoptera; once he obtained a position as a professional writer, however, he relegated his butterflies to avocational status.

3. *Early breadth, mature breadth.* Sometimes the breadth exhibited by a young Carter, Hiller, Planck, or Nabokov does not resolve itself into devotion to a single profession, but rather leads to multiple simultaneous careers. An extraordinary example is Sofia Kovalevskaya, a late nineteenth-century Russian mathematical prodigy who became a world-renowned mathematician, and was also recognized by her early twenties as one of the most significant poets and playwrights of the period. Kovalevskaya produced mathematical papers and treatises along with poems and plays until she died prematurely of influenza at the age of 41.

Such dual careers are not uncommon historically. The inventor George Washington Carver learned as a child how to knit, crochet, make lace, weave, sew, draw, and carve – all of which served him well in his profession. He was also a painter throughout his life, winning a number of prizes at international art shows such as the Chicago World's Fair. This talent also held him in good stead as an inventor, for one set of inventions involved devising new materials for the making of oil paints and their pigments which he first used in his own paintings.

4. *Early specialization, mature breadth.* Sometimes creative individuals are recognized and groomed early for a particular talent, but find the time and inclination to branch out after they have established reputations in that primary field. A good example is the physicist Richard Feynman, who exhibited extraordinary mathematical ability as a child. Only after he had established an international reputation as a physicist did he begin to 'play' (his word) with a wider range of other activities, some within science and some outside of it. Within science, he constantly changed fields, explicitly employing the 'novice effect' to stimulate new creative ideas. During his late twenties, he took up bongo drumming, achieving near professional skill by his forties. During his forties, he took up painting, and acquired sufficient skill to sell his artwork under a pseudonym during his fifties and sixties. He told one interviewer that he would

consider becoming a professional artist if he ever ran out of scientific ideas. He never did.

Gordon Parks had a similarly diversifying career. He first came to prominence as an internationally recognized photographer. By his late thirties and forties, however, he began to branch out into multiple, concurrent careers as a musician, composer, poet, novelist, journalist, activist, film director, and painter. Many of these endeavors involved a synthesis of talents; in 1969, at age 57, he stormed the gates of Hollywood, writing the screenplay adaptation of his autobiographical novel, *The Learning Tree*, composing the film score and directing the film. He parlayed this success into a movie career as director of the 'Shaft' movies, yet also managed to perform and record original musical compositions, to choreograph a ballet, publish poetry and several novels, and at the end of his life exhibit oil paintings.

5. *Early specialization, serial mature foci.* It is probably more common for people to specialize serially than to attempt multiple careers simultaneously. Nevil Shute, the best-selling author of *On the Beach* and *The Far Country*, was actually trained as a mechanical engineer and spent the first 20 years of his professional life designing aircraft and other mechanical devices. He turned to writing professionally only in middle age. As noted above in the cases of Harold Varmus (literature to biomedical research) and Hans von Euler-Chelpin (art to physical chemistry via color theory), some people only discover by chance where their interests lie and make major changes in the nature of their professional training.
6. *Early breadth, serial mature foci.* Some people take creative career paths that mediate between the extremes of complete specialization and simultaneous multiple careers. These people often develop a broad range of talents as children and young adults but choose a single career path in order to obtain financial or personal security; achieving success they then set out to find new challenges. Roger Guillemin, who was mentioned in the Introduction, provides an example. Guillemin was raised in a well-to-do family in France and given every educational advantage, including a good foundation in drawing, painting, and music, as well as in literature and the sciences. He chose to train as a physician, but later became a biomedical researcher. Throughout his career, he continued to enjoy music and to paint in watercolors occasionally, but merely as pastimes. When he obtained a computer capable of performing drug design for his research, he recognized the potential of the programs to also design art and began toying with the possibilities. After an illustrious scientific career culminating in a Nobel Prize, he retired to become one of the founders of electronic art, which now consumes the greatest part of his creative passion.

How Common Are Different Typologies of Creative Life Stages?

How common are these different typologies of creative life stages and strategies? Unfortunately, no formal studies exist to answer this question. No reliable studies have been performed to estimate the number of prodigies that exist in any discipline. No reliable studies exist to describe the distributions

of creative *potential* (as opposed to IQ and other standardized test scores) during childhood and adolescence. We cannot, therefore, estimate with any degree of confidence how many precollege individuals actually exhibit or develop creative talent, whether singly- or multiply-focused.

Various studies, however, suggest some generalizations that may eventually prove to be useful. Prodigies are, by definition, rare. Some research has been put into identifying prodigies and studying their development and potential; Feldman, in particular, clearly demonstrated that prodigious talent requires a co-occurrence of talent, desire, and opportunity that is not always present. Gagne argued that as many as 30% of the student population displays evidence of at least 'mild' giftedness in some type of academic endeavor, but it is not known how many of these develop or train that talent, or do so to the relative exclusion of other pursuits. Almost nothing is known about children who are multiply-talented. It is therefore difficult to say with certainty how great this pool of polymathic children may be. A close look at worldplay, a very complex form of make-believe among children and adolescents, suggests, however, that this pool may be salient.

Worldplay, which involves the invention of an imaginary world sustained over months or years, may in fact serve as a surrogate marker for generalized creative ability. In their most elaborate forms, the imaginary worlds of childhood resemble the Middle Earth that J. R. R. Tolkien explored in *The Hobbit* and *The Lord of the Rings*, replete with imaginary peoples, languages, lands and landscapes, maps, histories, literatures and all the rest. Most childhood play worlds are obviously less developed than this, yet it is not uncommon for the young creator to explore one or even some of these elements in combination: invented languages and imagined people actualized in oral or written stories, perhaps; or make-believe ecologies and geographies visualized in drawings and maps; or whole invented countries with political histories painstakingly recorded in play newspapers and ersatz government documents. The Brontë siblings' amply documented play in Glass Town, Angria and Gondal is perhaps the best known example on record.

Four important points emerge from the study of worldplay. First, somewhere between 3 and as many as 12% of the population may have invented an imaginary world in childhood, so the creative nurture it provides affects a conspicuous proportion of people. Second, that invention provides sustained experience with creative behaviors and creative process. Third, this experience tends to be trans-disciplinary, involving skills and interests that cut across the arts, humanities, social sciences, sciences, and technologies. Fourth, and finally, the creative behaviors learned in childhood worldplay appear to transfer to mature professional endeavors. A population of creative adults invented imaginary worlds in childhood at a significantly higher rate than average college students. The Brontë sisters parlayed their worldplay experience into mature creative impact as novelists. Connections between childhood worldplay and mature creativity are also evident for other individuals mentioned above, viz. Morris, Tolkien, and Paolini. In sum, there may be at least as many young people building general creative capacity for mature endeavor through free choice forms of complex play as there are prodigies preparing more narrowly for particular creative vocations.

Studies of creative adults also confirm that early breadth of creative activities can be just as useful a form of training as narrow specialization. A study of Nobel Prize winners in literature, for example, found that about 35% had an adult avocation involving a visual art, most often drawing or painting, and most of these had begun this avocation as a child or adolescent. Some of these polymathic individuals, such as Hermann Hesse, Rabindranath Tagore, Derek Wolcott, and Gao Xingjian, have maintained second careers as visual artists. Another 24% of literary Nobel laureates had formal training in college or beyond as scientists, engineers, mathematicians, or physicians, and were actively engaged in both writing and another profession concurrently. Thus, at least half of all literary laureates have had a serious, often professional, interest in some discipline other than that in which they have been most creative, suggesting that breadth of interest may be beneficial to building creative capacity and certainly is not detrimental to it.

Studies of Nobel prizewinners in the sciences yielded similar results. There is a highly significant correlation between success as a scientist (as measured by election to the British Royal Society, the US National Academy of Sciences, or receiving a Nobel Prize) and actively maintaining one or more arts, crafts, musical, or literary avocations as an adult. On average, less than one-sixth of average scientists have such avocations, while on average almost every Nobel laureate does. As noted above, some of these eminent scientists, such as Guillemin, have second careers as artists, or, in the case of fellow Nobel laureate (chemistry) Roald Hoffmann, as poets and playwrights. Such data suggest that examining only the professional productivity of very creative individuals often misses a very significant fraction of their creative output. Quantifying total creative output across life stages, especially when it ranges across several disciplines, remains a challenging problem.

Summary and Conclusions

In sum, there are many productive ways to navigate the life stages of creativity, each of which requires different strategies and each of which poses a different set of obstacles and opportunities. Creativity need not be limited to a single discipline though it certainly can be. Understanding one's personal creative style, range of talents, and opportunities for development can help one to navigate the stages most productively and effectively.

See also: Joseph Haydn 1732–1809; Pablo Picasso 1881–1973; Play; Women and Creativity.

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Logic and Reasoning

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Glossary

Categorical statement Statement of presumed fact.

Categorical syllogism Argument containing a major premise, a minor premise and a conclusion, each of which is a categorical statement.

Conditional statement Statement that is in, or can be put in, the form *If A then C*, where *A* and *C* represent *antecedent* and *consequent* respectively.

Conditional syllogism Argument containing a conditional statement as its major premise, and a minor

premise and conclusion, both of which are categorical statements.

Deduction Inference based on rules of logic.

Formal argument Argument expressed in a standard form, such as a categorical or conditional syllogism.

Induction Inference based on generalization from a sample to all members of a set.

Informal argument A set of claims, expressed informally, that are intended to establish the truth or plausibility of a conclusion.

Creative thinking is often contrasted with critical thinking. The former is generally seen to be relatively unfettered by logic or rules of any sort, while the latter is considered to be more logical, analytical and rule-based. In view of this distinction, which is widely endorsed among students of human cognition, why should there be a chapter on logic and reasoning in a book on creative thinking? The answer is that each kind of thinking needs the other to complement what it contributes to intellectual activity; either, by itself, is an incomplete story. Creative thinking is responsible for the generation of ideas and the invention of new processes; critical thinking is needed to evaluate those ideas and processes. The importance of each type, or aspect, of thinking is clear. Apart from the generation of new ideas, progress would not be possible; but not all ideas that are generated are of equal worth, and efforts to implement them all would produce only chaos, thus the need for critical evaluation. Individuals may differ with respect to the degree to which their thinking is characteristically more creative or more critical, but effectively intelligent living requires a modicum of both. The focus of this essay on logic and reasoning is intended to complement, to some degree, the emphasis of this encyclopedia on creative thought.

What Is Logic?

The item on *formal logic* in Runes's classic *Dictionary of Philosophy* goes on for more than ten double-column pages with very small print. It has nine major section headings: The propositional calculus; Hypothetical syllogism, disjunctive syllogism, dilemma; The functional calculus of first order; Opposition, immediate inference; Categorical syllogism; Theory of types; Algebra of classes; Algebra of relations; and Zermelo set theory. Logic, in short, is a very large topic, with many ramifications. The term can have numerous meanings depending on the context in which it is used. Moreover, several different systems of logic have been developed. Usually, however, the term, unless otherwise qualified, refers to a system of rules of inference and argumentation not greatly

different from those articulated by the early Greek philosophers, notably Aristotle.

Formal logic deals with the question of validity; it provides the rules for telling valid from invalid arguments. An argument is considered valid if its conclusion follows from (is implied by) its premises and invalid otherwise. A valid argument is guaranteed to produce an empirically true conclusion if, and only if, its premises are empirically true. An invalid argument, even with true premises, can produce either a true conclusion or a false one.

A distinction is generally made between deduction and induction – two basic types of inference that everyone uses. The difference is sometimes described by saying that deductive inferences go from the general to the particular, whereas inductive inferences go from the particular to the general. This characterization works fairly well, but not perfectly.

Deduction makes explicit in the conclusion of an argument only what is implicit in the argument's premises:

Any map can be colored with no more than four colors so that no abutting regions will have the same color.
Here is an outline map of the United States.
Conclusion: It is possible to color this map so that no two abutting states have the same color.

The conclusion of an inductive argument goes beyond what is in the argument's premises:

Many people have tried to construct a map that cannot be colored with only four colors so that no two abutting regions have the same color.
No one has succeeded in doing this.
Conclusion: It is not possible to construct such a map.

The examples just given illustrate the different degrees of certitude that the two forms of argument justify. The possibility that four colors suffice to color any map was stated as a conjecture in the middle of the nineteenth century, and it resisted all efforts to prove it either true or false until the latter part of the twentieth century. During that time, the second of the illustrative arguments could be made, but only with less than complete confidence that the conclusion was true. After the conjecture

was proved, and accepted by qualified mathematicians as a theorem, the deductive argument could be made and its conclusion accepted as definitely true (admittedly requiring faith in the opinions of the mathematicians who declared the proof to be sound).

With respect to the claim that what is explicit in the conclusion of a deductive argument is already contained implicitly in the argument's premises, one might ask if that is the case, what is the point of making it explicit? One compelling answer to this question is that what is implicit in the premises may not be obvious if it is not made explicit. Every mathematical theorem is implicit in the axioms of the mathematical system from which it is derived. It is, one might say, one of the conclusions that follow from those axioms. In most cases, however, the conclusion is far from obvious in the absence of the sequence of inferences that explicates the logical path to it from the axioms.

Deduction lends itself to formalization and there are many formal constructs and tools to facilitate construction and assessment of deductive arguments. These include syllogistic forms, calculi of classes and propositions, Boolean algebra, and a variety of diagrammatic aids to analysis such as truth tables, Euler diagrams, and Venn diagrams. Induction is not easily formalized; indeed *inductive reasoning* and *informal reasoning* are often used as synonyms. Inductive reasoning, which is also sometimes referred to as *plausible reasoning*, has to do with weighing evidence, judging plausibility, and arriving at uncertain conclusions or beliefs that one can hold with varying degrees of confidence.

Deduction and induction differ also in that there are generally agreed-upon rules of inference in terms of which deductive arguments can be evaluated, while generally agreed-upon rules do not exist for evaluating inductive arguments. Deductive arguments can be determined to be valid or invalid; the most one can say about an inductive argument is that it is more or less convincing. Consequently there is likely to be greater commonality of opinion with respect to the merits of specific deductive arguments than with respect to the merits of inductive ones. Different observers who are familiar with formal logic will usually make the same assessment of deductive arguments; in contrast, inductive arguments are often assessed differently by different knowledgeable observers.

Deductive arguments are often cast in the form of a *syllogism*. In Aristotelian logic a syllogism is an argument containing a major premise, a minor premise, and a conclusion. The deductive argument about map coloring above is in this form, and is an example of a *categorical* syllogism by virtue of having premises and a conclusion all of which are categorical assertions. In contrast, one of the premises of a *conditional* syllogism is a conditional assertion, as in the following example:

If he took the 2:30 bus, he will be here on time.
He did take the 2:30 bus.
Then, he will be here on time.

The many ways in which the rules of deductive logic can be violated, producing invalid forms of argument – forms in which the reputed conclusions are not implied by the premises – have been objects of study by philosophers for millennia.

Two frequently noted invalid forms of the conditional syllogism are the following:

If A then C
Not A
Therefore, not C

and:

If A then C
C
Therefore A.

The first of these forms illustrates the fallacy of drawing a conclusion from *denial of the antecedent*, and the second that of drawing a conclusion from *affirmation of the consequent*. (The first and second terms of the *if* premise of a conditional syllogism are referred to respectively as the *antecedent* and the *consequent*.) Inductive arguments can take a great variety of forms, and it is not possible to divide them neatly into those that are valid, or compelling, and those that are not.

What Is Reasoning?

Dictionaries give a variety of definitions of reasoning, some emphasizing the drawing of conclusions by means of inferential processes, some more or less equating reasoning with problem solving, some representing it as orderly methodical thought. Some, but by no means all, equate reasoning with thinking logically. For present purposes, reasoning is taken to be the mental activity involved when people attempt to assess the plausibility of a claim, work out a solution to a non-trivial problem, imagine the possible consequences of some contemplated action, ponder the relative merits of contrasting principles by which they might guide important choices, explicate tacit assumptions on which different positions regarding controversial issues appear to rest, weigh evidence for and against some tentative conclusion or hypothesis under consideration – for example, that a defendant in a criminal trial is guilty of the alleged crime – or engage in other cognitive activities of a similar nature.

This connotation of reasoning is relatively inclusive; notably it does not equate reasoning with thinking in accordance with principles of logic. From this perspective, whether people, in fact, think logically is an empirical question. A related empirical question is whether the characteristics of good reasoning differ depending on the context in which the reasoning occurs. Does good mathematical reasoning differ from good legal reasoning in significant ways? Does the reasoning that electricians do when trouble shooting an electrical wiring problem differ in fundamental ways – subject matter aside – from the reasoning that doctors do when attempting to find the cause of an illness or a set of symptoms? Does good reasoning, when done by highly trained professionals in the pursuit of their specialties, differ – again subject matter aside – from that which is done every day by people who are not professional specialists?

Many philosophers, including Aristotle, Descartes, Russell, and Kant, among a host of others, have considered reasoning to be a distinctively human ability. Even those who allow that

other species engage in reasoning are likely to acknowledge that the reasoning that humans do and that which other species do differ not only in degree but in kind. People can engage in counterfactual reasoning – reflect on what might have been – and can anticipate probable future consequences of alternative courses of action. They can form hypotheses and devise ways to test them. They can invent axiomatic systems and explicate their implications as mathematical theorems. There is little reason to believe that other species have these abilities or anything close to them.

Do People Think Logically?

How logic relates to the way people typically reason – in particular, whether people naturally think logically – has been discussed and debated by philosophers for centuries, and it has received a great deal of attention from cognitive psychologists in the more recent past. The idea that reasoning is guided by logic has been promoted in one or another form by many writers across the centuries, including notably British mathematician/philosopher George Boole, German philosopher Immanuel Kant, and Swiss psychologist Jean Piaget. One prominent view among contemporary psychologists is that, although people do not necessarily reason in accordance with the rules of a formal logical calculus, their reasoning gives evidence of being based on logical intuitions that are basically sound.

A contrasting view, also prominent, is that the reasoning that most people do most of the time gives little evidence of being based on sound logical intuitions. According to one variant of this view, the development of logic has had little to do with the problem of assessing the soundness, strength or conclusiveness of the kinds of arguments that are typically encountered in everyday life, or with the way people deal with problems the solving of which would seem to require reasoning.

Psychologists have published numerous empirical studies the results of which demonstrate various ways in which people's reasoning commonly violates the rules of logic or otherwise goes astray. Examples abound. Simple statements are readily misinterpreted (*All A are C* may be taken to mean also *All C are A*, a confusion that is sometimes referred to as the premise-conversion phenomenon). Conditional assertions (*If A then C*) are frequently interpreted as biconditional assertions (*If and only if A then C*). Conditional arguments sometimes take the invalid forms (mentioned above) of denying the antecedent (*If A then C; not A; therefore not C*) and affirming the consequent (*If A then C; C; therefore A*). People often fail to see the logical equivalence between a conditional assertion, *If A then C*, and its contrapositive, *If not C then not A*. Judgments of the validity of formal arguments are often influenced by features that are irrelevant to the question of validity (the truth or falsity of premises, the empirical plausibility of conclusions, personal preferences).

People find it easy to overgeneralize (to reach sweeping conclusions on the basis of small samples) and to draw conclusions from less-than-compelling evidence. They are more likely to accept the conclusion of a logical argument if it is consistent with what they already believe than if it is not, and this is true of both valid and invalid arguments; and in seeking

evidence that is relevant to beliefs, they are more likely to seek, and give more credence to, evidence that supports existing beliefs than evidence that tells against them. Similarly, they are more likely to judge an argument to be valid if it yields a conclusion they prefer than if it yields one they dislike. They are likely to believe they foresaw the outcome of uncertain events, when there is little evidence that they did so in fact. These and similar proclivities are often discussed under such rubrics as *confirmation bias*, *myside bias*, and *hindsight bias*, among others.

There are large individual differences among people with respect to their ability to reason in accordance with the rules of logic. But while the ability to reason well correlates with general cognitive ability, as indicated by IQ or other conventional measures, and with level of education, even people with high cognitive ability and advanced education are susceptible to many of the common biases that have been documented to plague human reasoning. And experts in specific areas – doctors, scientists, stock brokers – are not immune from such biases even when reasoning about matters pertaining to their areas of expertise.

For a long time philosophers, among others, have been interested in identifying forms of argumentation that are engaged to win disputes independently of their logical merits. Some of these forms are sufficiently in evidence to have been given names, sometimes even impressive-sounding Latin names. Examples include: *argumentum ad hominen* (attacking the character of the originator of a claim rather than evaluating the claim on its merits), *argumentum ad passiones* (appeal to one's passions or emotions), *argumentum ad misericordiam* (playing on feelings of pity or compassion), *argumentum ad populum* (appeal to popularity, to the idea that if many people believe it, it must be true), *straw man* (distorting an argument for the purpose of making it easier to refute), *false dilemma* (presentating a binary choice as though it were forced when it really is not), *red herring* (treating something that is irrelevant to an argument as though it were relevant), *reification* (treating names as though they necessarily refer to actual entities). There are many more examples of identified stratagems for defeating opponents in disputes other than by logical reasoning, but these suffice for present purposes.

Many 'failures' of people to reason logically are attributed by some psychologists to deference that is given to standard conventions of language usage, which take situational variables into account. Statements of the same form can convey different logical interpretations depending on their content and/or the context in which they are made. *If you make me a better offer than Company X did, I will take the job* and *If you go to University X, you will get a good education* have the same (conditional) form, but the first statement seems likely to be interpreted as a biconditional – *If and only if* – whereas the second one is not.

The Relationship Between Logic and Reasoning

Everyday reasoning tends to be more messy – less easily represented formally – than the kind of reasoning that is typically studied in the psychological laboratory. Moreover, it generally has the pragmatic goal of arriving at true conclusions, whether

or not it does so by means of formally valid arguments. Consequently, some scholars argue that logic has very little to do with the way people reason in dealing with the problems that they typically encounter in daily life. One argument supporting this view is that many, if not most, of the reasoning challenges that could be addressed with logic can also be addressed effectively with alternative cognitive tools, such as mental models, pragmatic reasoning schemas (scripts, frames) or social contracts, that codify situation-specific knowledge about what has proved to work in those situations. Problems the solutions of which appear to require reasoning are sometimes solvable by appeal to memories of personal experiences with similar problems in the past.

The perspective that logic has little to do with everyday reasoning also gains some credence from the ease with which arguments can be constructed that have a logically invalid form, but that yield conclusions that most people are likely to find acceptable. The following argument, for example, is invalid by virtue of denial of the antecedent, but people are likely to accept it despite that fact:

*If I leave before 4:00, I will miss the rush hour traffic.
I can't leave before 4:00.
Therefore, I won't miss the rush-hour traffic.*

It is also easy to construct valid arguments the conclusions to which people are likely to question with good reason. Conditional arguments of the form:

*If A then B
If B then C
Therefore, if A then C*

are generally considered valid. But consider the following argument:

*If he strikes the keys too hard, he will damage the piano.
If he damages the piano, it is not well made.
If he strikes the keys too hard, the piano is not well made.*

The argument unquestionably has the proper form, and one may find it hard to say precisely what is wrong with it, but the conclusion seems not to follow cleanly from the premises. Also it is easy to construct statements that have the same truth value according to the rules of logic, that people are not likely to consider to be equally true. In formal logic, if the conditional claim *If A then C* is true, then *If A and B then C* is also necessarily true. However, people who have no trouble accepting the claim:

If he arrives Friday evening, we will take him to the baseball game on Saturday

are likely to balk at accepting as equally true

If he arrives Friday evening and leaves the first thing Saturday morning, we will take him to the baseball game on Saturday.

What these examples, and many others that could be used, illustrate is that rules of logic that have unequivocal interpretations as long as one is dealing with abstract

assertions – *All A are B; If A then C* – can be problematic when applied to arguments involving meaningful natural-language assertions.

Opponents of the idea that everyday reasoning is logic-based make a variety of arguments against the possibility. They contend, for example, that conclusions drawn in everyday reasoning typically follow only tentatively from premises, and are defeasible – can be overturned by subsequent information – and because traditional logic makes no provision for this, it cannot accurately represent everyday inference. Logic-based theories of everyday reasoning also are ruled out by considerations of computational complexity, some theorists argue; because everyday reasoning makes use of large numbers of premises – essentially one's entire knowledge store – the consistency checking that logic would require would be computationally intractable. There is also the claim that allogical constraints restrict the inferences that people make to be a small subset of those that logic permits.

Although researchers have documented many ways in which human reasoning commonly strays from the dictates of logic, few would claim that logic plays no role in human reasoning at all. To demonstrate that the inferences that people make often reflect the influence of one or another type of bias or allogical factor is not to show that logic has no influence. Moreover, many students of human cognition have noted that the evidences of ineptness that have been obtained with reasoning tasks in the psychological laboratory are hard to reconcile with the fact that people generally function passably well – and often very well indeed – in their daily lives. It is difficult to believe that people are as generally irrational as a listing of the reasoning biases and infelicities that have been revealed in the laboratory suggests. Perhaps the safest generalization that one can make, taking all the evidence into account, is that human reasoning displays a complex mix of logical, illogical, and allogical influences. Logic plays a role in reasoning, but that role is complicated by the influences of linguistic conventions, contextual factors, one's knowledge of the subject on which reasoning is focused, and numerous other variables. People give evidence of having many sound logical intuitions, but they also resort to less-than-impeccable logic when engaged in everyday reasoning – even in situations that call for deductive inferences.

A continuing challenge to research is that of producing a better understanding of why people sometimes fail to apply logical principles that they appear not only to understand but to realize are relevant to the reasoning tasks that confront them. That many researchers believe that people do this is seen in the distinction that has been made between *competence* and *performance* and the claim that one's logical competence is not always reflected in one's performance of logical tasks. Presumably such failure can have a variety of causes, including oversight (failure to recognize the applicability of a principle in a specific context), linguistic confusion (misinterpretation of possibly ambiguous language), bias (reluctance to accept a particular conclusion as true), and carelessness or lack of motivation (unwillingness to make cognitive effort).

In formal logic, syntax is all one has to worry about. As in mathematics, the name of the game is symbol manipulation; what the symbols represent is irrelevant. The question of primary interest in formal logic is whether an argument is

valid, which is to say whether it has a legitimate form. In natural language interpretation, the situation is very different; when doing practical reasoning in real-life situations, one wants to know what a statement is intended to *mean*, and what the speaker's or writer's purpose was in making it. Syntax counts, but so do semantics and pragmatics.

The question of primary interest in practical reasoning is whether the conclusion of an argument is true. The answer depends not only on the argument's form but also on the meanings of the words that comprise it and on whether, given those meanings, its premises are true; and the meanings of words depend, in large measure, on the contexts in which they are used. While these types of considerations have little to do with logic, they cannot be ignored if one is to reason effectively in real-life situations.

Sometimes a distinction is made between *validity* and *soundness*. In terms of this distinction, an argument is said to be valid if, and only if, it has a logically legitimate form; it is said to be sound if, and only if, it has a logically legitimate form *and* its premises are true. By itself, logical validity ensures only that a conclusion follows from the premises; logical validity coupled with assurance that the premises are true ensures that the argument's conclusion is true – that the argument is sound.

It has been argued that responding to everyday language in strict accordance with the rules of logic would be maladaptive, because interpreting literally what people say would often have the effect of misconstruing their intentions. People may use conditional statements (*If you finish the project on time and within budget, you will get a bonus*) when they really mean to convey a biconditional relationship (*If and only if you finish the project on time and within budget, you will get a bonus*). They sometimes express themselves metaphorically, not intending to be taken literally. They often state arguments incompletely, expecting the listener or reader to fill in what is missing. Correct interpretation of messages conveyed in natural language often requires consideration of extra-linguistic aspects of the contexts in which the messages occur. Application of the rules of logic to what people explicitly say, without taking these and other nuances of language use into account, can yield erroneous, perhaps nonsensical, results.

Logic can tell us whether specific deductive arguments are valid or invalid, but it does not tell us which of the countless inferences that might be made from a set of premises are worth making. That the reasoning people do is guided by more than logic is apparent from the fact that most of the inferences that could be drawn from a set of premises are never considered, or even recognized as possibilities. Anything that follows logically from *If P then Q*, follows also from *If P and A then Q*, from *If P, A and B then Q*, from *If P, A, B and C, then Q*, and so on. Not only are the many logical implications of assertions generally not considered, if they were considered with concrete meaningful assertions, they would often be rejected. Consider that if *If Pete comes to the party, it will be a great success* is true, so, logically, is *If Pete comes to the party and insults the host, it will be a great success*; however, presumably few of the people who might believe the first assertion would believe the second.

This example illustrates that conditional assertions are likely to involve unstated conditions as well as those that are made explicit. When one says *If Pete comes to the party it will be a great success* one is, in effect, assuming not only that Pete will

not insult the host, or do any number of other objectionable things that he could conceivably do, but also that the countless other ways in which the party could be a disaster will not materialize.

The example also illustrates the point that practical reasoning generally leads to conclusions that are less than certainly true, but can be accepted with varying degrees of confidence. This is, in part, because natural-language assertions typically are not to be taken as literally true. *Birds fly* is true of most (live) birds, but not of all; it is not true of new-born birds, birds with broken wings, or emus. One understands that the prediction *If you take the cruise, you will have a wonderful time*, even when based on experience and made in good faith, is not guaranteed to be true. Consequently some scholars consider probability theory to be more appropriate than logic as a model for practical reasoning.

There are several theoretical accounts of reasoning. We have already noted the prevalence in these accounts of such concepts as mental logic, mental models, pragmatic reasoning schemas, and social contracts. Central to other prominent theoretical accounts of reasoning are information-theoretic concepts, relevance theory, and dual-process ideas. No single account has yet emerged as clearly dominant over all the others.

Much of the reasoning that people do is for the purpose of finding explanations – answering questions of what, how and why. As American philosopher/logician Charles Sanders Peirce, among others, argued, uncertainty and doubt appear to be states of mind that people find uncomfortable and attempt to avoid. The compulsion to have explanations can motivate investigations that lead to new knowledge; it can also yield beliefs in cause–effect relationships where only correlations, at most, exist.

Everybody arrives at conclusions, and everybody can give reasons for conclusions they have drawn. There are differences among people, however, with respect to the way in which they arrive at conclusions and the tenacity with which they defend a conclusion once it has been reached. At one extreme are those who characteristically jump to a conclusion very quickly, accepting the first possibility that comes to mind, and then defend it stubbornly against any counterindicative evidence that is offered against it. These individuals see their role as that of defending the conclusion against attack; therefore they are likely to try to gather whatever evidence they can that favors the conclusion and discredit any that would tend to cast doubt on it.

At the other extreme are those who attempt to weigh all the evidence that is available before making up their minds on any question, and then, having arrived at a conclusion, consider it subject to modification if further relevant evidence comes to light. These people may often appear to be indecisive, inasmuch as they are likely to find the evidence on specific questions to be inconclusive or insufficiently compellingly favorable to any one of the hypotheses being considered to justify taking a strong position on the issue.

Probably most of us fall somewhere between these extremes. We arrive at conclusions perhaps more quickly than we should, but not without some effort to weigh at least that evidence that is readily at hand. And we often persist in holding on to conclusions that we have drawn, but not to the point of being totally blind to counterindicative evidence and

completely incapable of changing our minds. As individuals we may be less than entirely consistent in our uses of evidence, and to find it easier, for example, to be relatively open and objective when the evidence in question pertains to a claim the truth or falsity of which is of little consequence to us than when it pertains to one in which we have considerable vested interest.

The relationship between logic and reasoning is, in short, a complicated one. On the one hand, people frequently violate widely recognized principles of logic in their everyday reasoning. So we cannot say that reason is ruled by logic. On the other hand, logic does influence everyday reasoning in a variety of ways. We all know, for example, that if two assertions contradict each other, they cannot both be true, and we are keen to find contradictions and inconsistencies in other people's arguments if not in our own. Moreover, in some fundamental sense, it *must* be the case that logic is the codification of human intuitions; perhaps most of us need to consult a logic textbook to learn how to think logically, but someone had to write the (first) textbook – and where are we to assume that author learned logic?

Improving Reasoning

It was once widely believed that an effective way to improve people's ability to reason logically was to subject them to training in some rigorously deductive discipline, such as geometry. While it is unquestionably true that one must engage in careful deductive reasoning in order to do well in geometry, the idea that training in this discipline will greatly improve the success with which people deal with the practical problems they encounter outside the classroom appears not to have many proponents today.

Educational researchers have given much attention to the question of how best to enhance people's problem-solving skills. One objective of this work has been to try to determine the effectiveness of teaching general, domain-independent, heuristic strategies relative to that of teaching domain-specific knowledge and techniques. Domain-independent strategies that have received attention include decomposing a problem into subproblems, finding one or more effective representations of a problem, finding a similar problem that is simpler or whose solution is known, and considering extreme instances of the problem type. Proponents of teaching domain-specific knowledge and techniques argue that general-purpose strategies may be generally helpful, but they seldom provide what is needed to solve difficult problems in the absence of knowledge and know-how that are specific to the problem area. While there has been a lively debate about the relative utility of domain-independent capabilities and domain-specific knowledge as determinants of effective reasoning – especially in problem-solving and decision-making contexts – there is also the view that both types of capabilities are likely to be involved in truly competent intellectual performance wherever it is found.

Does learning logic help students to become better reasoners? One may wonder what would be the point of offering courses in logic if the answer to this question were known or

assumed to be no. The evidence that people who have taken such courses are, on balance, better reasoners than those who have not is spotty, and psychologists who believe that formal logic has little to do with the way people reason in practical situations would not find this to be surprising. On the other hand, evidence that knowledge of logic does not make one a better reasoner also is not compelling. Perhaps the safest conclusion one can draw with respect to this issue is that learning logic can hardly do any harm and, for many people, is likely to do some good. However, to be most effective, knowledge of formal rules of logic should be supplemented with empirically derived knowledge of how people actually reason and especially knowledge of common ways in which reasoning can – and often does – go wrong.

Is it possible to teach people to be better – more effective – reasoners in a general sense? Presumably it is possible to teach people to be effective reasoners in specific domains – to be effective at medical diagnosis, at legal case building, at automotive fault analysis, at computer circuit design, but is it possible to teach people things that will make them better reasoners independently of the domains in which they function? Is it possible to identify principles that apply across different disciplinary contexts and situational specifics? Evidence supports the view that domain-general training can improve reasoning – make one a better reasoner in general – but that to be a truly effective reasoner in a specific domain requires, as well, considerable knowledge that is specific to that domain.

See also: Critical Thinking; Dialectical Thinking; Further Implications for Creative Thinking.

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Longitudinal Studies

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Glossary

Cross-sectional studies Data are collected comparing one set of individuals' responses to those of another set of individuals within a given population at a given time.

Longitudinal research methodology A form of repeated measures design in which a minimum of two data points are collected from the same individuals over some significant passage of time.

Meta-analysis Process of collecting and synthesizing a collection of related studies and statistically combining their results through the comparison of effect sizes.

Retrospective studies Data are collected from individuals in the form of memories about their past including experiences, opportunities, feelings, or aspirations.

Threats to validity Criteria for judging the degree to which the qualities of a method, design, or instrument may affect the accuracy of the study results.

Why Longitudinal Research?

Longitudinal research follows the same individual, group, or organization over time. Like the field of giftedness more generally, the roots of creativity research lie in the longitudinal study of high-IQ men and women begun by Lewis Terman in the 1920s and continuing throughout the subjects' lives. Terman's original questions continue to animate the field of creativity research. Are there any rigorous predictors of exceptional adult achievement? What conditions and experiences promote the fulfillment of early potential? How well do formal measures of high ability predict real-world behaviors and attainments?

Like the field of creativity in general, longitudinal research on creativity encompasses studies of individuals in particular professions or disciplines, a person's general style or approach to work or life, or a process that enhances creative productivity. Methodologically, longitudinal research is superior to cross-sectional and retrospective methods in its ability to address the development and expression of creativity across the lifespan. Cross-sectional studies, in which groups are examined at one point in time, are unable to connect characteristics and experiences across multiple intervals of time.

Retrospective studies and biographies of successful creative producers fail to explain why and how these individuals achieved more than age peers with similar characteristics. Retrospective studies also suffer from incomplete and biased memories of long-past experiences. Although quasi-longitudinal, most pre- and post-test research is too short in duration and includes too few data points to qualify as longitudinal research.

Longitudinal study is prospective, tracing the pathways of individuals who have not yet achieved exceptional adult outcomes. The question of who becomes a creative-productive adult, for instance, requires a method of following apparently equally promising children and youth to see which aspects of ability, family background, personality, and motivation differentiate the expression of creativity in adulthood. The repeated measures of longitudinal study enable scholars to investigate

processes, trajectories, and nodal periods in development. In addition, repeated measures studies can answer fundamental questions of change and stability in creativity over the life span. Does creativity inhere in the person? In the interaction of individuals with particular environmental conditions? Does creativity change systematically in quality or intensity in response to experiences, physical changes, or levels of responsibility associated with different life periods? How do developmental pathways vary in different domains of creativity such as music composition, scientific research, or political leadership?

These fundamental questions about the unfolding of creativity are paralleled by practical issues about how to support creativity. Identifying future creative producers requires longitudinal study of how well creativity tests and early creative behaviors predict later outcomes. Once the validity of identification methods is established, connecting information about experiences and outcomes becomes central to promoting creative behaviors. Longitudinal studies are ideally suited to investigate the long-term effects on creativity of educational interventions, family and mentor support, and organizational structures.

Methodological Challenges

Following the same individuals longitudinally overcomes many weaknesses that hamper other research methods. However, the considerable expense and time required in repeated measures research means that even the most rigorous and well planned longitudinal studies suffer from additional threats to validity. Some studies are hampered by small sample size either due to lack of sufficient funding or because of small numbers of qualified exceptional subjects. Participant drop-out from longitudinal studies is a major problem in validity, especially because attrition tends to be disproportionately high among lower-achieving and less physically and psychologically healthy subjects. Few scholars conducting longitudinal studies have the resources to follow appropriate comparison groups;

in other cases no clear comparison group exists. Other problems include testing effects whereby study findings are biased as a result of subjects' repeated exposure to measurement instruments, researcher interactions, or opportunities to reflect on their lives. Longitudinal studies that follow a single group suffer from period effects, in which results are entangled with the common historical period in which participants live. For example, women's career trajectories are deeply entwined with the social expectations of their time, restricting generalization about any single cohort's experiences. Researchers attempt to minimize these problems by studying more than one age cohort or comparing their results to other study samples. For instance, both the Grant Study of successful aging and Rena Subotnik and colleagues' follow-up of alumni from a school for the gifted used matched samples from the Terman study; Mark Runco and Robert Albert compared the trajectories of boys who were gifted in different domains.

Classic and Major Longitudinal Studies

Despite the challenges in conducting longitudinal research, longitudinal studies are centrally important to the field of creativity. Among early classic work, the Terman study of giftedness continues to be mined for information about creativity in adulthood, while Erik Erikson's theory of ego development and Warner Schaie's work on intellectual functioning over the life span remain foundational.

Most current longitudinal studies of general or domain-specific ability and achievement include some information about creativity. The Study of Mathematically Precocious Youth (SMPY) is a major, multiple cohort study that has investigated the antecedents and consequences of exceptional mathematics ability in the US as measured by high scores on the SAT college entrance examination taken in early adolescence. The Grant Study has been following the health, attainment, and aging outcomes of a group of men identified as exceptionally high-functioning during their Harvard undergraduate years in the 1940s. In Europe, the Munich Study of Giftedness and the Munich Longitudinal Study on the Ontogenesis of Individual Competencies (LOGIC) are major follow-up studies that include components of creativity.

Though not centrally focused on creativity, the SMPY, Grant, and Munich studies are examples of large, well-designed, long-running longitudinal investigations that have yielded findings about the development of creativity as well as the personal characteristics and environmental conditions that support sustained creative production. In contrast to these studies, Jacob Getzel and Mihaly Csikszentmihalyi directly investigated creativity in their classic longitudinal study connecting young artists' problem-finding (a central component of the creative process) on a given task and subsequent career success as a professional artist. Still ongoing is a 50-year follow-up investigation of the predictive validity of the Torrance Tests of Creativity. Other major longitudinal studies that center on creativity are the Mills Study of creative personality in women, begun in the late 1950s, and Albert and Runco's investigation of creative potential attainment in two groups of boys identified in the 1970s as exceptionally gifted in math/science or high-IQ.

Antecedents of Adult Creativity

Longitudinal studies of creative individuals have investigated the connections between mature creative production and a range of pre-adult measures of personality, family experiences, interests, and motivation. Most find connections between adult creative productivity and earlier evidence of openness, complexity, autonomy, unconventionality, and originality. Vitality is another commonly studied individual trait found to predict creative accomplishment among adults. The domain in which creativity is expressed makes a difference: connections between early personality traits and adult outcomes vary for scientists, artists, and other types of creative achievers. Most research using personality draws from standard psychological tests such as the California Psychological Inventory (CPI) or the Minnesota Multiphasic Personality Inventory (MMPI). An emerging approach is the use of the Five-Factor personality inventory, with particular emphasis on the personality cluster of openness to experience as predictive of creative productivity. The Grant Study of adult development follows subjects' use of psychological adaptation mechanisms as the major personality measure. Developmental assets, such as positive connections with others, high self-esteem, and strong skills, have been found to predict academic achievement, but this promising set of variables has not yet been used in repeated measures studies of creativity.

Mixed results come from the study of creative achievers' families. Some researchers reported that childhood experience of family tension or parental mental illness was associated with later productivity, while others found that highly functional and supportive families produced children with sustained creative achievement. Both the Mills Study and Albert and Runco's exceptional boys study found that parental traits continued to differentiate adult offspring's creative productivity and domain-specific creativity, respectively. The Grant study, in contrast, found no direct effects of family background on adult outcomes, although family experiences undoubtedly played a role in one's adult coping style.

Adolescent and young adult interests and preferences consistently emerge as predictors of mature career choices and creative accomplishments. In a representative Israeli sample, adults whose careers matched their age-18 leisure creative activities were more highly placed and more accomplished professionally than their peers. Mills study researchers found that women's creative activities immediately following college predicted creative achievement in mid-life. Csikszentmihalyi and colleagues reported that gifted teenagers were drawn to intensive immersion in their interest area. More recently, Tai and his colleagues' secondary analysis of a US national longitudinal study (NELS-88) found that high school students who expressed interest in science careers were much more likely to earn college degrees in science fields than classmates with identical course histories and tested ability who lacked such early aspirations. Finally, the Study of Mathematically Precocious Youth found that adolescent values and preferences combined with ability and motivation to determine the college majors and career direction of profoundly gifted individuals.

Unsurprisingly, various indicators of motivation emerge across studies as contributing to creative productivity; however, motivation has not been as extensively studied as other

antecedent variables. Ambition and high aspirations, characteristic tendencies to persist in a challenging task, seeking of flow states, and willingness to work long hours have all been linked to long-term positive outcomes. The emerging psychological construct of grit refers to the constellation of motivation and persistence variables that captures many of the motivation factors in the literature on creativity. Angela Duckworth demonstrated the explanatory power of this variable in a number of cross-sectional studies of talented populations. In studies of elite music education, Rena Subotnik and Linda Jarvin explored qualitatively the changing role of various psychosocial factors during transitions in the development of competencies, expertise, and artistry. These studies suggest the value of investigating grit and other conative factors as predictors of creative productivity in longitudinal research.

Development of Creativity

Longitudinal studies of creativity over the lifespan are appropriate for answering fundamental questions about the timing, shape, and stability of creative ability and creative productivity. The relatively few lifespan studies of creativity found that early evidence of creativity can predict continued creative potential and creative productivity in middle and old age. No overall developmental theory of the processes and trajectories of creativity emerges across longitudinal studies, however. E. Paul Torrance began a line of research on the shape of development in childhood. Although attempts to replicate his well-known claim of a fourth-grade slump in creativity have shown mixed results, longitudinal studies show that the progression of creativity does appear to involve peaks and troughs. Researchers have proposed different shapes and ages of transition for the trajectory but no empirical consensus has been reached across studies. In reviewing this literature, Runco and Charles concluded that the lack of consistency across studies results from differences in definitions and measurements of creativity, individual factors, and domain characteristics. There is general agreement that developmental, biological, and environmental factors interact with patterns of growth and change in creativity. For instance, childhood emergence of the concrete operations cognitive structure is likely to dampen divergent thinking, as is an environmental press for conventionality. In childhood, as throughout the lifespan, longitudinal research shows continued interplay between cognitive and conative processes.

An exception to the general stability of creativity over the lifespan is the finding that expression of novelty by very young children is generally not predictive of future creative productivity. Controversy persists as to whether apparently original products in early childhood are creative accomplishments or reflections of a lack of exposure to the rules and practical constraints in given domains. The development of early musical originality appears to be more continuous with later creative productivity than is the case in other domains.

Research that follows adults over time also demonstrates parallels between creativity and general developmental processes. Creative productivity in middle age and beyond has been linked to generativity in several studies. George Vaillant reported that the mentally and physically healthiest Grant Study men and Terman

women were those who used psychological coping mechanisms of altruism, humor, anticipation, suppression, and sublimation. These defenses were more characteristic of creatively productive older adults. Creativity also appears to be linked to successful aging, possibly through the use of creative adaptive responses. For instance, among elderly Grant Study men, high creativity in mid-life predicted long-term physical vitality in Grant Study men better than early general psychological adjustment or IQ. In the Mills study, Helson and colleagues found that women with strong identity achievement were more likely to be lifelong creative producers.

Long-term follow-up studies of adults are able to distinguish between the developmental trajectories of creative ability and creative production. This distinction has the potential to clear up some of the confusion about ages and patterns of decline in creativity after early adulthood. Cognitive and personality traits associated with creativity tend to show consistency over time. Creative productivity, on the other hand, is much less stable. Peaks and troughs in adult creative accomplishment have been linked to life roles and environmental demands, and to biological declines in physical vitality and sensory abilities. It could be, for example, that a peak in creative productivity among mathematicians in their early 20s results from a combination of optimal cognitive powers and physical stamina, professional demands to make one's name, and relative freedom from family responsibilities.

Identification and Predictive Validity

Educational efforts to enhance creative productivity require effective identification of individuals with creative potential. In one sense, all longitudinal research of creativity has to do with questions of external validity: the relation of indicators of creative potential to subsequent realization of potential in the form of creative achievements. As already noted, childhood or adolescent interests, preferences, and leisure activities have been found to predict later creative productivity. However, most of this research concerns the match between early inclinations and later career pursuits, rather than relative levels of creative potential and ensuing outcomes. The relationship between tested ability and subsequent creative accomplishment, on the other hand, is a well-established topic of longitudinal study that directly addresses the issue of predictive validity of identification methods.

The Study of Mathematically Precocious Youth (SMPY) and the longitudinal follow-ups of the Torrance Tests of Creative Thinking are the most sustained and definitive follow-up studies of early identification of exceptional ability. The Study of Mathematically Precocious Youth has completed the first 35 years of a planned 50-year longitudinal study of five cohorts of men and women (~5000 individuals) who were identified at age 12 or 13 as exceptionally intellectually gifted. Follow-up data collections after five, ten, and 25 years indicate that SAT scores of gifted young adolescents are predictive of college and adult accomplishments. A quarter of the variability in college major/degree and occupation was predicted by the two SAT scores (in conjunction with smaller contributions of spatial ability and adolescent preferences). SMPY participants were much more highly accomplished than unselected college graduates in

creative productivity as measured by their record of patents, publications, and tenured positions at top universities.

Psychometric approaches to the identification of creativity have focused on individual traits posited to underlie creative productivity. Current perspectives on creativity view person-level variables as part of more complex systems and contextual interactions. However, the long history of divergent thinking measures and their continued use in educational program identification warrant examination of the validity of creativity tests. The longest-term predictive validity research on an instrument designed to measure creativity is the collection of follow-up studies of the Torrance Tests of Creative Thinking (TTCT). Initially published in 1966 and subsequently revised, the TTCT measures divergent thinking as operationalized by the degree to which subjects' ideas and problem-solving exhibit fluency, flexibility, originality, and elaboration. Torrance and his colleagues followed groups of elementary and high school students who were first tested in 1958–1965 with repeated TTCT results, intelligence and achievement test data, and demographic information. High school subjects were followed up after seven and 12 years. Elementary school subjects were followed 22, 40, and 50 years after the original testing. Adult outcomes included measures of the quantity and quality of adult creative achievements.

In a review of research on the predictive validity of divergent thinking measures, Jonathan Plucker concluded that methodological weaknesses in previous longitudinal work was the source of mixed findings across studies. To remedy this problem, Plucker reanalyzed the 22-year elementary school follow-up data using structural equation models. His finding that just under half of the variability in adult creative productivity was attributable to TTCT scores in childhood is close to the (not yet published) results from the 50-year follow-up by Runco. IQ added to the predictive validity of the TTCT in all cases; however, the contribution of divergent thinking to adult creative achievement was more than three times that of IQ. Both Plucker's 22-year reanalysis and Bonnie Cramond and colleagues' findings from a subsequent 40 year follow-up found that quality and quantity of creative products were highly correlated, but that different aspects of divergent thinking predicted quality and quantity of adult creative achievements. Both researchers concluded that tests of divergent thinking are predictive of creative achievement over and beyond tested intelligence.

Arthur Cropley's investigation of the psychometric properties of creativity tests revealed no examples of long-term predictive validity studies as extensive as the Torrance TTCT research program. When available, correlations between creativity tests and subsequent creative achievement were generally around 0.50. Like Plucker, Cropley concluded that psychometric efforts to measure creativity yield useful predictions of real-life accomplishment, but that unmeasured psychological and environmental factors also play important roles in adult outcomes. For this reason, researchers caution that the currently available instruments are really tests of creative potential rather than creativity and call for multifaceted longitudinal studies to measure the more comprehensive theoretical models of creativity that currently characterize the field.

The predictive validity of early creative behaviors has also been investigated by longitudinal researchers. For example,

Subotnik and her colleagues studied the consequences of scientific reasoning in a long-term follow-up study of Westinghouse (later Intel) science competition winners. Karen Arnold investigated the career outcomes of high school valedictorians. As in creativity test results, these studies demonstrated links between early domain-specific creative behavior and adult outcomes, and drew attention to the decisive role of environmental and conative factors in actualizing high potential.

Ideal longitudinal study designs would include measured ability and behavioral variables, along with personality. Gregory Feist and Frank Barron used such a model in a follow-up study of University of California-Berkeley Ph.D. students who were identified in 1950 as having high potential to make creative contributions to their field. Judges' ratings of creative behavior, psychometric measures of intelligence and divergent thinking, and personality at age 27 all predicted adult lifetime creative achievement by age 72. With only two data points, this study's longitudinal design is not ideal; however, the usefulness of exploring multiple types of predictive variables is clear.

Conditions for Creative Productivity

Study of the antecedents, developmental trajectories, and early manifestations of creativity constitutes important basic research that can lead to practical applications. The conditions that foster creative achievement have been widely investigated. Studies of environmental effects on creativity include longitudinal investigations of family experiences, educational programs, creativity training activities, schooling, and work conditions.

The environmental conditions for eminence (big-C creativity that transforms a domain) have generally been studied retrospectively, as in Dean Simonton's biographical studies of eminence and Bloom's research on top achievers under the age of 30. A few prospective studies have attempted to identify highly gifted individuals with the potential for exceptional creative achievement in order to trace the effects of varied environmental conditions. Albert and Runco, for example, concluded that family and social environments differed systematically across early adolescent boys with high-IQ and those who were exceptionally able in mathematics. The two groups experienced different trajectories of personality, development, and accomplishment in response to early environments shaped by parental personality. In another example of environmental conditions for big-C creativity, Subotnik *et al.* found that the organizational structure and culture of undergraduate science played an important role in maintaining science interest for young adult Westinghouse science winners who had previously exhibited exceptional early creativity in science research. The Westinghouse research is an example of studies that investigate the conditions for eminence at the point of advanced training among individuals who are already exceptionally high performing, motivated, and on the verge of definitive career experiences and decisions. Berkeley study men, for instance, were within a year of receiving their doctorate when faculty judged their potential for outstanding scholarly careers. Such studies demonstrate the advantages of following members of select groups from which eminent achievers typically emerge.

More common are longitudinal studies of educational and training programs intended to foster little-c creative traits

and creative products. For example, researchers found positive effects on creative productivity resulting from participation in programs using the Renzulli Schoolwide Enrichment Triad Model and Feldhusen's Purdue Creative Training Program. SMPY subjects who participated in intensive summer educational programs showed long-term advantages in creative accomplishment as compared to nonparticipants. Maker's studies of low-income and minority elementary school students in the DISCOVER curriculum found that the program's nontraditional pedagogy had a positive effect on student creativity when teachers implemented the program and students experienced a stable level of implementation across grades. In their 1994 analysis of longitudinal studies of giftedness and talent, Subotnik and Arnold concluded that identification criteria and educational program characteristics were closely associated with long-term treatment outcomes. Programs that identified high-IQ or academically gifted students were predictive of intellectual and educational accomplishment but not of creativity. For instance, Arnold found that high school valedictorians were excellent university and career achievers but not particularly creative as adults. The connection between selection criteria, program characteristics, and outcomes continues to emerge in more recent studies, suggesting the need for identification methods and educational interventions that target creativity explicitly.

True longitudinal studies of treatment effects are rare in the literature on creativity. Much more common are pre- and post-test studies of creativity training programs. Three meta-analyses that examined studies of creativity training effectiveness found positive effects of training on divergent thinking and creative problem-solving. Creativity training has also been found to result in positive gains in creative performance and attitudes and behaviors, though these effects are smaller than those for cognitive outcomes. The largest effects come from programs with cognitive approaches. Training program studies generally include only two data points, collected over a short period of time. Two years was the longest reported interval between intervention and post-test in the meta-analysis reports of training studies. With more data points and extended duration, true longitudinal studies have the potential to establish the connection between educational interventions and subsequent creative productivity. One promising direction is the secondary analysis of national longitudinal databases, exemplified by the work of Tai and his colleagues using the NELS-88. Although this comparison of science career aspirations and college degrees currently only includes two data points, the design of the longitudinal study allows for additional follow-ups. The value of such studies to creativity research is limited because none of the longitudinal databases explicitly target variables associated with creativity.

Longitudinal researchers can also explore the effects of innovative schools by following the lives of graduates. Some of these studies are basically pre- and post-test designs with alumni outcomes as the criterion variable. Others are genuinely longitudinal, such as Arnold's Big Picture Longitudinal Study that traces the adult lives of over 1000 graduates of a network of alternative high schools. Big Picture Learning high schools feature an innovative model of personalized curricula intended to capitalize on the interests and creativity of socio-economically disadvantaged secondary school students. In the first five years of a planned 15-year longitudinal follow-up of

Big Picture alumni, elements of the educational model were found to connect to adult creative behaviors and attitudes. Specifically, Big Picture high schools require students to design and demonstrate their own learning within highly individualized school and internship settings. The resulting ability of students to name and follow their own passions and interests is a widely-found characteristic of creative individuals.

Everyday creativity in the workplace is a growing area in studies of creativity, although most of this work features cross-sectional or pre- and post-test designs. Amabile and colleagues conducted a notable longitudinal study of workplace creativity that enabled investigation of temporal effects in creativity and affect. Subjects were professionals at several companies who belonged to teams working on potentially creative projects. Researchers coded incidences of creativity and affect in nearly 64000 specific incidents reported in daily narrative diaries of each participant's work day. Results showed that positive affect was associated in a linear fashion with creativity: creative thoughts and actions followed an incubation period of one to two days after a positive emotional state. Amabile and her colleagues proposed a cycle of positive affect and creativity in the workplace in which individuals' positive emotional states and organizational receptivity to originality foster creativity. More specifically, this study suggests, high workplace morale and affirmative reception of employees' creative insights might maximize creativity in project teams. Longitudinal studies of creativity in work settings is a ripe area for further work.

Future Directions in Longitudinal Research on Creativity

In their 1994 overview of longitudinal studies of giftedness and talent, Subotnik and Arnold criticized the field as overly dependent on small, single-cohort samples without control groups. These criticisms continue to pertain to the literature published in the intervening period. Overcoming threats to validity through the use of multiple measures, cohorts, and data collections remains an expensive proposition. Studies that include large samples, extended durations, multiple domains of creativity, and appropriate comparison groups also require extensive resources. The Study of Mathematically Precocious Youth is the most robust longitudinal study and overcomes many of these difficulties. Like national longitudinal studies, however, SMPY was not designed primarily as a study of creativity. Researchers of smaller scale studies address threats to validity by constructing comparison groups, occasionally within a single study and more commonly with cohorts from other longitudinal studies. Continued variability across studies on criterion (outcome) measures of creative potential and creative performance is still an obstacle to the potential power of longitudinal research. Most importantly, longitudinal studies of creativity remain rare.

Longitudinal research has made progress in the last 15 years. Methodologically, researchers are using more sophisticated analytic techniques than the correlational analyses of many earlier repeated measures studies. Structural equation models, meta-analysis, MANOVA, and growth-curve modeling are now routine statistical techniques in longitudinal studies. In addition to statistical methods that allow for greater complexity, measures of creative ability and performance are following theoretical

advances to become more multi-dimensional. Intelligence, divergent thinking, personality, motivation, and observed behaviors have all been shown to affect creative productivity; scholars need to incorporate these multiple and interacting person-level factors into longitudinal study designs. Environmental factors are equally complex, with research designs lagging behind theory in investigating the interactions between personal experiences and domain and field effects. Some researchers have introduced innovative data collection methods, such as the Experience Sampling Methodology introduced by Csikszentmihalyi and adapted by Amabile in Electronic Event Sampling Methodology. New technology-enabled forms of data collection offer the promise of making longitudinal data collection more financially feasible and grounded in everyday contexts.

Other trends are worth noting. Burgeoning interest in creativity in organizations is part of a larger move to consider creativity in context as opposed to the creative person. The role of affect and creativity in the personal realm are emerging areas in the field. Longitudinal study of underrepresented populations is still sparse, but studies like the DISCOVER program and Big Picture follow-ups are beginning to address this gap in the literature. Domain-specific studies are increasingly the rule, including longitudinal research on creativity in music, science, and technical creativity. Although there are very few cross-cultural studies, longitudinal studies in many countries reflect international interest in fostering creativity. Germany has been a leader in Europe as a longitudinal study center. Chinese researchers have carried out cross-cultural studies of technical creativity. Asia is emerging as a major research player in the field of creativity studies, although almost all of the research to date is cross-sectional. Finally, creativity researchers are connecting to the fields of brain research, aging, and organizational development.

Taken as a whole, the longitudinal research literature on creativity indicates the value of prospective study of creative potential. Widespread convergence across studies point to several key findings about creative potential and creative productivity. Because individual traits of creative producers are fairly stable across the life span, creative potential can be identified as early as elementary school as a meaningful indicator of future creative productivity. Psychometric identification methods have long term validity as predictors of creative accomplishment. Contemporary researchers are following theory in developing increasingly multifaceted identification models that incorporate cognitive, conative, demographic, and environmental factors. The collected studies suggest that creative potential can be best identified through combinations of general and domain-specific ability, personality, self-perceptions, and external judgments. Following identification, intentional

educational and training experiences have a positive effect on creative productivity.

Researchers in the field of creativity recognize the need for studies that encompass the domain-specific, multiplicative models of creativity that have emerged since most published longitudinal work was conducted. Theoretical and methodological advances hold considerable promise for accomplishing this work. Most importantly, the field needs longitudinal studies of creativity that make use of theoretical and methodological advances. New longitudinal investigations, comparisons across studies, and incorporation of creativity measures into national representative longitudinal studies are important directions for advancing knowledge in the field.

See also: Aging; Creative Environments, Conditions, and Settings; Divergent Thinking; Enhancement of Creativity; Intelligence (as Related to Creativity); Teaching Creativity.

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Relevant Website

<http://www.hmdc.harvard.edu/> - Murray Center for the Study of Lives: Repository for longitudinal data sets available to scholars for secondary analysis, replication, and follow-up.

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Mad Genius Controversy

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Glossary

Creativity The ability to produce new and valued ideas, products, devices, or works of art.

Faculty psychology A school of thought, associated primarily with the eighteenth and nineteenth centuries, that explained human behavior and the mental processes associated with these behaviors by reference to a number of more or less distinct mental powers or faculties, such as the faculties of reason, imagination, memory, or moral taste.

While some faculty psychologists believed that these mental powers could be improved through exercise, it was typically held that a pronounced display of strength in any one faculty, such as an individual's ability for abstract reasoning, was the result, primarily, of a native disposition in the form of a powerful faculty of reason.

Genius When used by reference to people, the term is reserved for those individuals in possession of an extraordinary capacity for imaginative creation, original thought, invention, or discovery. As such, it is applied to those select persons deemed greatest in any branch of art, speculation, or practice.

Humoral theory An early Western physiological theory, one that remained current in the Middle Ages and later, that rested on the idea that the variant mixtures of four primary humors, or fluids of the body (blood, phlegm, yellow bile, and black bile), determined the physical and mental qualities and dispositions of people.

Mad When used as an adjective, the term is in reference to behavior that arises from, is indicative of, or marked by mental disorder.

Manic-depressive illness A mental disorder (also called bipolar disorder) characterized by alternating periods of abnormally intense excitement (mania) and depression.

Psychological empiricism A school of thought, associated primarily with the eighteenth and nineteenth centuries, that believed all human knowledge to be derived from sense experience. As such, it stood in stark opposition to Faculty Psychology and the belief that knowledge is in some way innate to humans or the result of inherent dispositions.

Psychopathology The study of mental disorders and unusual or maladaptive behaviors. In informal use, psychopathology also refers to the condition of mental illness.

Romanticism A literary, artistic, and philosophical movement that flourished in Western society over a period from the late eighteenth to the mid-nineteenth century but with continuing influence today. It is characterized by emphasis on individualism, imagination, a deep appreciation of the beauties of nature, the exaltation of the emotions over reason, and a preoccupation with the exceptional figure in history, such as the genius, the gifted artist and the hero more generally.

Self-fulfilling prophesy A concept that refers to the idea that a strongly held expectation, a prediction, or a prophesy may inadvertently create the conditions for that prediction to become reality.

Introduction

A common assumption in Western society is the idea that profound creativity has an intimate connection to psychopathology. Despite speculations from Greek antiquity to the Renaissance and the Enlightenment regarding the mental state of individuals during the act of creation, the association of creativity with clinical madness is a modern phenomenon that does not predate the 1830s. As we shall see, it was the romantic movement in literature that was indispensable to the establishment of this medical verdict. Faced with obstacles to their

existence, the romantics engaged in the selective redefinition of certain cultural beliefs they inherited from the past. These redefinitions, although they tended to benefit the romantics by providing them with a clearer sense of their own identity (one that established their intellectual and artistic independence from the past), simultaneously invited a system of logic that left them defenseless against the label of clinical madness.

This logic was so compelling, in fact, that self-admissions of mental anguish and actual manifestations of madness on the part of many romantics may be seen as little more than adherence to what had become part of a role expectation deemed

appropriate for artists, writers, and other creative individuals. Moreover, evidence abounds that the expectation of madness continues to be part of a professional ideology of what it means to be truly creative. Given such, it is not unreasonable to assume that even contemporary writers and artists, far from disavowing any connection to madness, may actually invite it and inadvertently volunteer evidence of madness in diagnostic and psychological examinations.

Speculations on the Mental State of Creative Individuals Prior to the Romantic Age

Critical to an understanding of the ancient Greeks' speculations regarding the nature of the creative process are the concepts of demonic possession and melancholia. The 'demon,' which the Greeks conceived as a semideity that presided over a person, a locality, or some other discrete entity, was believed to be endowed with powers to shape the destiny of each in either a positive or negative fashion. Somewhat different from this general view of the term, Socrates regarded the demon as a divine gift granted to a few select individuals only. According to this view, the poet, priest, philosopher, and sage communicated with the gods through the intervention of their demon. It is in this sense that Socrates called upon his demon and attributed most of his knowledge to intimations from it. This conception of demons as the benevolent agents of the gods was generally endorsed by Plato and others and found support in Plato's doctrine of divine madness or 'enthousiasmos.' In this view, the poet, who himself is devoid of talent, is seen as divinely inspired, as an agent or servant of the gods. Inspiration and the gift of prophesy, however, were attainable only during particular states of mind, such as the loss of consciousness due to sleep or a mind affected by illness or possession. Importantly, to Socrates, Plato, and other contemporaries, the divine disturbance that invited prophetic or poetic activity was clearly distinguished from clinical insanity. Unlike the latter, the inspired madness of seers and poets was conceived as a virtue, a state of mind greatly desired. To quote from Plato:

Madness, provided it comes as a gift of heaven, is the channel by which we receive the greatest blessings. . . . [It] is a nobler thing than sober sense . . . madness comes from God, whereas sober sense is merely human.

Also, Aristotle's assertion that extraordinary talent is characterized by a melancholic temperament does not mean, as is frequently asserted, that Aristotle viewed insanity as concurrent with creativity. Insanity, according to Aristotle's reformulation of the Hippocratic humoral theory, did not occur in all melancholic individuals. To Aristotle, the term 'melancholia' was descriptive of a type of individual, the 'homo melancholicus,' who, depending upon the particular balance of his 'humors,' could be either a sane person of distinction or a madman.

Quite different from the subsequent Roman era and the Middle Ages, where there was relatively little concern or fascination with uncommonly creative individuals, the Italian Renaissance produced a renewed interest in those persons esteemed most highly in the arts. For these possessors of superior creative ability the term 'genio' was reserved. However,

creativity was thought of primarily in terms of an imitation of the established masters and of nature. Unlike the modern conception of the genius, one that stresses originality as the distinguishing feature of the creative individual, the standard of the humanistic tradition involved the 'imitatio-ideal.' While some, like Leonardo and Vasari, insisted that the 'genio' should not be just imitatively creative, but newly creative, these attacks on the 'imitatio-ideal' did not become commonly accepted during the late Renaissance.

Similar to the Greek descriptions of the poet, philosopher, and sage, the unique attributes of the Renaissance 'genio' commonly were described in terms of melancholia and 'pazzia,' or madness. But again, a distinction was maintained between the sane melancholics capable of rare accomplishments and those condemned to insanity. Ficino, who popularized the Aristotelian idea of melancholy, regarded this type of temperament, in its application to distinguished persons, as a divine gift. Accordingly, only the melancholic temperament was considered capable of creative enthusiasm. Hence, assessments of scholars and artists in terms of 'pazzia' were generally not intended to convey the notion of insanity. When applied to great people, the term referred to qualities associated with the melancholic temperament, such as eccentricity, sensitivity, moodiness, and solitariness. Far from being regarded as negative qualities, displays of these characteristics of melancholic behavior were turned into a fad in sixteenth century Europe.

It was during the eighteenth century that the term 'genius' was introduced in reference to individuals who displayed a high degree of creative ability. Different from the Renaissance 'genio' and the associated 'imitatio-ideal,' the Enlightenment genius was defined as one who was in possession of an innate power that manifested itself in works of great imaginative creation where the decisive characteristic was profound novelty and the originally creative. Although most commentators on genius acknowledged certain subrational components, the leit-motif most frequently encountered stressed the rational processes of genius.

Perhaps the model exposition of the Enlightenment conception of genius is Alexander Gerard's *An Essay on Genius*. Defined as the faculty of invention "by means of which a man is qualified for making new discoveries in science, or for producing original works of art," the creative power in genius was conceived as originating in an active imagination. Asserting that an unbridled imagination constitutes a capricious and irresponsible faculty, he stipulated that it must be "subject to established laws." True genius, to Gerard, was only possible as a result of a synthesis or subtle interplay of four powers: imagination, judgment, sense, and memory. He argued:

Mere imagination will not constitute genius. . . . As fancy [imagination] has an indirect dependence both on sense and memory, from which it received the first elements of all its conceptions, so when it exerts itself in the way of genius, it has an immediate connexion with judgment, which must constantly attend it, and correct and regulate its suggestions. This connexion is so intimate, that a man can scarce be said to have invented till he has exercised his judgment.

Gerard was not alone in viewing genius as an interplay of different mental powers. To Duff, it was a balance of imagination, judgment, and taste; Voltaire saw imagination in conjunction with memory and judgment; Kant, in a first

version of his theory of genius, viewed it as a favorable proportion of sensibility, judgment, creative spirit, and taste; to Moses Mendelssohn, genius corresponded to a state of perfection of all mental powers working in harmony; to Shaftesbury, while he stressed the irrational traits of genius in terms of revelation and enthusiasm, a true genius did not infringe upon the rules of art; he needed knowledge and good sense.

The prevailing Enlightenment conception of genius did, therefore, recognize certain natural or subrational components rooted primarily in the creative imagination. However, it pointedly established judgment, or reason, as a counterweight to these components and buttressed judgment with memory, taste, sense, sensibility, and so forth. Judgment was not only capable of averting caprice and extravagance, but made madness a virtual impossibility for genius. As Gerard observed, "A perfect judgment is seldom bestowed by Nature, even on her most favored sons; but a very considerable degree of it always belongs to real genius."

The conception of the man of genius as 'rational' not only constituted an Enlightenment ideal but also, apparently, reflected the actual behavior of such men. As Rudolf Wittkower observed, for example, even artists, known since antiquity for their propensity for eccentric behavior, complied with an image of the conforming artist. Since the Renaissance concept of the 'melancholicus' had been supplanted by this newer image, "none of the great seventeenth-century masters – Rubens and Bernini, Rembrandt and Velasquez – was ever described as melancholic. . . . It was not until the romantic era . . . that melancholy appears once again as a condition of mental and emotional catharsis."

The Romantics' Redefinition of Genius and the Functions It Tended to Serve

The late eighteenth and early nineteenth centuries, under the impact of the romantic movement, saw a profound change in the prevailing conception of genius. This change, as we shall see, was intimately tied to the precarious state of existence of the romantic poets and men of letters.

The application of the term 'genius' to select individuals during the eighteenth century marked, as we have seen, the arrival of a new model for man. Generally deprived of wealth or privileged status, men of genius, or those who aspired to be such, tended to challenge the existing hierarchial order by substituting innate creative ability as a superior criterion for the evaluation of men. D'Alembert, an Enlightenment spokesperson for the man of letters, recognized three factors separating people: birth, wealth, and intelligence, but only intelligence was deemed worthy of true esteem. Unlike the others, he argued, intelligence is a dependable national 'resource,' by its nature inexhaustible and incapable of being 'taken' from its possessors. De Saint-Simon, writing a few years after the demise of the Old Regime in France, was less guarded in his vision of the future society; it was to be dominated by men of genius: scientists, artists, men of ideas. In fact, he cautioned the power holders and the propertied classes not to impede the geniuses' quest for power, 'great prestige,' and money. Failure to comply with this warning, he feared, would lead to the almost certain extinction of the ruling elites: "To be convinced of the truth of what I have

said, you have only to reflect on the course of events in France since [the Revolution of] 1789."

The period of reaction to all 'revolutionary' ideas initiated by Napoleon's defeat and the creation of the Quadruple Alliance meant, of course, that prospects of establishing intelligence as a foremost legitimate criterion for the ranking of men had received a serious setback. The Metternich era refused to comply with the demands of this new, self-appointed intellectual aristocracy. Indeed, the events of the late eighteenth and early nineteenth centuries made the position of this aspiring group rather precarious. The disappearance of the traditional 'sponsor' class, the nobility and the aristocratized bourgeoisie, and the subsequent hazards of commercialization and the modern marketplace, left the status of the man of genius in question. Generally impoverished and deprived of political power throughout most of the nineteenth century, the aspiring artist and man of ideas felt himself engulfed by the anonymous masses. Although the idea of genius may have commanded a degree of respect, even reverence, the men of genius themselves, faced with a practical world, lacked the special sense of identity necessary to separate themselves effectively from the masses.

It was the idea of a special kind of madness that could serve as a distinguishing factor, one that could mark a person as separate, unique, and even divinely chosen. The romantic artists and men of letters, in particular, revived the classical notion of divine mania or inspiration, and established it as a defining mark of the extraordinary individual. It was the aura of mania that endowed the genius with a mystical and inexplicable quality that differentiated him from the typical man, the bourgeois, the philistine, and the merely talented. It established the genius as the modern heir of the ancient Greek poet and seer and, like his classical counterpart, enabled him to claim some of the powers and privileges granted the 'possessed' prophet. In this role, the man of genius could counsel kings and blaspheme with impunity. Importantly also, the idea of mania conveyed to the romantics the notions of possession, suffering, and a mood of sentimental sadness, and the display of these qualities confirmed an individual's identity as a true genius. The theme of the blessedness of some special kind of madness is clearly reflected in Poe's 'Eleanora':

I am come from a race noted for vigor of fancy and ardor of passion. Men have called me mad; but the question is not yet settled, whether madness is or is not the loftiest intelligence; whether much that is glorious, whether all that is profound, does not spring from disease of thought.

Similarly, the poet Wieland spoke of the 'amiable insanity of the muses,' and the clergyman Beecher commented on the desirability of at least some degree of madness on the part of poets.

The desire of the romantics for an affirmed identity, however, constituted only one of their aspirations; a second closely connected goal was to establish their intellectual independence from the past. Although the conception of the innately creative genius did much to advance the cause of originality in intellectual life, those engaged in literature and the arts remained tied to the authority of the academies and the ancient masters. Therefore, the romantics' attempt to appropriate certain supposed qualities of the ancients had to be effected without assuming a subservient role to traditional authority. This necessitated a redefinition of genius.

Prior to the eighteenth century, it was commonly accepted that the human imagination constituted a capricious and dangerous element in the lives of men. Recognized as the source of original creativity, it was simultaneously admired and feared. Pascal, writing in the mid-seventeenth century, reflects this ambivalence clearly:

Imagination – it is this dominant part in man, this mistress of error and falsity, and more often trickster than not. . . . But being most often false, it gives no mark of its quality, marking the true and the false with the same nature.

To benefit from imagination and yet contain its great potential for disaster and evil meant, as Pascal cautioned the ‘wisest of men,’ that one had to consciously ‘resist’ its intoxicating powers with all one’s strength. It is not surprising, therefore, that during the eighteenth century, when the genius first became recognized by many as a model of a superior man, the nature of genius was defined in a way that virtually precluded victimization by his own imagination. As we have seen, in the typical Enlightenment explication of genius, the imagination was seen as constrained by a number of powers or faculties that were particularly developed in the great person. Indispensable to the harmonious interplay of mental powers was the faculty of judgment, or reason, which in conjunction with memory, taste and sense averted not only caprice and extravagance but also, as Gerard observed, made ‘madness and frenzy’ a near impossibility for genius.

The dominant Enlightenment view of the genius as an educated individual whose abundant imagination was properly tempered by good taste, training in the classics and an appreciation for the masters proved unacceptable to the romantic spirit. To create a new independence, genius could no longer be seen in the Enlightenment terms of balance, proportion, and a synthesis of mental powers. The romantics, therefore, granted the imagination a clear predominance over those faculties traditionally seen as the rational counterweights to the imagination. Like the Schlegels, Lessing, and others, Schiller proposed that the deliberate application, far from being beneficial, would serve to obstruct the imagination and bind the potential for profound creativity:

It is not well in works of creation that reason should too closely challenge the ideas that come thronging to the doors. Taken by itself, an idea may be highly unsuitable, even venturesome, and yet in conjunction with others, themselves equally absurd alone, it may furnish a suitable link in the chain of thought. Reason can not see this. . . . In a creative brain reason has withdrawn her watch at the doors, and ideas crowd in pell-mell.

To suspend the “laws of rationally thinking reason” meant, as the Schlegels observed, to be transported “into the lovely vagaries of fancy and the primitive chaos of human nature.”

Psychology, Physician-Psychiatrists, and the Clinical Association of Genius and Madness

The romantic redefinition of genius in terms of the imagination reigning supreme satisfied two goals simultaneously. Through its stress on the spontaneous and irrational imagination, it made possible the appropriation of ‘mania’ from the

past, but it did so while insuring intellectual independence in the present. There was, however, a critical byproduct: while the new definition liberated the romantics from the past, it also disassociated them from the very qualities that previously had been seen as establishing and safeguarding sanity. Given the commonality of the belief concerning the relation of sanity to the balance of mental faculties, the romantic reformulation of genius, which removed this balance, established a logical foundation for the association of genius and madness. And, most ironically, perhaps, the romantics, trapped by their premises and system of logic, began to suspect that clinical madness is indeed a likely if not inevitable end of the condition of genius.

The need of the romantics, then, for a sense of identity and for their own intellectual and artistic independence, led them to adopt a system of premises that left them defenseless against the label of madness. Trapped by their own logic, they came to see their madness as inevitable. Accordingly, the romantic men of genius were among the first to suggest (e.g., Lamartine, Schopenhauer, Wieland, Poe, and others), in reference to themselves and other eminent individuals, that the ancients were indeed correct in their assessment: the ‘demon of madness’ was more than just a stranger among their ranks. Although many of these confessions or pronouncements on the nature of genius were expressed in more general than specific terms, and referred to the ‘inspired’ madness of the ancients, some testified, quite clearly, to the fear of clinical insanity. Coleridge, for example, commented specifically on the dire consequences of a suspended judgment or reason:

The reason may resist for a long time . . . but too often, at length, it yields for a moment, and the man is mad forever. . . . I think it was Bishop Butler who said that he was all his life struggling against the devilish suggestions on his senses, which would have maddened him if he had relaxed the stern wakefulness of his reason for a single moment.

Similarly, Byron, although often appearing to revel in a professed madness, nevertheless spoke with considerable apprehension about his future: “I picture myself slowly expiring on a bed of torture, or terminating my days like [Jonathan] Swift – a grinning idiot.”

It would be erroneous to assume, however, that such trepidations and self-admissions on the part of geniuses were sufficient to establish as a medical fact the connection between genius and madness. For such to occur there had to exist a close correspondence between the intellectual grounds on which these trepidations were based and the specialized knowledge claims associated with the rising fields of psychology and the medical-psychiatric profession. It should be noted in passing that at least one dominant philosophical-psychological tradition was unfavorably disposed and frequently hostile to the romantic conception of the extraordinary individual. The psychological empiricism of Hobbes, Locke, and Hume (which, in the hands of Hartley, Bentham, James and John Stuart Mill, was transformed into psychological associationism) was unalterably opposed to the view that knowledge is in some way innate to humans or the result of inherent dispositions. Instead, these empiricists stressed the extrinsic nature of all human knowledge. The support the romantics needed to help articulate and legitimate their view of the extraordinary individual and the workings of his mind was

located in a highly speculative psychological tradition which predated the critical empiricism of Locke and Hume.

Before 1700, Western scholars attempted to understand the nature of the mind, learning and creativity from a modified Aristotelian position. This position recognized the existence of some half-dozen more or less distinct mental components or 'faculties,' which, to some degree, were subject to improvement through their exercise. The belief in mental faculties was gradually expanded and formalized during the eighteenth and nineteenth centuries and, through the writings of Wolff, Reid, Sully, and others, became established as a school of thought known as faculty psychology. In Reid's reformulation of this perspective, for example, the number of components of the mind was expanded to 24 but retained such traditionally recognized intellectual powers as perception, judgment, memory, and moral taste. Although Reid and other faculty psychologists concurred that the mental powers could be improved through training, they believed that a pronounced display of strength in any faculty is rooted, overwhelmingly, in a powerfully endowed instinct or native disposition. Accordingly, an individual distinguished by an extraordinary ability to memorize facts was seen to possess an unusually vigorous instinct or faculty of memory. The belief in inherent mental dispositions supported not only the inception of the genius ideal but its subsequent romantic reformulation.

Unlike the school of psychological empiricism, therefore, the faculty psychology of Reid, Wolff, and others, with its stress on innate powers and inherent mental dispositions, was sufficiently vague and mystical to accommodate most of the romantics' assertions regarding the transcendental nature of profound creativity. Importantly, also, faculty psychology even concurred with the romantics' position that the genius's dependence on an 'overcharged' and highly impulsive imagination constitutes a form of madness, divine or otherwise. It had long been an established principle, particularly for faculty psychologists, that an excessive stimulation of any faculty of mind is incompatible with perfect health and mental adjustment.

Whether or not, however, the supposed infirmities of genius constitute clinical pathology rather than a divine gift or mania remained, until the middle of the nineteenth century, a matter more of philosophical speculation than of supposedly scientific fact. The individuals, overwhelmingly, who were to establish the verdict of clinical madness as a medical fact were those who had earned a medical degree and are classifiable under the general category of physician-psychiatrist. These specialists, although they embraced many of the assumptions of faculty psychology and brought to bear what then were regarded as the latest clinical concepts and diagnostic categories, relied quite heavily in their determination of genius as clinically mad on the self-admissions of illness on the part of the 'gifted.' And while many of these self-admissions were expressed in terms of the inspired madness of the ancients, these physician-psychiatrists took the men of genius at their words, they decidedly were not like ordinary, healthy humans.

The first examination of genius as a purely medical problem may be dated to Lélut, a French psychiatrist, who in 1836 scandalized the world of letters with the first clinical history of genius in which he claimed that Socrates's inclination "to take the inspirations of his conscience for the voice of a supernatural agent [his demon]" was evidence of a

"most undeniable form of madness." Other psychiatrists and scholars soon followed suit with their own views and analyses of other 'gifted' persons (e.g., Galton, Lombroso, Maudsley, Moreau, Stekel), with the result that within a century such works numbered in the hundreds. Importantly, the judgment of genius as pathological was the dominant position on the issue, one that derived its overwhelming support from members of the medical and the developing psychiatric professions. Those who projected the image of sickness distinguished themselves from each other by identification of different types of mental illness largely in step with the rise and fall of diagnostic categories in psychiatry then currently in favor. Whereas diagnostic labels such as psycho-physical disequilibrium, monomania, degeneracy, neurasthenia, and neurosis prevailed in the years up to 1950, the disease categories that have gained ascendancy since that time are those, such as schizophrenia and manic-depressive illness, that figure prominently in the contemporary lexicon of psychiatry.

Implications for the Contemporary Debate

As we have seen, the romantic poets and men of letters were among the first to suggest, in referring to themselves and other eminent individuals, that the ancients were indeed correct in their assessment: The demon of madness was hardly a stranger in their ranks. These pronouncements, as previously noted, played an integral part in the past in the determination of the genius as clinically afflicted. This tendency to take the gifted at their word regarding their own condition applies as well to contemporary examinations of the issue. Kay Jamison's book, *Touched with Fire: Manic-Depressive Illness and the Artistic Temperament*, provides demonstration of this fact. Jamison builds a clinical connection between creativity and manic-depressive illness by allowing scores of artists, composers, and writers from across time in Western society to reflect on their own changes of mood ranging from melancholic states to feelings of euphoria, their obsessions and fears of going mad, their thoughts about suicide, their addictions to alcohol and drugs: those and other behaviors and mental states, in other words, identified by the author as symptomatic of mood disorders.

One of the problems of treating such self-admissions as essentially reliable descriptions of mental illness is that it tends to overlook one critical fact: These pronouncements on the part of the creative individuals may involve self-serving descriptions and projections of images that were made in the context of cultural assumptions often quite different from those of contemporary society. In light of these facts, it remains unclear what meaning should be attached to the tendency on the part of many poets and other creative persons to admit to a 'touch' of madness.

Two examples illustrate the difficulties involved in the interpretations of such admissions. The first concerns an excerpt of a poem from Drayton, a poem written in praise of another poet, Drayton's friend Reynolds:

His raptures were
All air, and fire, which made his verses clear,
For that *fine madness* [italics added] still he did retain,
Which *rightly should* [italics added] possess a poet's brain.

This excerpt is open to a number of interpretations which include the reference to the divine mania of the ancients, a condition, as previously noted, that was not synonymous with clinical madness. Rather, it was a state of mind greatly desired. Given this fact, are we justified in treating this excerpt, as Jamison did, as an essentially reliable description of illness. Or is it not equally possible that Drayton's reference to the presence of a 'fine madness' on the part of Reynolds has little if nothing to do with clinical illness and was intended as an ultimate compliment a poet could be paid, one that confirmed his membership in the tribe of truly eminent poets?

Similarly, what are we to make of Coleridge's pronouncement who, in a defense of Swedenborg, proposed that, unlike ordinary madness, his was the madness of genius: "a madness, indeed celestial, and glowing from a divine mind." Is it not likely, as Kretschmer has argued, that pronouncements such as these are confirmation of the fact that "many men of genius themselves prize madness and insanity as the highest distinction of the exceptional man." After all, Kretschmer observes, "the mentally normal man is, according to the conception itself, identical with the typical man, the average man, the philistine."

Consistent with this line of argument, the association of creativity and madness deserves to be seen as a kind of role expectation appropriate for artists and writers that originated in antiquity and received powerful reinforcement as a result of the romantics' redefinitions of the nature of genius. In the way that contemporary scientists, accountants, and engineers are expected to display attributes of objectivity, reason, and emotional stability, for poets, writers, and artists the expectations involve manifestations of intuitiveness, a fanciful imagination, sensitivity, temperament, and emotional expressiveness, in short, manifestation of a kind of madness. It is not at all unreasonable to assume that, to the extent that these expectations continue to be part of a professional ideology of what it means to be truly creative, even contemporary writers and artists, far from disavowing the label of madness, may actually invite it. Indeed, they may even inadvertently volunteer evidence of madness in diagnostic and psychological examinations. Moreover, is it not possible that these expectations may involve the elements of a self-fulfilling prophesy? In a rephrasing of a line from Orwell, "they are wearing a mask, and their faces grow to fit it."

Such possibilities have implications for the issue of creativity and psychopathology. Indeed, they may invite conclusions at odds with the conventional association regarding these two variables. One of such conclusions is associated with the existentialist philosopher, Jaspers, who maintained that the greater manifestation of mental illness in geniuses was the result of society's selective granting of fame. To Jaspers, in other words, the term genius was a socially applied label primarily reserved for those talented individuals who displayed certain attributes of sickness closely tied to the role expectations noted above. He did not believe that the notion of the mad genius was

applicable to all historical periods. Rather, what distinguishes the nineteenth and twentieth centuries from the seventeenth and eighteenth, Jaspers reasoned, is a general mood or inclination in Western society that craves the mysterious, the unusual, the undefinable, and the blatantly diseased. Accordingly, although the Enlightenment tended to reward creative individuals who were healthy and rational with the distinction of genius, the nineteenth and twentieth centuries (since the time of romanticism, that is) have shown a distinct preference for those creative individuals who are diseased.

All of this is not to suggest that the display of symptoms of mental illness on the part of the creative are the result of nothing more than deliberate role playing and adherence to role expectations deemed appropriate for artists and writers. Rather, it is a reminder that examinations regarding the relation of creativity to mental illness must take full measure of relevant historical and socio-cultural developments as well as their impact on contemporary conceptions regarding the nature of creative individuals and the creative process. To the extent that these conceptions find expression in a pervasive societal belief in the existence of a close connection between the creative arts and some form of madness, as is the case in Western society, they are likely to be of consequence and become intimately tied to the acknowledged mind-body connection in the causation of genuine illness. As such, they are indispensable to a thorough understanding regarding the relationship between creativity and mental health.

Acknowledgment

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See also: Schizophrenia and Psychosis.

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Matthew, Pygmalion, and Founder Effects

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Glossary

Bradford's law An area-specific formulation regarding the percentage of total coverage by various journals in a field. When periodicals are ranked in order of decreasing productivity in a field, the sum of articles not produced by the most prolific authors of that field is proportional to the logarithm of the number of their producers.

Cumulative advantage A principle referring to the accumulation of personal or institutional advantages as a result of the social mechanisms of scientists.

Lotka's law Alfred Lotka's formulation about the distribution of productivity stating that the number of individuals making n contributions in a domain is inversely proportional to n^2 .

Matthew effect index (MI) Shows the national win or loss for citations in positive or negative percentage numbers. The index was formulated as a ratio of the deviation of the observed citation impact from the expected citation impact divided by the expected citation impact calculated from the impact factors of all journals used for publication by a country. The index is a positive number when the observed number of citations exceeds the number of expected

citations, indicating a gain situation, and a negative number when the observed number of citations is smaller than expected, implying a loss situation.

One-pass versus multi-pass processes *One-pass process* refers to the consideration of a scientific discovery as being made by the person who performed the last or most critical step. *Multi-pass process* acknowledges that several contributions and phases of reworking, reconceptualization, or rejection may be involved in the ultimate discovery. It recognizes interactive networks among scientists.

Pareto's law Vilfredo Pareto's empirical generalization stating that a minority of a population owns the majority of the resources, while the majority of the population shares the rest.

Price's law Derek Price's empirical generalization that the square root of the number of all contributors produces half of all contributions.

Self-fulfilling prophecy The situations in which one's expectations can influence an outcome on the expected direction. If one defines a situation as real, it consequently becomes real.

Introduction

Creativity was once regarded as elusive, obscure, magical, and beyond the sciences. In the past several decades the field of creativity studies has become more and more scientific. This implies objectivity, some of which is a result of careful experimentation. Such experimentation is usually intended towards the isolation of causes and effects. Not surprisingly, several broad 'effects' are believed to govern creativity. Several terms have been coined to describe effects that explain various mechanisms with relevance to creativity. The effects to be discussed here focus on mainly noncognitive and external aspects of creativity. They are the Matthew, Pygmalion, and Founder Effects. They explain the social mechanisms of scientists, the role of significant others, and the timing or primacy of scientific discoveries, respectively.

Matthew Effect

There has been debate about the relative importance of internal versus external influences on the development of scientific interests. Internal influences refer to the influence of scientists' work as isolated from others' influences. External influences refer to social, cultural, and contextual influences. Creativity is often studied in terms of internal influences: the majority of studies on creativity depend on cognitive and personality aspects of creativity. External influences have been less studied

but did become the primary interest of the sociology of science. One result was the concept of the Matthew effect. The *Matthew effect* describes the reward and communication system of science based on the passage in the Gospel according to St Matthew, which states, "For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath."

Put in the context of scientific creativity and productivity, this statement addresses the issues related to the major criteria of success in academia such as publications, grants, and facilities. A dramatic expression of the competition in academia is the phrase 'publish or perish.' According to Merton, who coined the term *Matthew effects*, this game is not played fairly, with some people winning every time disproportionately to their superior skills, ability, and work. He pointed to various social processes responsible for the biased evaluation system that leads "the accruing of greater increments of recognition for particular scientific contributions to scientists of considerable repute and the withholding of such recognition from scientists who have not yet made their mark." As a sociologist, he attempted to explain the reward and communication system in science in sociological terms: "the reward system [...] influences the 'class structure' of science by providing a stratified distribution of chances, among scientists, for enlarging their role as investigators."

According to Merton, science is public, not private, and the Matthew effect reflects the social climate that influences the degree to which scientists will be known by others. Merton's

view emphasized external influences on recognition of scientific creativity rather than individuals' real potentials. By external influences, Merton referred to the community of scientists that may disrupt the rightful distribution of credits because of their systematically biased ascriptions.

A corollary to this proposition is differential access to facilities and opportunities called *misallocation of resources* that works in favor of more established and famous scientists. Inequality in the reward system provides further opportunities for known scientists and penalizes the unknown names in the field. The Matthew effect simply represents the equivalent claim as the proposition "the rich get richer and the poor get poorer" in economics. This situation reflects a sort of monopoly held by the famous scientists.

Some of the first evidence of the Matthew effect came from Harriet Zuckerman's interviews with Nobel laureates in the early 1960s. These indicated that 'ultra-elite' scientists receive disproportionately more credit for their contributions to science whereas obscure scientists get disproportionately little. The distribution of the number of publications is highly skewed: there are many Ph.D. holders who publish one or no articles while a small number of scientists publish hundreds of papers as well as books. Although the skewed numbers can be attributed to other factors such as a scientist's differential ability, efforts, and career expectations, Zuckerman's findings raised some questions about the fairness of the mechanism.

Cumulative Advantage

The idea of *cumulative advantage* is relevant to Matthew Effects. Career trajectories of the scientists depend, to a great extent, on their cumulative advantage, defined as the social processes that determine the allocation of resources and opportunities such as laboratories, research grants, and talented research assistants and their accumulation among particular scientists and institutions. The advantages can be personal such as reputation and age of the scientists or contextual such as institutions and available resources.

Reputation is the most significant personal advantage. Social processes favor reputable authors over lesser-known authors even when both produced publications of equal quality. Even in collaborative works in which well-known scientists contributed very little, such scientists are credited with most of the work because of their reputations while other contributors receive little credit even if they invested more effort. This is true even when the famous scientist is listed last in cases where the order of authorship reflects the level of the contribution from highest to lowest. This situation persists because of the underlying preconception among the community of scientists that the famous one provided the idea, resources, and connections. This misperception paves the way for other critical decisions that help the known scientists.

When positions become available, they usually are awarded to the scientists with higher recognition, publication, and fame, who are thus able to do more research and further increase their reputations. The less-known scientist, on the other hand, will have a very limited opportunity to stay in the current position because of limited resources and facilities. Once scientists are Nobel laureates, they are Nobel laureates throughout their lives, and this title often increases the

influence of their work beyond that work's merits. Their books will sell better because of the 'Nobel laureate' designation, and no journal will want to reject their papers (journals may even ask them to write papers). The ideas in the book will be read by many other people and more people will be convinced about those ideas and cite them in their own works.

Cumulative advantage specifically refers to the benefit of the early bloomers in sciences because of their relative advantages in trained capacities and locations enabling their access to resources. Studies of creativity and age show that researchers who publish earlier attain a greater number of publications than those who publish at older ages. Moreover, early publishers also produce higher quality contributions. This phenomenon can simply be regarded as normal because early bloomers will have more time to produce. From the perspective of cumulative advantage, however, this is related to the precocity bias that promotes early bloomers since early publications are assumed to reflect overall productivity. While there are scientists who cannot keep up their earlier performances and those who perform better in later years, they are fewer in number. The role of cumulative advantage is evident among older and younger scientists. Longitudinal studies of 2000 American scientists from several fields showed that the inequality between older and younger scientists has risen with respect to their number of publications and number of citations, which underlined a marked stratification.

As for the institutionalized advantages, lesser-known scientists can break the cycle if they are at major universities where their publications can be disseminated among the elites of the field. Statistics indicate that a good proportion of the research grants are provided to particular universities. Grants often yield more original papers and attract more high-ability novice researchers. Likewise, many of the Nobel laureates work at particular universities such as Harvard, Columbia, Berkeley, and Chicago. In a recent empirical study controlling author quality, journal quality, and article-specific characteristics, researchers found that there are 19 elite universities that have a positive impact on the initial reception of an article and on peer recognition for its contributions. Specifically, scholars affiliated with two universities, Harvard University and University of Chicago, have a greater chance for peer recognition. This finding was limited to the departments of economics, and similar studies can be extended to other departments as well.

The critical factor that distinguishes certain scientists from others is the limited awards, opportunities, and facilities provided to scientists. If only three Nobel Prizes can be granted in a year in a given category, this does not mean that only those three scientists may deserve them. However, the recognition of the scientists after they win the Prize differs disproportionately to the quality and significance of their works. The problem is that there are a few prestigious awards that could be granted to many successful and aspiring scientists. Another example is inequality in scientists' access to laboratory and financial support to maintain their research. Although scientists working in less-known or liberal arts colleges might come up with very bright ideas, they cannot carry out their research because of teaching requirements or lack of facilities. The same situation rules when it comes to publishing papers. Academic journals have strict rules such as publishing only a certain number of articles in each volume – to the extent that only 10–25%

of submissions are accepted in the essential journals. The limited space in the journals tends to be allocated for the prolific minority rather than the novice or less prolific researchers. Furthermore, when two rival scientists with and without articles apply for a grant, their publications will be taken into consideration as well as other qualifications. Success, awards, and opportunity breed further success, awards, and opportunity, just as money breeds more money. Limited prizes, money, and facilities allotted to famous scientists distinguish them from the other colleagues.

The role of reputation for further recognition exhibits itself in the cases of 'multiples' when two or more researchers discover the same thing. Even though each scientist who developed or discovered the same thing deserves an equal amount of credit, respect, and recognition, the more famous one is associated with the discovery rather than the others. Some theories, such as the Darwinian Theory of Evolution, are named after the scientist, while many other discoverers who contributed to the development of the theory will not be even known and recalled by later generations. This cycle keeps going for the benefit of the more famous, and the disparity between famous and obscure researchers will increase independently from their capacities as scientists. However, Donald T. Campbell and Herman Tauscher noted the other direction for the attribution processes for 'multiples.' They indicated that scientists with unique or few contributions can be credited with a discovery rather than other scientists with many contributions because singularity of contribution provides unequivocal in the communication.

The Matthew effect is influential in the communication system through its manipulation of the visibility of scientific works. Like the influence of marketing strategies and advertisements for commercial products on their sales, reputations and the quality of previous work increase the possibility of recognition, appreciation, and dissemination of new work in comparison to a new scientist with no distinguished work beforehand. The names of the innovators sometimes overshadow the quality and importance of the innovations. When one thinks of professional conferences in any field, the presentations of the prominent figures in the field are followed by many researchers whereas novice researchers have fewer followers even when they sometimes introduce more original works.

Formalized Effects

Cumulative advantage may be related to various parallel effects. The so-called skewed distribution of productivity, for instance, was formalized by Alfred J. Lotka as 'inverse square law' based on his bibliographical studies in physics and chemistry. This formula states that the number of scientists with n publications is inversely proportional to n^2 . This formula yields a curve with many people with one or zero publications whereas a couple of researchers produce hundreds of publications. If there are 100 scientists with only one paper, there can be 25 people producing two, and approximately 11 with three papers. The number of scientists with a higher number of publications decreases asymptotically. The resulting graph is a left-skewed distribution. This formula implies that approximately 5% of scientists produce about half of all papers and the others share the other half. On the other hand, the

proportion of all contributors with only one publication is about 60%. Even though Lotka's law does not apply to all areas, recent studies about productivity proposed that it is useful in understanding the underlying pattern of author productivity.

Lack of universality in Lotka's law has been addressed by Bradford's law (or law of scatter) which was developed based on journals and articles grouped to identify the number of periodicals related to particular subjects. The process yielded a constant representing the subject area within the following formula, and used to determine the percentage of total coverage by various numbers of journals in a field: $R(n) = N \log n/s$ ($1 \leq n \leq N$), where $R(n)$ represents total number of journal articles, N represent total number of journals, and s is the constant for a subject area.

Derek DeSolla Price proposed another formula for the distribution of scientific productivity. According to it, half of the total number of papers published by N scientists belongs to \sqrt{N} scientists. Assuming that there are 1000 articles in a field published by 100 scientists, 500 of them belong to the 10 most prolific scientists. Price suggested that two-thirds of the scientists publish only one paper and do not produce any more. There was a slight difference in the underlying assumption of his formalization: success increases the probability of further success, but failure does not increase the probability of later failure because lack of publication is a 'nonevent' and it cannot be counted as a publication (any event) is counted. Therefore, he suggested a cumulative advantage distribution, which is an increasing function, rather than negative binomial distribution which can be an increasing or decreasing function, reflecting the failures and successes.

Another principle that is applied to scientific productivity is Pareto's law (also known as the 80/20 rule) originated in economics. Italian economist Vilfredo Pareto observed that 20% of the population owns 80% of the land in Italy. The remaining 20% of the land is shared among 80% of the population. This imbalance between the 'vital few' and 'trivial many' as described in Pareto principle seems to fit the distribution of the productivity of the scientists as well. A small percent of scientists own the majority of publications and resources, while the majority of scientists own only a little.

These 'laws' reflect the inequality in productivity. Inequality in citations is even more drastic. Eugene Garfield counted the citations of 19 million articles. Of all articles cited, less than 1% were cited more than 100 times; another 3% were cited between 25 and 100 times; and 58% were cited only once in a 20-year period. Therefore, distribution in citations is more uneven than publications. However, research shows that the inequality in citations is not related to professional age, which was claimed to influence productivity in favor of early bloomers because of precocity bias.

Extension to Countries and Journals

Other than personal and institutional aspects, the Matthew effect has also been detected at the macro level, leading some to ask if there are Matthew effects for countries. Ideally, scientific publication is only related to the content of the scientific works rather than their regional origins. However, this ideal situation may not be the case because of economic, cultural,

and institutional reasons. Thus, a few countries can receive citations predominantly higher than the many other countries, which receive only a few. A Matthew Effect Index (MI) was developed that yields a positive or negative number indicating the win/loss status of the country in citations. The MI index is higher based on the extent to which the observed number of citations can exceed the number of expected citations. The expected number of citation is determined based on impact factors of all journals in a country. The MI index is equal to the difference between observed and expected citations divided by expected citations. The resulting value is a percentage. In a study comprising 40 countries and 2712 journals, only ten countries (Switzerland, Denmark, the Netherlands, Sweden, United States, United Kingdom, New Zealand, Ireland, Germany, and Finland) had positive MI values (higher than expected citations). Analyses of the Matthew effect for countries allowed a new type of journals, called 'Matthew core journals,' which refer to 145 journals accounting for 50% of the citation wins and losses. Those journals were critical for gaining or losing excessive amount of citations.

In an empirical study, the role of the journals in which the articles are published was assessed by comparing the citations of identical papers in journals with high impact factor versus low impact factor. Analyses showed that impact factor of the journals played a significant role in getting citations: papers published in high impact journals received twice as many citations as their identical copies published in journals with lower impact factors. Matthew effects as associated with journals influence the citation and therefore visibility of the scientific works.

Evaluation

The Matthew effect was seen as pathology because it conflicts with meritocracy in science. Monopoly is as undesirable in science as it is in economics. However, Michael Strevens argued that the Matthew effect can be good for society and science. He argued that rewards are proportional to their contribution to society so that contribution to society is maximized. The contribution to society, then, is proportional to its epistemic security, that is, trustworthiness of the discovery or contribution. For example, a new medical treatment for an illness can have good epistemic security after it has been observed to cure the illness successfully. There should be no problem with receiving more rewards if the contributor has resolved an important problem of human beings. Based on this line of reasoning, allocation of credit proportional to the rewards is not at odds with scientific norms since this mechanism is helpful in maximizing science's contribution to humanity. According to this rival hypothesis, the Matthew effect does not seem to violate the fair distribution of credit in particular fields in which the consequences of the discoveries and their epistemic security can be tested. However, this may not be the case in many fields in the social sciences, and the Matthew effect can rule more strictly.

Limitations

The Matthew effect cannot be easily generalized to fields other than the hard sciences because some do not require many

resources. For example, in the fields of the arts and literature, the Matthew effect is not dramatically observed in terms of access to resources, since the cost of writing a poem or making a musical composition requires only a pen or a musical instrument in comparison to hard sciences, which require a laboratory and grants. Nonetheless, previous works or publications in arts and literature can still determine the acceptance of future works.

Second, empirical results supporting the cumulative advantage hypothesis can be explained by some other perspectives as well. For example, some explained creativity with multiplicative functions that propose a log-normal distribution because the product of several factors that influence creativity produces a highly skewed distribution, which is different from simple addition of the same factors. The combination of normally distributed factors such as creativity, intelligence, and motivation, yields more complex effects than suggested by the cumulative advantage model.

Third, some models that are more personal in nature explain the continuity of creative productivity better than the cumulative advantage model. Simonton showed that latent factor of creative ability can successfully explain longitudinal stability of the individual differences in sciences. This argumentation takes us back to the beginning of the discussion where I dichotomized the ways of understanding creativity as internal and external. A seemingly consistent hypothesis relying on external influences can well be explained by a totally different model. Furthermore, Simonton's rival hypothesis rejects the early bloomer's advantage in producing more output. According to his findings, the age curve shifts but follows a similar pattern for late bloomers when their creative potential is assumed to be zero. It is the creative potential that makes the difference for productivity rather than the age of first publications.

Pygmalion Effect

A person's perception is sometimes as important as what they are observing or considering. In part for this reason, a great deal of research has examined the ways various psychological constructs, such as intelligence, creativity, or personality, are understood by various lay groups. These understandings represent what are called *implicit theories*. Explicit theories, which refer to views held by scientists and researchers, are shared, tested, disseminated, and discussed. All of the theories mean they are explicit, and they may have impact on scientific work and theory construction. Implicit theories are also potentially important. They are stable yet not shared or tested. The implicit theories of teachers about creativity are extremely important. They no doubt shape teachers' expectations about students, and those expectations are critical for students' academic achievement and intellectual growth.

The *Pygmalion effect* occurs when expectations lead to actual changes in behavior. The label Pygmalion comes from a Greek myth that tells the story of a sculptor from the island of Cyprus who carved an ivory statue of a woman. She was so beautiful that Pygmalion fell in love with her. Pygmalion treated the statue as if it were an actual woman and wanted it to be real. He prayed to Aphrodite, the 'goddess of love,' who brought

the statue to life. Social psychologist Robert Rosenthal was the first to name this effect, and thus it is also known as the *Rosenthal effect*.

The role of expectations on human behaviors is discussed not only in the concept of the Pygmalion effect. There are other effects related to expectations, such as the Hawthorne and Placebo effects. However, the concept most closely related to the role of expectations on human behavior and that on which Rosenthal bases his definition is *Self-fulfilling Prophecy*. Understanding the Pygmalion effect is easier when self-fulfilling prophecy is well-understood.

Self-Fulfilling Prophecy

Like the Matthew effect, the concept of self-fulfilling prophecy was introduced by Robert K. Merton. In his book, *Social Theory and Social Structure*, he defined it as the situations in which people's expectations can alter realities in the expected direction because the target person acts in accordance with the expectations. Self-fulfilling prophecy highlights the importance of definition of situations: "If men define situations as real, they are real in their consequences." This principle, however, works in many cases of subjective reality regarding human affairs, but not for natural affairs. Note that the definition of the situation does not have to be correct. Hence, a false definition of the situation may trigger a new behavior which can make the false definition become true.

There are plenty of examples self-fulfilling prophecies. Think of the banking system. Can a bank go bankrupt because of rumors that it is going bankrupt? According to self-fulfilling prophecy, that is very possible! If a good majority of the investors are convinced that the bank is going to collapse soon and that they may not be able to withdraw their money unless they do that as soon as possible, it may become a reality. Their expectations, which were not true beforehand, led to a new behavior which, in turn, resulted in what they expected. Some researchers explain underachievement of the black population in the United States with the concept of self-fulfilling prophecies. Prophesized underachievement becomes a reality.

There is empirical support for the concept of self-fulfilling prophecy. Ray C. Rist was interested in teacher-student relations based on the premise that students' variations in success, rewards, and creativity should be considered in a larger scope, the social structure surrounding them. He, therefore, argued that the dynamics of the interaction are not uniform and hypothesized that initial presuppositions of teachers about their students' abilities and their expectations are critical for academic achievement. Teachers, informed that certain students were 'fast learners' or 'slow learners,' treated those two groups of students differently and had different expectations. He observed that teachers have recognized that their expectations were biased and influenced by their social status and ethnicity.

How is it possible? One answer is that these expectations about others are communicated to those who are expected to behave in particular ways and that those who receive the message then react in accordance with this message and consequently confirm the expectations. The power of the message communicated is related to the subjective status of the message sender. If the person who claims a prophecy has

high status in the eye of the message receiver, the message is perceived and followed as if true.

The overlapping aspects of the Pygmalion effect and self-fulfilling prophecies are clear: the power of expectations. But how are they different? The Pygmalion effect could be defined as a self-fulfilling prophecy that occurs at an interpersonal level. "One person's expectation for another person's behavior can quite unwittingly become a more accurate prediction simply for its having been made." Whereas self-fulfilling prophecies explain the influence of beliefs on the consequent behavior, the Pygmalion effect specifically focuses on how one person's expectations about another person's behavior can turn out to be a reality just for having been expected.

The Pygmalion effect is more intriguing when it is applied to creativity. First, there are some settings, like school or business environments, in which creativity is markedly influenced by interpersonal relations. In those settings, power relations and the status of the others might play a significant role on the manifestation of creativity. The question above can be altered with that in mind: "What would happen if, for instance, teachers could change their expectations about the creativity of their students?" "Could this lead to a positive change for the students?"

Teachers and Students' Creativity

Teachers' expectations are especially important when it comes to creativity because studies show that there is already a mismatch between teachers' perceptions of creativity and creativity as a construct and its correlates. Erik L. Westby and V. L. Dawson examined teachers' understanding of creativity in comparison to the definition of creativity in previous studies. Teachers were also asked to identify their most and least favorite students. They found that teachers' perceptions of creativity were different from those in the prior studies. Interestingly, students who are unappealing to teachers exhibited the characteristics of creative people. Teachers tend to see their favorite students as creative students, whereas they do not regard their least favorite students as creative. It is not hard to imagine that teachers' expectations about those favorite but not very creative students will be high and that the expectations about those not favored but nevertheless creative will be low. In other words, the Pygmalion effect seems to influence some students but not all, especially the creative ones.

R. Pippert conducted an experimental design to test the Pygmalion effect for creativity. *Torrance Tests of Creative Thinking* were administered to 20 fourth-grade and 20 sixth-graders who were randomly assigned to experimental groups. The results of this test were given to teachers as pretest results so that they could 'know' which students were 'highly creative.' Teachers were encouraged to observe those highly creative students for their creative potential. Those names were brought up again over a period of several months. The pretest was administered again and results showed that students in the experimental group classified as creative improved their creativity scores more than those in the control group. In interviews with teachers, they were asked if they suspected the stated purpose of the study. The creativity scores of pupils whose teachers did not doubt the stated purpose were higher than the pupils whose teachers did.

In another study by Rosenthal and his colleagues, all children in grades one through six received a test that supposedly discovers creative potential. Also, they were asked to draw a man and to draw as many things as they could. Twenty percent of the children were randomly selected as 'bloomers' in terms of creative ability, and the teachers were informed that those children had unusual creative ability. The tests were administered again at the end of the academic year, and classrooms and teacher-student interactions were observed. Even though no overall difference was found for teacher expectancy effect, 'bloomers' in the fifth grade performed at higher levels than those not identified as unusually creative. Even though those results did not convincingly demonstrate the Pygmalion effect for creativity, another finding from this study underlined the role of teachers: the students with the highest score gains had teachers who are likeable, interested in children, enthusiastic, professional, and inclined to give encouragement.

Prophecy Creativity

Can we manipulate the creative performance of people by changing our expectations about them in other settings? An empirical study by Samuel J. Marwit and James E. Marcia provides an answer. They used responses to inkblot tests as an indicator of intellectual ability. Since inkblot tests involve obscure stimuli, the responses to them can be viewed as a measure of divergent thinking ability, which has been regarded as a good estimate of creativity. They hypothesized that the number of responses given by a subject is influenced by the examiner's expectations. In the study one group of examiners predicted many responses while another group predicted few. The results showed that subjects of the former group provided 54% more responses than the latter group. In another study, examiner's expectations were manipulated regarding the possible responses from the inkblot tests by letting a group of them know that more animal percepts should be obtained than human percepts. The other group was told the opposite. The ratio of animal to human percepts was 33% higher in the former group than in the latter group. These two studies indicated that expectations about others can influence the creative responses as well as change the content of the responses.

Pamela Tierney and Steven M. Farmer tested the role the Pygmalion effect has on employee creativity in organizations. Supervisors who have high expectations about employee creativity were perceived by employees as supportive of creativity. The correlation between supervisor and employee expectations for employees' creative performance was moderate and significant. According to this study, expectations manifest their influence through intermediate steps like motivational effects and self-efficacy. Employees' self-efficacy on creativity mediated the Pygmalion effects (supervisors' expectations). This means employees who were seen as highly creative by their supervisors and reported about themselves that they had a strong creative capacity demonstrated more creativity in their works. This finding confirms the proposition that the expectations of others are communicated to them.

In another study in an organization setting, researchers hypothesized that leadership, individual problem-solving style, and work group relations influence innovative behavior through their influence on perceptions of the climate for

innovation: the more supervisors expect innovative behaviors, the more a subordinate becomes innovative. The analyses showed that expectations of supervisors influenced individual innovative behavior even though this effect is specific to certain tasks such as technical tasks.

Studies of the role of expectations on creativity showed that assuming creative potential in everyone is conducive to creativity. Recognizing the significance of Pygmalion effects for creativity, thus, would be a significant addition to the implicit theories of teachers and supervisors.

Founder Effect

Recall that the Matthew effect emphasized the social mechanism of sciences that favor the famous scientists. Nickles defined another term, the *Founder effect*, also known as the *Historical Priority effect*, which refers to the importance of the timing or primacy of the scientific works. The idea is that some works of obscure scientists can make them famous just because of the triggering effect of the works. The Founder effect is best understood along with the Matthew effect and sometimes competes with it. Both involve the distribution of credit among discoverers. The Matthew effect highlights the role of reputation and other advantages on the distribution of credit while the Founder effect underscores the role of initiation or foundation of a new line of thought. The Founder effect represents cases where scientists made a name for themselves just because their work launched a new idea or series of research and triggered others scientists' works that in turn may have yielded a discovery. Hence the Founder may not have himself actually discover the key finding.

According to Nickles, two different models of creativity are possible: traditional/enlightenment and romantic models. He argued that all discoveries fall into one of these. The Enlightenment model relies more on empirical proofs which are evaluated through inductive or deductive reasoning. Because of heavy emphasis on rational means, scientists are viewed as calculating engines. Romantic reaction to enlightenment view relies more on intuition. Instead of tracking the empirical evidence through rational processes, sensitivity to the lack of fit on the whole is viewed as responsible for the discovery. Oft-cited 'Aha!' moment in the creativity literature was a romantic understanding of creativity.

The two perspectives merge on their conception of science as a *one-pass process*. This suggests that scientific works are presented as if they become knowledge when they are finished like a snapshot of the final scene without elaborating on the processes of reworking, reconceptualization, or rejection. This is a simplification that reduces a whole process into 'scientist A made discovery Z' thinking. In actuality, scientific discovery is a *multi-pass process*. Several investigators usually make contributions, additions, or reinterpretations, each taking the problem into a different point. Because of the heavy cognitive overload involved with multipass thinking, and the emphasis on the individual in the history of science, it is easy and typical to recall the 'heroes' of science and ignore the complex networks that each added small blocks to the huge building. Jose Ortega y Gasset actually proposed that modern science owes much of the contribution to mediocre scientists who constitute the

majority of the community. One last point about Founder effects: the initial step that provides the initiators with credit can be in the wrong direction with respect to scientific correctness, or it may be misunderstood by the real contributors who followed the founder. Some prominent examples for Founder effect are Max Planck and Frederick Banting.

Example Cases

Max Planck is known as the discoverer of quantum of energy because of Einstein and Ehrenfest, who started their works with (and misread) Planck's works. The discovery of quantum of energy, in fact, emerged years later, and Planck's solution to the problem was abandoned. Max Planck initiated his work and got credit because he coined the term 'quantum,' while his solution eventually was not accepted. In this example, association of the discovery of quantum energy with Planck rather than Einstein can be explained by Planck's reputation (therefore, the Matthew effect is relevant in this situation because Einstein was not well known at that time) as well as his initiative for a new line of thought even though his naming was just accidental and [his] solution was not correct. In Planck's case, both Matthew and Founder effects operate together.

Frederick G. Banting's case (along with Charles Best) represents how an enthusiastic but unknown scientist can get credit for his initial work that gave birth to a significant discovery. Even though Banting was credited with the discovery and received the Nobel Prize, his work was not on the right track in terms of the resulting discovery. His hypothesis, based on the idea of duct ligation to isolate internal secretion in the

pancreas, did not comply with the established facts in physiology. He was correct in addressing the problem (which concerned enzyme action) even though his work did not solve it. However, that deficit did not change the fact that Banting's idea was the first step that led other researchers to contribute to the solution. Banting was an unknown scientist when he came up with his idea. Therefore, his case represents the sole operation of the Founder effect without the Matthew effect.

Similar to the Matthew effect, the central idea of the Founder effect is the suggestion that there is more innovation in science to be recognized and, therefore, more credit to be shared among many more contributors. Nickles noted that the problem of cognitive overload can be handled by de-emphasizing the individual scientists so that the role of social 'state variables' and 'forces' can be better understood.

See also: Creativity in Science; Education and Creativity; Social Psychology.

Further Reading

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Margaret Mead 1901–1978

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Introduction

In the image we have of her later years, she moves determinedly with her trademark walking aid – no ordinary cane but a forked stick of British cherry wood, as high as her shoulder. Her figure is short and unshapely, and she might easily be described as dowdy (unless one notices the careful attempts to take account of fashion in her dress). Despite her superficially nondescript appearance, this woman is no more ordinary than her cane. Her appearance, whether on New York streets or on TV, made her a popular eponym for a sojourner in primitive, exotic territory. The field trips that she completed before her middle age left in their wake countless young persons who dreamed of becoming ‘another Margaret Mead.’

Four decades earlier, she was slight with traces of recent illness that caused her mentor to impose some restrictions on her first field trip. The year was 1925, and the prominent anthropologist, Franz Boas, was sending Margaret on her way to Samoa to study ‘how the young girls react to the constraints of custom,’ and the related topics of adolescent crushes and the budding of romantic love.

In more than one sense her academic discipline was almost as young and professionally uncultivated as Margaret herself. There was a strong sense of urgency to investigate unstudied cultures at the point of vanishing before the advances of modern civilization. (Margaret reported that “When I was a graduate student, I used to wake up saying to myself, ‘The last man on Paratonga who knows anything about the past will probably die today. I must hurry’” (Mead, 1972: 338).) Despite the temporal pressures, little money was available for the purpose. There were few graduate students currently pursuing anthropology (only four of them at Columbia, where Margaret was working on her doctorate). There was a paucity of instructors; Boas taught almost all of Margaret’s courses. While prior investigations had tended to be male oriented, Margaret would be a female studying other females. And, perhaps the greatest challenge of all, as Margaret noted, there had been little or no ‘how’ in her previous education for field work; thus, she was forced to invent her methods of study literally on the spot. It is her creativity in this respect and its wellsprings – rather than the facts of her research – on which this article will focus.

In her autobiography, *Blackberry Winter*, Margaret speculated about who and what accounted for being “brought up within [her] own culture two generations ahead of [her] time” (Mead, 1972: 2) – testimony to a certain creativity of which her parents were continuing exemplars. Certain aspects of that childhood are undeniably significant in Margaret’s developing creativity. As detailed in what follows, information about Margaret’s growing years will come – unless otherwise explicitly indicated – from the composite of Mead’s autobiography and Jane Howard’s biography of her in 1984.

Growing Up as a Future Anthropologist

Born on 16 December 1901, Margaret was the first of her parents’ children and the first baby born in a new hospital in Philadelphia (at a time when hospital births were still considered *avant garde*). In her reflections on her childhood, Margaret seizes initially on her status as the child of two social scientists, concerned in their different ways with the condition of the world.

Margaret’s mother continued her research toward a doctorate in sociology while raising a family that would eventually include four children. (A fifth died in infancy.) Margaret’s mother, Emily Fogg Mead, was in several ways a prototypic feminist, valuing her career objectives, although finding herself with little time to spare for them. Her agenda embraced numerous household tasks even though fluctuating levels of domestic finances did allow some household help, including a series of cooks. She was an attractive woman but not inclined to spend money (or have it spent) on unnecessary clothing, hair styling, furs, or personal ornament.

Margaret’s father, Edward Sherwood Mead, was an economist on the faculty of the University of Pennsylvania’s Wharton School of Finance and Commerce. However, he was more peripatetic than the average academic, as he helped to establish extension branches of the university, and this – like his wife’s research needs – occasioned a number of temporary but recurring moves of the Mead household. Despite his professional focus on economic matters, he seemed to let money slip between his fingers and was financially strapped when Margaret was ready for college and planning to attend Wellesley. Only an atypical intervention on the part of Mrs. Mead persuaded him to relent from his initial opposition to any college plans and allow his daughter to enter De Pauw University, his undergraduate school. (He permitted Margaret to transfer to Barnard the following year.) According to Margaret, the temporary resistance to her academic ambitions was pecuniary and not associated with minimization of female intellectual potential. On the contrary, “. . . he thought of purely intellectual endeavor as feminine. He had barely known his father and he had the same kind of mind as his mother. Characteristically, he was very proud of my mother’s achievements and honors . . .” (Mead, 1972: 45).

The third significant adult and the ‘most decisive influence’ in Margaret’s childhood was her paternal grandmother, who lived with the family throughout Margaret’s transitions from infancy to adulthood. Margaret was home schooled for the majority of her preadolescent years, attending formal schools only sporadically, and her chief teacher was that grandmother, Martha Ramsay Mead. Martha was well suited to undertake her granddaughter’s education. She had been a schoolteacher as a young woman, went to college with her husband after their post-Civil War marriage, and after graduation taught at both early and high school levels.

Her methods of instruction were different from what Margaret might have encountered in contemporary public instruction; she deemphasized rote memorization and emphasized observation and inductive skill. She was also significantly free of the sort of social consciousness that Margaret's mother demonstrated.

Seeds of Later Work

What were the repercussions of this early environment for Margaret's later work? There are several possibilities:

Margaret seems to have had an early disposition to compare her own social experience to that of others without immediately assuming the superiority of the more familiar circumstances. She attributed her ambivalence to her sense of difference: "I took pride in being unlike other children and in living in a household that was itself unique. But at the same time I longed to share in every culturally normal experience ..." (Mead, 1972: 21). Margaret's ease with an itinerant life style facilitated Margaret's work across cultures. Her daughter, Mary Catherine Bateson, suggested a complementary benefit of Margaret's frequent changes of venue in adulthood: "By her peripatetic life, she created a kind of multilogue to which individuals contributed who would otherwise have been in isolation, their ideas never juxtaposed in fruitful ways" (Bateson, 1984: 198) Bateson added that "the greatest part of her originality lay in the invention of ways of listening and synthesizing" (Bateson, p. 198). There is an interesting echo here of what Margaret said she respected most in her father, namely, his capacity to listen (Mead, 1972). Listening is, of course, an essential component in the process of observation and note-taking.

Nancy McDowell in 1980, Jane Howard in 1984, and Sydel Silverman in 2004 all pay tribute to Margaret's distinctiveness in those composite skills. Howard considers Mead's notes to be the most important souvenir of her field trips: "With each field trip, she refined her note-taking techniques, distinguishing more and more precisely the events from the patterns they represented, and supplementing each record with letters home" (p. 430). Margaret received an early grooming in note taking from her grandmother, who assigned her the task of taking notes on the behavior of her two younger sisters, Elizabeth and Priscilla, born respectively when Margaret was between seven and ten years old. Margaret viewed this note taking as a continuation of her mother's journaling of her own infant achievements (13 filled notebooks) and that of her younger brother, Richard, born some two years after Margaret, his achievements – as is typical of second borns – receiving diminished maternal attention, although still occupying four notebooks. Margaret began to think of her younger sisters as her own children, whom she could not only observe but also "teach and cultivate" (Mead, 1972: 69).

Parentification and Creativity

This childhood fantasy of playing the parental role is one aspect of the phenomenon of parentification which has been noted to contribute significantly to the development of other

creative women. Margaret's recruitment by her grandmother to help her with the younger Mead daughters likely fed Margaret's parenting fantasies, but the experience of her own rearing by her parents was also a strong potential contributant. In the prologue to her autobiography Margaret recalled the words of one of her oldest friends: "In my house I was a child. In your family's house I was a person" (Mead, 1972: 2). The friend's description of the Mead household has its parallel in Margaret's reflection toward the end of her autobiography, "In my family I was treated as a person . . . It might be necessary to keep me . . . from reading too much or sitting up too late. But it was never suggested that because I was a child I could not understand the world around me and respond to it responsibly . . ." (p. 301).

Temperamentally strong willed, Margaret was able to capitalize on the degree of autonomy her parents granted. She related several pertinent anecdotes: Sent from the table for not having washed properly, she banged every one of the six doors between the dining room and her "third floor refuge" (Mead, 1972: 40). Margaret was three years old when she was walking with her father who rebuked her for kicking wet leaves as she walked. After he walked off in frustration, Margaret sat down on the wet pavement and, with some evident calculation, bewailed her abandonment to a small audience of other Sunday strollers. This early sense that in some way she "had always been a match for Father" (1972: 42) may have fortified her throughout a lifetime in what other women might have considered a redoubtable 'man's world.'

A year or two after the latter incident Margaret decided, for reasons that are unclear, to organize a secession from the household, involving herself, her small brother, and an infant sister, Katherine. Defeated by the logistics of securing food and bathroom necessities while keeping doors locked, she finally yielded to her quietly pleading mother. The undercurrent of precocious control in these tales from the nursery has a potentially important relationship to creativity insofar as it signals a cognitive flexibility, a freshness of perspective that fortunately was not wedded to interpersonal insensitivity.

The infant sister in the abortive secession attempt seems the catalyst for what, following Jefferson A Singer and Peter Salovey in 1993, might be called a self-defining memory in Margaret's history – one which, curiously enough, became prominent when Margaret was already an adult. Baby Katherine, the delight of her family, died suddenly before she was a year old. Margaret responded to the loss with a series of daydreams, culminating, in her twenties, with the fantasy "of being stolen away to educate a child; when she was grown, my friends recognized that she must have been my pupil, for only I could have brought her up" (Mead, 1972: 67). This memory is not precisely dated, but we may suppose that it occurred within a few years before she stole away (figuratively) for work that would become intimately joined to her idiosyncratic educative goals – work that would not only bring her the recognition of her friends but also the attention of the world.

Although Mead was not among the exemplars of creativity considered by Mihaly Csikszentmihalyi in 1996, his reflections may be pertinent to an examination of her early years. While he repeatedly asserts the high variability of precursors of adult creativity, among those he found worth mentioning were the parent(s) treating the child like a fellow adult and the incidence of 'missing fathers' in the individual history. In exploring

the latter phenomenon Csikszentmihalyi contends that it is not the actual paternal death (or, one is tempted to add, prolonged absence or noninvolvement) that is crucial, but the effect it has on the child's assumption of adult responsibilities. Mead's father was not missing from her life, but as the foregoing account of her development indicates, parentification was prominent in her activities, and household values encouraged a certain egalitarianism in her interactions with adults.

Csikszentmihalyi notes that, strange as it may seem, creative persons' formal schooling appeared to have little effect on their lives. Individual teachers, on the other hand, were often an important source of inspiration. Thus, Margaret could not be considered disadvantaged by her dearth of formal education. The influential educator in her early life was, of course, her grandmother. It was that grandmother who was the imaginary audience for her first letters from the field (cf. Mead, 1977).

Coming of Age in Samoa

One might find an unintended *double entendre* in the title of Mead's first book (1928/1973) – the report of her first field trip, which was to make her at least a minor celebrity while she was still in her twenties. Doubtless, Mead ripened as an anthropologist-in-the-field during her solitary investigation of Tau, a site in American Samoa. The observational techniques, including mode of recording, that she developed – and the focus of the observation itself – would have a significant impact on future anthropological field work. Although her interpretation of her data would stimulate considerable controversy throughout her career life and particularly in the decade after her death, what Silverman in 2004 described as the fastidiousness of her field work is likely among her greatest legacies to her fellow professionals. In Silverman's words: "Mead was in many ways a pioneer ... scrupulous about detailed recording, about keeping data in a form that made them usable by other scientists, and about stating explicitly the method she used and the circumstances under which her data were collected" (Metraux and Silverman, 2004: 212).

Mead only gradually found her way to anthropology. As an undergraduate at Barnard she considered various career possibilities, including writing, politics, sociology, and psychology. She took her master's degree in psychology, using the population (Italian American immigrants) that her mother had studied for a master's degree in sociology, but with a distinctively psychological topic (intelligence testing). The eminent anthropologist, Franz Boas, whom Mead initially encountered in her undergraduate course work, suggested the topic; his interest in issues related to mental life may well have eased Mead's transition from one to another of the social sciences. Indeed in his 'Foreword' to *Coming of Age in Samoa*. Boas summarized what he regarded as an outstanding gap in previous anthropological research: "The personal side of the life of the individual is almost eliminated in the systematic presentation of the cultural life of the people ... yet the way in which the personality reacts to culture is a matter that should concern us deeply ..." (Mead, 1963: iii).

Mead was attracted to anthropology by Boas and, to an even greater degree by Ruth Benedict, an older graduate

student and instructor at the time. Benedict told Mead that all she and Boas could offer the younger woman was the opportunity to do meaningful work. No enticement could have been more compelling.

When the time arrived for Mead to go into the field, Boas steered her toward work with American Indians, but Mead's preferred target was Polynesia. Her doctoral dissertation, a traditional library effort, had involved that part of the world. Margaret described herself as a graduate student "when [she] dimly understood anthropology as a salvage operation" (1972: 338) concerned principally with elders' memories, peculiarities of kinship systems, consequences of primitive myths, etc. Boas agreed to a compromise on the site for her work; she could go to American Samoa, devoting her days to work among the natives but would have overnight residence in an American naval home, a resolution of his concerns about Mead's physical frailty. He also offered her an atypical topic – the relationship between culture and the presence or absence of adolescent stress.

It might appear that Boas was using Mead's prospective work to capitalize on his own projects, but it seems likely that the topic reflected a coincidence of interests in the mentor and the former student as well as laying the groundwork for what Mead retrospectively considered a pioneering focus, namely, the study of women by a woman. Moreover, it represented an extension of what had been her sustained focus since her own childhood – a preoccupation with child rearing.

Of course, Boas was not without a working hypothesis when he sent Mead off on her maiden investigation. Simply put, he believed there was no biological necessity undergirding the experience of the adolescent stress that was frequently reported in American culture. After all her observational forays, Mead returned with what appeared to be data confirming the existence of a smoother, less troubled adolescence in the Samoan culture. Initially, the book on Mead's Samoan venture grabbed the popular imagination. Highly readable, it was to become a best seller.

Prior to publication, Mead's publisher persuaded her to enhance the book's appeal by adding two chapters in which she made educational suggestions in the light of her findings. She was quite amenable to this suggestion which was entirely consistent with her childhood fantasy of being in a privileged position with regard to offering child rearing recommendations.

The recognition Mead received from the book and consequent speaking engagements gave her an early start in what would be an important component of her professional lifetime – interpreting her scientific work for the public and introducing that public to her professional field. Unfortunately, her advice may have entailed some premature generalizations, and this could be viewed as a scientific misstep.

Margaret returned from her Samoan adventure with something she was less inclined to discuss publicly – the seeds of what would be a new romance. Before leaving for Samoa, Margaret married her high school sweetheart, Luther Cressman. A dock strike in England had affected the itinerary of the ship on which she was traveling, and a consequent layover in Sydney left Margaret and a few other passengers whiling away the extra time aboard ship rather than touring the city. Among them was Reo Fortune, a New Zealander, bound for Cambridge. The two young people struck a chord that

resounded in Margaret's mind for months after they parted, and what began as a friendship culminated finally in divorce and remarriage for Margaret. The ease with which Margaret secured a nonacrimonious divorce and made the marital transition from Luther to Reo is somewhat remarkable. She supplied few details in her autobiography (and, indeed, had tried earnestly to keep the matter private for decades).

The divorce is given short shrift, but what Margaret does say in 1972 is illuminating. She recalled an early unshared fantasy of hers and Luther's which had them living with six children in a country rectory where they could serve a parish that depended on them heavily. However, when on the basis of her tipped uterus, a gynecologist warned her to expect nothing but miscarriages, her vision of the future changed: "... if there was to be no motherhood, then a professional partnership of field work with Reo, who was actively interested in the problems I cared about, made more sense than cooperation with Luther in his career of teaching..." (1972: 189). Again, there is evidence of the *idée fixe* of child rearing potential which had a pivotal position in both her professional and her marital decisions.

Stranded on a Mountain Top

Mead was never again without a professional partner on her field trips, and in the most widely known of these shared ventures – her work in New Guinea – she would address a hitherto largely untreated topic, the anthropology of sex and gender. Initially, both the site and the topic (like the acquisition of Reo Fortune, her first field partner) owed much to chance. Mead and Fortune were on their way to a site Reo selected to suit his research purposes, with Margaret evidently prepared to adjust her research to the site. Their route involved crossing a mountain ridge that, because Margaret had a weak ankle, required the use of native porters for her transport as well as the transfer of material necessities. For some reason the carriers deserted their task, stranding Mead and Fortune on the mountain top. Since movement forward was not immediately possible, the researchers decided to make the best of their situation in a small and unpromising community. Thus began Mead's investigation of the Arapesh and her long-run reflections on the relationship between sex and culture.

Mead ultimately considered *Sex and Temperament*, the book that emerged from her work with the Arapesh, and subsequently the Mundugumor and Tchambuli, to be her "most misunderstood work" (1963). For years readers would be impressed by the striking contrasts evident in her description of the three groups. Mead herself had been struck by the different ways in which they either attended to or ignored sex differences. Among the Arapesh she found that qualities considered stereotypically feminine in American culture were valued in members of both sexes. Among the Mundugumor, on the other hand, aggression thought to be more characteristically masculine in the Western world was cultivated in both sexes. In the third group, the Tchambuli, there was differentiation of expected behavior, but it was the reverse of that in Mead's home culture. Yet Mead seemed to feel her readers did not fully appreciate that the real target of her research was the discovery of personality traits as variations among

individuals that were not necessarily the consequence of sex. In her words (1963, Preface to 1950 edition, unpaginated) she asserted that initially she had "hoped that [her] investigation would throw light on sex difference" but "found after two years' work, that the material ... threw more light on *temperamental* differences, i.e., differences among *innate* individual endowments, irrespective of sex." Betty Friedan, in her classic feminist work of 1963, *The Feminist Mystique*, indicated the potential value of Mead's work to the recrudescence of the feminist movement more than three decades after the first edition of *Sex and Temperament*. Friedan maintained that societal images of the female could have benefited from Mead's "vision of the infinite variety of sexual patterns and the enormous plasticity of human nature" (Friedan, 1963/1974: 127), coupled with Mead's "truly revolutionary vision of women finally free to realize their full capabilities in a society which replaced arbitrary sexual definitions with a recognition of genuine intellectual gifts as they occur in either sex" (Friedan, 1963/1974: 127–128). Friedan pointed out a relevant passage in *Sex and Temperament*: "... many, if not all, of the personality traits which we have called masculine or feminine are as lightly linked to sex as are the clothing, the manners, and the form of head-dress that a society at a given period assigns to either sex" (Mead, 1935/1963: 280)

By the time Friedan's magnum opus appeared, Mead had written another semi-popular work, *Male and Female* published in 1949, in which she revisited her earlier field work and specifically focused on questions of maleness and femaleness. For many persons who, like Friedan, subsequently examined trends in Mead's thinking (e.g., Lyons and Lyons, 2004), *Male and Female* may have seemed like a virtual *volte face* from the conception of wide-ranging role plasticity in *Sex and Temperament*. Friedan expressed her disappointment: "At times she seems to be arguing ... that while women's potential is as great and various as the unlimited human potential, it is better to preserve the sexual biological limitations established by a culture" (1963/1974: 128).

It seems possible to adopt a more generous perspective on Mead's stance in this work of the late 1940s. A close look at some of the pages that Friedan cites in reporting her frustration reveals that Mead was speaking interrogatively and not declaratively. In other words, she was raising questions that have continued to occupy scholars in the psychology of gender for decades.

In attempting to consider the relationship between and among sexual biology, individual temperament, and cultural influences on each of those factors, Mead was undertaking an enormously complex task. As Peggy Reeves Sanday said in 1980, "The manner in which she treated the interaction between biology and culture ... was unparalleled for someone writing on a subject fraught with so much waffling in Western thought. The complexity of her approach greatly confused reviewers, who wanted her to decide once and for all whether it was either-or" (p. 340). The questions she raised were not popular when she initially posed them, and her daring to abide with multidimensionality and ambiguity is a challenge for many readers.

In 1996, Mihaly Csikszentmihalyi describes low gender stereotypy and high tolerance for complexity as characteristics of creative individuals. The presence of both qualities in Margaret's makeup would seem to have equipped her well for work on what

would come to be called the psychology of gender. The three most significant adults in her childhood primed her to enact the female role in a nonstereotypic way. At the same time both her mother and her grandmother were constant examples of the importance of child rearing. It is hardly surprising that a 'continuing passion for the nurturance of children' sporadically invaded Mead's writings on female roles and, in turn, excited the animus of some feminist critics who regarded it as undesirable support for traditional thinking.

By 1963 – the same year that Friedan challenged the feminine mystique – Mead also indicated her growing concern with excessive adherence to traditional concepts of sex role dictates. In the preface to the 1963 edition of *Sex and Temperament*, she expressed the hope that "exploitation of the way in which simple primitive cultures have been able to rely upon temperamental clues may be useful in shifting the present extreme emphasis upon sex roles to a new emphasis on human beings as distinct personalities" (Mead, 1963, Preface, unpaginated).

The 'Quantum Leap' and Other Ventures

The married couple that left New Guinea after their mutual adventure with the three tribes were not the Margaret and Reo who had encountered each other years earlier on the docked ship. Stress and gradual estrangement supplanted their earlier attraction, and this time they went their separate ways.

After divorcing Fortune, Mead married anthropologist Gregory Bateson, whom she and Fortune met in New Guinea. The last years of Mead's intensive field work involved joint endeavors with Bateson in Bali and Iatmul. During this period they advanced ideas of anthropological record keeping by investing in equipment that permitted taking pictures in rapid succession. This allowed the photographs to constitute visual field notes that could be integrated with the corresponding verbal record – a procedure that Mead referred to as a 'quantum leap' and that has been hailed by other anthropologists for its inventiveness.

If Mead's autobiography slighted the unfolding of her career over the last several decades of her life, she did not neglect her maternal milestones, musing on the births of her daughter and granddaughter, to each of which she devoted a chapter. What she had seen of the active dislike of children among the Mundugumor, coupled with her distaste for the values of that culture, had fueled her yearning for children in an environment in which they would be appreciated and her determination to attempt pregnancy, despite the risk of repeated miscarriages. That desire was finally satisfied by the birth of her daughter, Mary Catherine, born in 1939 of Mead's marriage to Bateson. That marriage also ended in divorce. Again, few details are available, but there is reason to infer that this time the dissolution of the marriage was less agreeable to Mead than in earlier instances.

What Margaret herself recognized as an unusually intensive span of data collection in the field (1925–1938) turned out to be the period of her greatest inventiveness. These are undoubtedly the years in which and on which her public fame was founded. Those were also the years which she focused on in her autobiography.

Certainly, her remaining years were highly creditable by usual academic standards, that is, close to four decades filled with numerous well-received scholarly papers, interdisciplinary efforts, curatorial work, college teaching, and bidden and unbidden consultation with government officials and groups. In 1980, Dillon labeled her a citizen scholar and notes that there is probably no citizen who appeared more often on a greater variety of topics. Her public ministry also expanded to include television appearances and a monthly column in the women's magazine, *Redbook*.

A Rope So High

What were the most outstanding examples of Mead's inventiveness?

Margaret herself had something to say about this: She was convinced that she "had invented a new kind of field work, I knew how to study children and place their rearing within the total culture, in this way giving a dynamic element to what would otherwise be a fairly flat picture of the life of another society" (Mead, 1972: 231). This emphasis on the life of the individual within a given society – and not merely on the characteristics and practices of that society as a whole – was a reflection of Mead's interests in psychology. Those interests would spur Mead's various attempts to inspire interdisciplinary studies of anthropological subjects, which never seemed to excite as much cooperation across professions as she might have hoped.

The distinctiveness of Mead's field work was, of course, complemented by the meticulousness of her recording procedures, including her insistence on detailed note taking. Her notes were those of an "exceptionally honest ethnographer" (McDowell, 1980: 283) – and one might add, an exceptionally thorough one – including, for example, the conditions in which field work was conducted; the composition of field work teams; the division of labor among team members; and individual examples, that is, descriptions of actual persons; and situations in which she not only observed but also intervened in some way (McDowell, 1980). Eventually Mead's and Bateson's qualitative leap in photographic procedures enriched the meticulous record keeping.

As Nancy McDowell also indicated, Mead was careful to note the extent to which the presence of the investigator might distort data collection and interpretation. Reviewers of her work often seem to ignore this anticipation (by decades) of what would later be described elsewhere as the examiner/experimenter effect in the social sciences. In fact, in 1972 Mead suggested that differences between herself and her second husband, Reo Fortune, in their divergent observations on the Arapesh might be related to their temperamental differences. Margaret was more likely to seize upon nurturant components of the culture, while her husband, whom she saw as the more aggressive of the pair, might be more sensitive to the less frequent aggressive cultural elements. At more than one point, Mead expressed the hope that the effect of the investigator on the collection and report of data might become a regular part of anthropological research, but this was not to happen in her lifetime.

Another example of the effect of Mead's personality on her field work involves the issue of 'deviancy.' When Mead used

the term, she seemed to be referring not to psychopathology but, rather, to operation against the grain of the culture in which the individual was imbedded. Mead's interest in this subject was, again, ahead of her time. McDowell contended in 1980 that the frequent well-chosen and clearly labeled use of deviant examples in Mead's writing helps clarify the general operation of the culture, with the reader apparently learning from the exceptional cases. In their discussion of the significance of cultural deviation in Margaret's work, neither Mead nor McDowell makes what could be an interesting connection with Margaret's life: Margaret regarded herself as a "deviant" (Mead, 1972). It might be supposed that this self-perception of deviance referred to her following a career path that was relatively unusual for her time and, particularly in her youthful solitary field of work, required a degree of derring-do that was stereotypically male. However, this was not Margaret's view. For her the deviation worth noticing was in the reverse direction: "I was a deviant in the sense that I had much greater interest in the kinds of things in which most women, not committed to a career, were interested" (Mead, 1972: 227). In the content of Mead's body of writings, it seems quite valid to assume, as Howard did in 1984, that Mead was referring to what might be considered a preoccupation with children unusual in a career woman.

Mead's conception of deviancy was inextricably linked with her interest in temperamental variation. Her corresponding interest in innate dispositions belies any insinuation that she discounted the role of biology in the behavior of human beings. Indeed, her focus on temperament allowed her to visualize how biologically based tendencies could interfere with realization of cultural values or even promote resistance to them. On the other hand, she was attentive to the ways in which child rearing could modify the expression of temperament in the direction of cultural conformity. The picture she painted was a complex one. Research in the service of that complexity was her goal, although she repeatedly fell short of that ideal in the publicly oriented portion of her work. In a sense she was always the child self rendered in her exhilarated verses during the year of her first field trip, the child whose skipping rope got caught in trees as she attempted to tear a star from the star-studded sky. She closed those youthful verses with this image:

God only smiled at one whose glee
Could fling a rope so high (Mead, 1972: 145)

The gods of the social sciences were less forgiving when Margaret made a reach-too-far in her public pronouncements, whether in print or in her personal appearances. Many of her colleagues were disturbed by her premature generalizations, her supplementing incomplete knowledge with astute guesswork, and her readiness to speak as an anthropologist on almost any question (see the work of Rhoda Métraux and Sydel Silverman in 2004). However posthumous reappraisal of her career lifetime, for example, in the memorial issue of the

American Anthropologist (1986, vol. 82, no. 2), yielded a balanced perspective which honored her contributions without ignoring her limitations.

In 1984, Howard reported Friedan's verdict after Margaret's death on 15 November 1978: "I felt that Mead, who was born twenty years before me, had gone as far as she could with feminism and that I, in reacting to her, took it a step further and was in a way her heir. I felt part of a procession" (p. 426). The procession of social scientists has moved forward, but it is worth looking back occasionally at this singular figure who, depending on one's vantage point, appears as a young researcher, a citizen scholar, a champion of children, or the ghost of the child she once was – rope in hand and star in view.

See also: Mentors.

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Memory & Creativity

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Glossary

Encoding Assigning a specific label to the information that is to be stored in long term memory, in order to make it suitable for storage, retrieval, and further processing.

Long term memory (LTM) A system able to hold a large amount of episodic or semantic information permanently, organized as a network.

Retrieval Activation of the information retained in long term memory, presumably with the use of valid retrieval cues or specific mental strategies.

Storage The intermediate phase of the memory process, which consists in keeping the memorized information in the latent form that potentially allows retrieval and further processing.

Working memory (WM) System responsible for maintaining a restricted number of pieces of information for up to a few minutes; also acts as an information processing unit, responsible for the manipulation of symbols during problem solving and other types of cognitive activity.

Memory is a psychological structure that, apart from its many other functions, takes part in the cognitive mechanism of insight in creative problem solving and determines the specificity of information processing observed among creative individuals. The importance of memory phenomena to understanding of creativity is enormous, for obvious reasons: creativity is an activity of mind, and activities of mind are executed through memory. Therefore, creativity cannot occur without the participation of memory processes and structures. However, psychological theory concerning the relationship of memory to creativity is not well developed, and empirical results are rather scarce. For these reasons, the present article outlines the map of the problem at a very high level of abstraction and with a large amount of speculation. The order of presentation is determined by the stages of memory processes, corresponding to the stages of information processing.

Sensory Memory and Creativity

Stimuli arriving from the external world are first memorized for a short time by two structures: sensory store and short-term store. The sensory store (e.g., iconic memory for images or echoic memory for sounds) holds the information for less than one second. Because of its extremely short duration, the sensory memory is not accessible for introspection, and people usually do not realize that they possess such an ability. Both iconic and echoic memory act at the preparatory stage of stimulus elaboration, thanks to which the next stages are not swamped by a surplus of information.

There is no evidence whatsoever that sensory memory is connected in any way with creative processes or creative abilities. Interestingly, though, the sensory memory may play an important role in perception and appreciation of creative performances, particularly in music, ballet, and visual arts. From the evolutionary point of view, the sensory memory is still mysterious, but it is possible that it evolved in the service of speech perception. An ability to keep in mind sounds that have

already disappeared probably allows human beings to perceive spoken language smoothly and rapidly. Without echoic memory it would be perceived as a staccato of separate sounds. Keeping past sounds in mind for a moment makes this process much more efficient. Words are perceived as complex structures rather than sets of unconnected vowels and consonants; therefore they are recognized with enormous speed and efficiency. Moreover, holistic perception of words makes it possible to use prosody and intonation as a means of speech perception and, in consequence, as a means of language comprehension.

This is just a hypothesis but if the reconstruction of adaptive functions of the sensory memory outlined above is close to reality, we could speculate about relationships between echoic memory and music perception, as well as between iconic memory and ballet dancing perception. The same mechanism that makes speech perception speedy and efficient can produce greater appreciation of music (echoic memory) or ballet dancing (iconic memory). One can even doubt whether human beings would invent music and ballet as important domains of creativity if they were not able to perceive sounds and movements smoothly. Production of sounds and structured body movements obviously serve important social ends, such as communication, but these reasons seem insufficient to invent the art of music or dancing. For that, our ancestors had to be able to appreciate esthetic rather than social aspects of sounds and movements, which – according to my hypothesis – would not be possible without the phenomenon of sensory memory.

These speculations lead to yet another hypothesis, namely, that musical abilities (or just being fond of music) are rooted in individual parameters of echoic memory. People who can keep in their echoic memory more information for a slightly longer time may be better prepared to appreciate and understand music when compared with persons characterized by less efficient mechanisms of sensory memory. However, this hypothesis may be difficult to verify because individual differences in sensory memory have not been investigated at all.

Even if such differences really do exist, their range may be very restricted, as it usually is in the case of basic, evolutionarily old, and biologically rooted mechanisms.

Working Memory and Creativity

The short-term memory (STM) store is able to retain information for limited intervals of time, ranging from a few seconds to several minutes. This system is now called *working memory* (WM) because it is responsible for both maintaining pieces of information and manipulating them, which is synonymous with human information processing. Metaphorically speaking, WM is a central processing unit of the human mind, or 'the blackboard of the mind.' Less metaphorically, it is an active part of memory consisting of a number of pieces of information that are either in the state of readiness for upcoming processing or in the state of just being processed. It is unlikely that the central processing unit of the human mind would not take part in the cognitive mechanics of creative processes. Some theoretical models assume such an engagement in an explicit way. There is, however, little empirical evidence about how and to what extent working memory processes affect creativity.

Characteristically, WM is very limited not only in time but also in its capacity, because it is able to manipulate fewer than ten pieces of information (words, numbers, etc.) simultaneously. Short-term memory capacity is traditionally defined as the 'magical' number seven (plus or minus two) but this value is probably overestimated. Recent estimates (e.g., Nelson Cowan's) suggest that working memory cannot retain and manipulate more than four elements simultaneously. Although this is a very small number, people still differ in working memory capacity (WMC), and these differences result in different ability levels. It has been convincingly shown that WMC determines the general cognitive ability level (i.e., intelligence). Unfortunately, no evidence concerning the relationship of WMC to creativity has been obtained, although in some studies both intelligence and creativity tests were used to check this hypothesis.

The difference is probably rooted in the particularity of cognitive mechanisms of intelligence and creativity as two distinct dimensions of human intellect. Intelligence is the ability to tackle convergent, well-defined problems of average complexity and average novelty. Such problems are well described in terms of a number of separate 'chunks' of information, which have to be memorized and manipulated for a short time in order to let the problem solver reach the solution. In other words, an intelligent problem solver has to split the problem into separate portions of information, keep these portions in working memory, and manipulate them in order to achieve a suitable solution. In such cases, the more items a problem solver is able to keep in the short-term store, the more competent he or she is in tests consisting of convergent, well-defined problems of average complexity and novelty. On the contrary, if a problem solver's WM capacity is small by nature, or declines for any reason, he or she inevitably loses some part of his or her intellectual ability, because tasks that are critical for the person's intellectual level may surpass the actual limitations of WM.

Nothing like this seems to exist in the case of creativity. It is usually assessed with tests consisting of divergent tasks of low complexity (e.g., Unusual Uses, Alternative Definitions, etc.),

which do not exploit working memory thoroughly. As far as the limited capacity of WM is concerned, such problems may even be regarded as relatively 'easy.' No surprise, then, that creative abilities assessed with divergent thinking tests do not correlate with WMC.

Of course, creativity is not reduced to simply divergent thinking ability, particularly if real creative endeavors rather than basic cognitive skills are taken into account. However, there is no point in looking for the working memory determinants of 'real' or eminent creativity, either. The problems undertaken by exceptionally gifted creators and great achievers are usually divergent, too, but also ill-defined and very complex in nature. In fact, problem finding and problem definition constitute the vital part of creative processes in real life, that is, outside the psychological laboratory. Finding, definition, redefinition, and solution of such problems usually take a lot of time, effort, and motivation, but they do not seem to require extended capacity of working memory. Individual differences in WMC may matter in the case of problems of average complexity, because – for instance – if a problem needs four items to be kept and manipulated in memory, a person with a capacity of four is naturally endowed to tackle such a problem, whereas a person whose capacity is only three is naturally unable to deal with it. But both hypothetical persons are structurally unable to deal with a problem consisting of 100 or 1000 items of information, that is, with very complex, unclear, ill-defined problems that require a creative approach.

This does not mean that such complex problems are unworkable for any human being, whose WM capacity – even relatively large – usually does not exceed four portions of information. Rather rarely, a very complex and ill-defined problem is solved by a very creative individual by means of his or her exceptional capacities, but not necessarily by means of WM capacity, as it seems. Such creative achievements are attainable through specific strategies of problem solving, and through inventive manipulations with problem structure and problem definition. Such manipulations are sometimes referred to as *metacognitive strategies*. For instance, a creative person organizes his or her knowledge of the problem hierarchically: a relatively small number of higher-order, abstract portions of information may contain many lower-order chunks of information, accessible for processing only after having been 'unwrapped.' Another metacognitive strategy used by creative individuals amounts to simplification of the problem structure so that it is workable with WM of limited capacity. However, such manipulations refer to long-term memory processes, mainly selective encoding and 'familiarization.'

There is a paradoxical tension between the structural limitations of WM in terms of the very small number of items that can be effectively maintained and processed, on the one hand, and the requirements of complex and ill-defined problems that are typically undertaken in mature creativity, on the other hand. If 'creative problems' are much too complex for human working memory, no matter how efficient and capacious it is in the case of a given person, how can such problems be solved at all? An interesting solution to this paradox comes from the theory of long-term working memory (LTWM), developed by K. Anders Ericsson and Walter Kintsch. LTWM is conceptualized as a part of long-term store that is activated by retrieving cues maintained in working memory proper. In other words,

WM does not need to retain anything that is directly used in problem solving. It retains only retrieval cues, thanks to which the vital information is quickly and easily retrieved from LTM. Long-term store is not structurally limited, so there is no threat of it being overloaded. And a person must keep in mind only a few hints that make it possible to use a kind of 'highway' between WM and LTM. Ericsson and Kintsch believe that their model accounts for expert performance in a variety of domains, as well as for language comprehension. Since mature creativity is a form of expertise, their model should be explored more thoroughly in creativity studies.

Models of working memory usually assume that this structure shows two aspects: one purely mnemonic and another pertaining to cognitive control. For instance, in the model developed by Alan Baddeley the mnemonic functions are performed by such 'devices' as the articulatory loop and the visuo-spatial scratch pad, whereas the control functions are performed by the central executive, which is described as a 'device' of attention deployment. The dual nature of working memory suggests that creative thinking and creative performance may be determined by efficiency of cognitive control rather than by capacity of working memory understood as the number of 'chunks' that can be memorized for a short period of time. Or, possibly working memory capacity should be defined as an ability to perform mnemonic functions under the auspices of control mechanisms. For instance, switching between tasks is a popular means of investigating cognitive control. It seems that creativity requires switching between thoughts rather than tasks. An ability to switch from one mental activity to another is probably vital for flexibility of thinking and resistance to mental blocks. Such relationships have not been systematically studied, although there are data suggesting that a high level of dopamine increases the strength of cognitive control, reduces switch costs in the task switching paradigm, and improves performance on divergent thinking tasks, particularly if flexibility is taken into account. Creativity probably needs both increased and reduced cognitive control, depending on the phase of working on a problem at hand. Such studies, if performed systematically, should broaden knowledge about the relationship between creativity and working memory.

Long Term Memory and Creativity

Contrary to working memory, long term memory is able to retain information for an unlimited period; it is also assumed to possess unlimited capacity. This does not mean that the human mind is able to remember everything; however, forgetting and other imperfections of memory do not result from the capacity of the LTM store but from other sources, such as interference, inefficient strategies of remembering, etc.

Three basic categories of memory processes define the efficiency of operations in LTM: encoding, storage, and retrieval. These operations, or stages of the memory process, determine the way in which LTM performs its basic functions, including the ones connected with creativity, problem solving, and insight.

Encoding

Information cannot be placed in long-term store without having been encoded. This is an operation analogous to labeling

products in a department store or allocating new books to appropriate shelves in a library. Only after the information is encoded can it be stored in memory as a part of related knowledge structures. In most cases, encoding amounts to categorization. For instance, the scene shown in a news headline is categorized as a 'street accident,' a portion of textbook knowledge as 'the quantum theory of particles,' etc. The psychological function of encoding is obvious: it allows assigning the information to the appropriate parts of the LTM store. In this way, it makes it possible to arrange LTM as an organized system of knowledge. It is also a necessary condition for future retrieval, because nothing can be regained from the store without being properly labeled.

Creativity is probably connected with, and affected by, the specificity of encoding in three ways. First, a person can *encode information in a peculiar way*, different from other people. For instance, a child can categorize the animals familiar to him or her into the categories of nice, shaggy, and awesome. This kind of categorization, though illogical and far from what biology offers, probably serves some important cognitive needs of the child. Such categorization is also unusual, different from what the majority of people think about animals and how they classify them. This is probably why small children perceive the world so originally. Children's originality is normally accounted for in terms of their being free from obstacles, conventions, and inhibitions typical of adult life. However, this phenomenon should also be regarded as a manifestation of the unusual way in which children categorize objects, and in consequence as a result of the specific way of encoding information that is stored in their LTM.

In the case of adult creative individuals, the instances of bizarre categorization are probably accompanied by the conventional, 'uncreative' way of perceiving the world. In other words, an adult creative person is able to categorize the world in the 'official,' objective, commonly accepted way, as well as in the unusual, subjective, and personalized manner. This is the second exemplification of how the activity of this stage of LTM operations affects creativity: *alternative encoding*. A person who encodes alternatively is able to take advantage of unusual encoding (making unpredictable associations, discerning similarities, etc.), while still being close to reality and conventions – a phenomenon recognized by Ernst Kris as "regression in the service of the ego." Some techniques of creativity training deliberately focus on the phenomenon of alternative encoding, with the conviction that divergent thinking and unexpected associations are more likely to result from the ability to memorize the same item of information in many different ways.

The third property of encoding found in creative persons is *selectivity*. It is particularly important for the construction of the cognitive representation of the problem. Problems worth creative endeavor are usually too complex and ill defined to be memorized completely and categorized with the use of clear-cut terms. Selection of information is therefore necessary; however, successful problem solvers are able to memorize only the important elements of the problem, while ignoring less important and superfluous ones. Less efficient solvers try to memorize everything, thus being unable to focus on the gist of the problem situation. It is very unclear what the origins and determinants of this ability to encode information in the

selective way are, as well as to what extent it is susceptible to development and training. However, the selectivity with which some people store information in their LTM store inevitably makes them more efficient solvers of complex, ill-defined problems; therefore, it makes them more creative.

Peculiar, alternative, and selective encoding are responsible for creative behavior in many ways. They help people produce original associations, they are responsible for 'perceiving things' differently, and they allow simplification of the structure of excessively complex problems through selectivity of encoding. In many instances, creative behavior is a result of natural, effortless use of specific encoding, although from the observer's perspective it may give the impression of being a result of rather difficult and complex processes. In other words, creative processes are sometimes less 'exotic' than they seem to be from the point of view of somebody who normally does not encode information in a peculiar way.

Creativity also benefits from so called *prospective encoding*, which involves setting up criteria for future acquisition of knowledge that might be relevant to a problem at hand. Careful examination of the problem and its requirements helps establish exact criteria of information needed for the continuation of creative problem solving. Such knowledge may not be available at the moment, but it can be easily acquired upon the appearance of particular learning opportunities. The mental set established by prospective encoding induces highly selective acquisition of knowledge; consequently, it enhances the likelihood of sudden and insightful recognition of new possibilities for dealing with the problem.

Storage

Storage amounts to keeping previously encoded information for a long time. Contrary to naive conceptions of storage, it is an active process, likely to impose unexpected changes on the seemingly dormant information kept in LTM. Three phenomena connected with storage are worth investigation from the creativity point of view: selective forgetting, familiarization, and spontaneous recovery.

Selective forgetting may account for the phenomenon of 'incubation.' According to the classical four-stage model of creative thinking, incubation is a stage of unconscious idea production, following preparation but preceding illumination and elaboration. Modern cognitive approaches do not deny the empirical evidence that the 'incubational' break sometimes helps in the creation of new ideas, although they usually do not accept the notion of subconscious 'incubation' of solutions. It has therefore been suggested that, during the 'incubational' break, people selectively forget superfluous information, particularly the unnecessary elements of the cognitive representation of the problem. The memory preserves only a part of the information that has been gathered concerning the problem: its definition, requirements, and context. After having forgotten a huge part of this information, people are more likely to 'view the problem from a new perspective,' that is, to experience sudden and holistic understanding of the problem, synonymous with insight.

'*Familiarization*' is another term introduced by Herbert Simon in order to account for the phenomenon of 'incubation.' Simon assumed that problems worth creative endeavors

are complex and difficult, requiring a lot of time and effort to be solved. During the long process of problem solving, almost all trials seeking a solution are unsuccessful, except the final ones that result in solutions. This does not mean that earlier trials are worthless: their function amounts to 'familiarization' with the problem, that is, making it more and more understandable, clear, and simple. Simplification of the problem structure and definition makes it possible to grasp it with a small number of items of information. This, in turn, makes it possible to manipulate the problem within the system of short-term memory, which has very limited capacity to handle information. In other words, every instance of problem solving relies on the vital operations of working memory, which performs the basic operations of information processing. But in order to be suitable for such operations the problem has to be simplified to a great extent; otherwise, the working memory system is likely to be flooded. Familiarization is a means of making the problem simple enough to be dealt with by the system of working memory. Thus, numerous unsuccessful trials seeking a solution have an important simplifying function, due to which problems originally too complex become more and more workable for the very limited capacity of the memory system.

Spontaneous recovery consists in an increase of the likelihood of recall of information if it is kept dormant for some period of time, compared to the likelihood of recall at the beginning of the learning process. It is assumed that vital information is blocked by other pieces of knowledge, learned more recently or acquired through the learner's conviction of their importance. After some period of time the blocking pieces of information lose their activation, thus yielding access to the previously inaccessible knowledge. It is also assumed that the LTM store becomes more and more organized with time, a process taking place without any intention or effort on the learner's part. Due to such hypothetical processes, people can sometimes remember more information after some time has passed than at the beginning of the learning process – a phenomenon known as 'reminiscence.' These phenomena are important for creative thinking and problem solving because they may be responsible for the elimination of mental sets, blocks, and other obstacles often preventing people from attaining original solutions. This is why 'incubational' breaks probably help work out creative solutions, although there are other cognitive mechanisms that operate with similar results (e.g., selective forgetting, familiarization).

Selective forgetting, familiarization, and spontaneous recovery are possible mechanisms of insight, which – according to modern cognitive theories – is basically a memory phenomenon. From the phenomenological perspective, insight is a sudden flash of understanding ('Aha!' response). From the cognitive perspective, however, its mechanisms are probably rooted in operations taking place in long-term memory during the storage phase. However, recognition of such a theoretical possibility requires that storage be viewed as an active, purposeful, and 'creative' phase of LTM operations. Spontaneous changes of the LTM structure during the storage phase do not guarantee that insight will occur and help people solve the problem in a creative way, but without these cognitive operations the phenomenon of insight would be very difficult to account for beyond its purely phenomenological aspects.

Retrieval

Retrieval consists in recalling information previously encoded and then kept in the LTM store. It is the reverse process to encoding, and its efficiency mostly depends on encoding strategies used in the first stage of the memory process.

The main problem of retrieval amounts to *accessibility* of information stored in LTM. Creative ideas are often just recovered from memory, or they result from uncommon combination of stored memories, although they may create the impression of being crafted out of nothing. In other words, a creative idea – or at least the very core of it – remains in the LTM store for a long time, ‘waiting’ to be noticed and used. The difficulty lies in accessing such an idea or its bud, because it is not kept in memory in its ready-made, easy to retrieve form. If it were like this, it would probably be memorized and retrieved easily by many people; as a result, such an idea would reappear frequently and, by definition, could not be called creative. So, the act of creation consists, by and large, in the use of effective retrieval strategies, through which vital information may be accessed and used in problem solving.

Hence, the problem lies in making already stored information accessible, so that it can take part in the creative process. This aim is achieved in two ways: by the use of appropriate retrieval cues and by the application of effective strategies of search of the LTM store. The *retrieval cue* is a means of decoding information kept in the LTM store, analogous to the operation of taking away an item from the shelf in the real storehouse, library, or other kind of depot. Normally, the information is retrieved from LTM with the use of exactly the same code (e.g., a category or label) with which it was put into the LTM store. These are the instances of the commonplace use of memory, resulting in uncreative behavior. However, the information may be retrieved with the use of entirely new codes, providing that a problem solver is able to recode the items constituting his or her knowledge, that is, to label the pieces of information kept in the LTM store in a new way, different from the initial encoding. Analogical thinking is enhanced in this way, since notions, memorized events, and other pieces of knowledge can be retrieved on the basis of their similarity to other areas of experience. It is a process particularly important for creativity if the analogies and similes are remote and unusual, which means that the pieces of knowledge utilized for the building of the analogy have to be retrieved with cues other than the ones used during the acquisition of knowledge.

As to the *LTM search strategies*, the problem consists in making the search as global as possible. Robert Weisberg suggests that the inability to use previous experience while solving a new problem, a phenomenon frequently described in the literature on mental ‘ruts’ and other blocks to creativity, may result from ‘local’ memory search. This kind of search is limited to the narrow, well-defined areas of knowledge stored in the long-term memory, and does not apply to other areas of knowledge, even though these regions could be highly relevant to the problem at hand. A problem solver is unable to use some fragments of his or her knowledge because they are ‘too distant’ from the areas defined by the problem space, and thus look ‘irrelevant’ to the problem. Of course, the distance between the knowledge responsible for problem representation and some potentially useful but neglected areas of experience may be

superficial or only seem to exist. Furthermore, the boundaries between different fields of knowledge and expertise are usually fuzzy and conventional, sometimes artificial; however, they define the boundaries within which the memory search is normally performed. In consequence, the search is likely to be ‘local,’ that is, limited to the knowledge base that is directly applicable to the problem being currently solved. In order to make the search ‘global,’ that is, referring to the whole network of semantic memory and conceptual knowledge as well as to the vast number of episodes stored in LTM, the problem solver has to surpass the between-domain boundaries through analogy, metaphorical grasp, and mostly through the redefinition of the problem statement.

The creative search of memory does not have to be entirely global; sometimes it suffices to make the search less local, that is, less limited to the narrow conceptual boundaries defined by the initial problem statement. Redefinition of the problem statement naturally makes a problem solver more likely to cross the conceptual boundaries, as the newly defined problem requires a new set of information and provokes new associations. However, making the search ‘less local’ may be a deliberate strategy used by the problem solver, and trained during sessions of creative problem solving, not necessarily preceded by problem redefinition. On the other hand, redefinition of the problem is unlikely to occur without the global (or ‘less local’) search, because only the truly uncommon information retrieved from memory is able to make people perceive the problem in a fresh way.

Highly creative individuals are more inclined to global memory search than less creative people. The network of semantic memory of creative people is more compound, and thus more apt to make remote, unusual associations. The creative semantic memory is also more likely to be activated as a whole network rather than restricted associative regions if a priming stimulus is presented. The higher the general activation of the semantic network, the more likely it is that a person will perform a global search of the information needed during the problem solving session. Conversely, if the activation is limited to small areas of the semantic network, defined by the routine meaning of the priming stimulus, it is likely that a person will perform only a local search, with all its uncreative consequences.

Conclusions

Obviously, creativity is not just the proper use of one’s memory. However, the purely creative phenomena known from the studies of creative problem solving, like insight, analogical transfer of knowledge, or unusual remote associations, probably result from the peculiarity of memory processes. It is therefore justifiable to conclude that the memory of creative individuals differs qualitatively from the memory of less creative people. The quantitative differences (for instance, the sheer amount of knowledge about some topic) are probably less important because there is no evidence that the more one knows the more creative one is. On the contrary, experts are frequent victims of rigidity and mental ruts, unless their knowledge is flexible and creative due to the specificity of its organization.

See also: Analogies; Associative Theory; Cognitive Style and Creativity; Divergent Thinking; Insight; Intuition; Metaphors; Problem Finding; Problem Solving; Remote Associates.

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Mental Health: Affective Disorders

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Glossary

Affect Often used synonymously with emotions and feelings. 'Mood' sometimes refers to more general, diffuse and long term feeling states, as opposed to shorter-term affects or emotions. Feelings do vary over time periods varying from very short to very long.

Bipolar disorder A mood disorder characterized by periods of 'up' or elevated affect, generally as well as 'low' or depressed affect.

Depression Refers both to diagnostic categories characterized by low mood and specific cognitive and behavioral symptoms, as well as to these symptoms themselves. Symptoms include sad mood, cognitive symptoms of negative self-evaluation and attributions, and behavioral symptoms including slowed movement; it also can include physiological symptoms of sleep and appetite disturbance, and anhedonia, or lack of experienced pleasure.

Eminence Fame or recognition. Much early research on creativity and psychopathology was troubled by the confounding of eminence and social judgments with a person's actual level of creativity.

Everyday creativity A term used by Ruth Richards and colleagues to refer to creative activities, in work and avocations, of normal, non-eminent, non-extraordinary people in their day to day lives.

Flat affect A lack of emotion, either 'up' or 'down,' observed in people with schizophrenia and some other diagnoses. Overlaps with the lack of pleasure or anhedonia observed in people with a variety of diagnoses.

Mania, manic episode, hypomania Periods of 'up,' excited, or elated mood and associated behavior (including poor judgment and impulsivity). A manic or hypomanic (or mixed) episode is one of the criteria of the bipolar disorders. Hypomania refers to more mild forms of elevated mood.

Romanticism A philosophical and artistic movement, strongest in the eighteenth century, that emphasized the importance of 'primitivism,' nature and the natural, child-like innocence and a wild sensibility, and direct experience of the world. These were seen as fundamentals of life and of creative activity. A romanticist picture of creativity is held by many today, although there are other (e.g., modernist and post-modern) conceptions of artistic creativity.

Schizophrenia A severe mental disorder characterized by disturbances in several areas of functioning but predominantly defined by disturbances in perception (hallucinations, most common auditory), and cognition, the content (delusions) and form of thought. Related symptoms also occur in the less severe disorder, Schizotypal Personality Disorder.

Thought disorder Disturbances of thinking that mainly include formal thought disorder (how the person puts ideas together, reasons, and expresses ideas), which overlaps with unusual language. While formal thought disorder, particularly as assessed with psychological tests and procedures, was long held to be the defining characteristic of schizophrenia, it is now clear that it occurs in different forms across other diagnostic categories, including the mood disorders.

Introduction

Since at least the time of the ancient Greek philosophers people have noted similarities between the activities of creative people, particularly artists, and the disordered behaviors of madness. Aristotle observed a connection between what he called the melancholic temperament and genius, and this was famously expressed much later in Shakespeare's equating "madman, lover, and poet." During the nineteenth century the movement of romanticism valued madness – along with 'primitive,' 'natural,' and 'childlike' states and raw experience – as a route to art. Contemporary approaches attempt to ground the connection between creativity and psychopathology in empirical data; this research has taken up the complicated and rather vexing questions of trying to define madness, particularly in geniuses of the past, and the question of what constitutes creativity, again with problems of retrospective recognition of another kind. Moreover, some authors, notably George Becker, have argued that the connection between madness and genius is artificial, a myth reinforced or even created precisely by people's belief in it, the romanticist tenet that

artists and gifted people should be erratic and even insane. This prompted biased observation, self-fulfilling prophecy, and make-believe, creating geniuses and would-be geniuses who have appeared or pretended to be mad.

This article explores the possible connections between affective disorders – and related subclinical phenomena – and creativity (and related, sub-genius-level phenomena). It describes the strengths and weaknesses of the evidence and addresses questions regarding whether or not there are specific forms of creativity and of madness with different relationships among them. When considering mental disorders, it is useful to think in two ways: Diagnostically, where the emphasis is on categories of disorder, perhaps akin to physical illnesses; and, conceptually, regarding the characteristics and traits comprising these disorders. With creativity it is possible to focus solely on recognized geniuses (those who have been 'diagnosed,' via recognition, with creativity, and have achieved eminence either during their lifetimes or later), or on the more general (and sometimes less intense) characteristics of creative thinking and activity shared to varying degrees by everyone and observable in everyday life. The first approach, in the case of both madness

and creativity, looks at categories, the second at continua. Relevant affective disorder phenomena include depressed thoughts, feelings (e.g., sadness), and behaviors, as well as manic and hypomanic traits of vivid perception, elation, and behavioral and cognitive acceleration.

At a very basic level creativity and mental disorder are similar in being characterized by the living of unusual human lives in the realms of behavior, thoughts, feelings, spiritual activity, and, some might argue, physical health, form (for example, from a perspective of 'body performance'), or deformity. Physical illness also bears some connections to creativity, most likely inspiring or producing it, providing enforced contemplation, resulting from a hard lifestyle, as well as simply co-occurring with greatness. Genius and madness share being considered unusual; yet, later I will discuss Everyday Creativity, the way all of us, whether or not mad, famous, eminent, recognized, or particularly gifted, can be creative, and also sometimes somewhat mad.

Genius and Madness

Mental disorders are generally characterized as including unusual and troublesome components in three realms, behavior, thought or perception, and feeling. Creativity is usually defined as doing or producing something novel and original, with the caveat that this 'product' is of high quality. The latter introduces a confound with social recognition, customs, culture, and the judgment by others regarding the value and quality of a work; it is well-acknowledged that favorable judgment may not occur in the lifetime of the creative individual. People may not be well-known, well-regarded, famous, or eminent in their own lifetimes, but their work may be judged positively later, resulting in eminence after death. 'Outsider artists' may never be recognized, and there is current interest in unrecognized and belatedly-acknowledged women creatives and other 'outsiders.' Similarly, much work in this area has relied not only on *post-hoc* judgments of the creative work but also on retrospective diagnosis of psychopathology from biographical and historical evidence about a person's life in the past.

Creativity is usually judged on the basis of productive behavioral activity manifested in the course of the creative person's life and likely to last through the generations. This can be an artistic creation but can also consist of activities in the areas of leadership, achievement, or attainment, for example in the military or in business. Much of the research on the genius-madness controversy is muddy and confusing because it has required judging the validity or quality of a creative product as well as the assessment mental disorders retrospectively.

This said, there is a wide-ranging empirical and biographical literature that draws connections between psychological disorders and creative activity. Creative individuals have been judged retrospectively to have had grim and pathological life histories, including tumultuous and difficult childhoods and later lives, schizophrenia, antisocial-like behavior, alcoholism and drug addiction, depression and the bipolar disorders, and a variety of 'neurotic' disorders. When retrospectively diagnosed, many psychiatric categories are not easy to tell apart. In particular, the boundaries between schizophrenia and the mood disorders have been porous and controversial over the years.

Biographical studies focus on possible symptoms and diagnoses of creative and famous individuals in the past. Early research emphasized characterological disorders, but perhaps the strongest early research and theorizing drew connections between schizophrenia – and the disordered thinking associated with it – and creative work. In the 1970s empirical support for the connection between mental disorders and creativity came from literature suggesting genetic connectedness between mental disorders – mainly in the 'schizophrenia spectrum' (which at the time included some of the diagnoses now considered mood disorders) – and creativity and achievement. With psychiatric disorders in general some have argued for 'compensatory benefits' (such as creative thinking and drive) that may account for the persistence in the population of mental disorders with severe negative consequences for many carriers. Much as the sickle cell trait is linked to resistance to malaria, there may be positive selection pressure for traits genetically linked with mental disorders.

Biographical studies tended to find large numbers of people with schizophrenia among retrospectively diagnosed creative and eminent individuals, and to draw parallels between creative activity and schizophrenic cognition. Schizophrenia has been a compelling and fascinating concept, and in the earlier days of psychiatric diagnosis it remained a broad and rather ill-defined category encompassing much abnormal behavior and experience. In addition, psychoanalytic accounts of the creative process emphasized the power and utility of what Ernst Kris termed 'Adaptive Regression in the Service of the Ego,' the creative person's gaining access to 'Primary Process' cognitive and emotional activity operating as part of the Id and below the control of the ego. Primary process cognitions were thought to contain material that was raw, illogical (or a-logical), possibly child-like or developmentally early, uncontrolled, full of the primary drives of sex and aggression, and unedited. It was asserted that people with schizophrenia had easier and often unintended access to this material – possibly essential as the raw material of creativity – than did others, who might only access their unconscious lives in their dreams.

Cognitive approaches tended to focus on the relationship between creative divergent thinking (as it was conceptualized by Guilford) and the disordered thought of schizophrenia (thought disorder, TD). Keefe and Magaro noted that both thought disorder and divergent thinking (TD and DT) may be indistinguishable conceptually and represent an 'equality' of cognitive activities; both refer to nonnormative production of ideas that are statistically unusual. An additional question concerns the 'quality' and the shareability of these unusual ideas.

Over time the diagnostic category of schizophrenia has shrunk somewhat, particularly in the United States, and has moved away from a position where most affective symptoms could often be considered part of either the core schizophrenia syndrome or of the 'schizophrenia spectrum.' However, Eysenck lumps together both schizophrenia and mood symptoms as related to a single (creativity-relevant) construct he calls 'psychoticism,' and important mixed and in-between categories of 'schizoaffective disorder' still exist in the DSM. Schizophrenia's core symptoms also include affective features, today associated with the 'negative' or 'deficit' syndrome of schizophrenia. While depressive symptoms do occur in schizophrenia, the affective negative symptoms of schizophrenia – flat,

absent, or inappropriate affect and anhedonia – mainly reflect absences of emotion, as opposed to depressed low mood.

There remain questions, however, as to how much (and whether) schizophrenic cognition is ‘adaptive,’ ‘in the service of the ego,’ child-like, or strictly-speaking regressive. While schizophrenia has waned in popularity as the primary mental disorder related to creativity, others, for example Louis Sass, argue that schizophrenic flat affect combined with thought disorder is particularly suited to creative work in areas such as abstract art. Here a ‘distanced’ and ‘alienated’ perspective is important, as well as in mathematics, analytic philosophy, literature, and the pictorial and plastic arts in the eras of modernism and then post modernism.

In recent years much of the work on creativity and psychopathology has focused on contemporary individuals, lessening the effect of retrospective bias, as well as using psychological test or interview assessments of both creativity and psychopathology. As an example of the latter approach, Frank Barron, Harrison Gough, Donald Mackinnon and others, starting at the Institute of Personality Assessment and Research (now the Institute of Personality and Social Research) at the University of California, Berkeley examined personality characteristics – both positive and negative – of creative and sometimes also less creative individuals in various fields, notably architects. Barron did further work on writers and student artists and found high levels of self-reported psychopathology in creative architects, writers, and art students. While it is impossible to list all those contributing to this vibrant research area, it is important to mention the work of Arnold Rothenberg, who looked at ‘Janusian thinking,’ where someone is able to hold two opposing thoughts simultaneously, and its role in the creative process; this is another area where a ‘mixed’ state may be particularly important. In addition, my own work examined psychometric assessments of manic, hypomanic, and schizophrenia-like traits, as well as paper and pencil measures of ‘normal level,’ non-eminent creativity.

Affective Symptoms and Disorders

More recent work has also looked specifically at mood disorders and noted apparently genetically mediated connections of these affective disorders with creativity, socioeconomic, status and achievement. This entry focuses on the affective disorders, which are mental health disorders characterized by unusual and troublesome variations in mood that interfere with a person’s functioning. In the DSM-IV-TR (the current edition of the psychiatric diagnostic manual), the relevant categories are termed mood disorders. Although there is currently a great deal of interest and controversy involving the diagnosis and treatment of bipolar disorder in children, this entry refers only to disorders of adults.

Symptoms

Symptoms and characteristics of the mood disorders can occur at subclinical levels in normal individuals and nonpatients, as well as in those with diagnosed mental disorders. These symptoms occur on continua, and it is important to consider subthreshold characteristics in relationship to creativity, not

just symptoms that meet the criteria for a diagnosis. These symptoms include both low or ‘down’ affect and related experiences associated with depression, ‘up’ or ‘high’ and related symptoms associated with manic or hypomanic episodes, as well as the sequential or simultaneous experience of different emotions.

Depressive symptoms include: behavioral and physiological characteristics of slowness, lethargy, insomnia or hypersomnia, change (increase or decrease) in appetite, loss of interest in pleasant activities, and characteristic ‘sad’ facial expression and posture; emotional characteristics of sadness, unhappiness, and feelings of worthlessness. Cognitive features include negative self-evaluation, global, internal and negative attributions regarding events and the self, as well as suicidal thoughts and impulses.

Symptoms of mania and less severe hypomania include impulsive and rapid behavior characterized by poor judgment and inattention to consequences, elated or ‘high’ affect, and sometimes infectious good mood (although some clinicians comment on a desperate and depressed quality underlying this mood). Additional symptoms are racing thoughts, pressured speech, grandiosity, high self-esteem, often decreased need for sleep, and inaccurately positive judgments about the self. A hypomanic episode is similar, but less severe.

Diagnostic Categories

The current psychiatric diagnostic manual, the DSM-IV-TR, begins by defining the symptoms and clinical phenomenology of ‘mood episodes,’ major depressive episode, and manic, mixed, and hypomanic episodes. A major depressive episode consists of a period of depressed (sad, hopeless, demoralized) mood or of lack of pleasure, accompanied by significant impairment and by other depressive symptoms. A manic episode is characterized by elevated or expansive, euphoric or excessively enthusiastic, or irritable mood. Mixed episodes are defined as periods when the person meets criteria for both a major depressive and manic episode in the same day, nearly every day for a week. Periods of alternating or simultaneously mixed mood will also be important to the discussion of emotions and creativity.

The mood disorders themselves include the depressive disorders, major depressive disorder and dysthymic disorder (for simplicity, such categories as ‘not otherwise specified’ are omitted from the discussion). Major depressive disorder is diagnosed if a person has experienced one or more major depressive episodes, but no manic, mixed, or hypomanic episodes. Dysthymic disorder refers to a person with chronically low mood, whose depressive symptoms are generally less severe but of greater persistence and longer duration than in individuals with major depressive disorder.

Next are the bipolar disorders, bipolar disorder type I and bipolar disorder type II, as well as cyclothymic disorder. Bipolar I disorder is diagnosed if someone has had at least one lifetime manic or mixed episode, and often the person will have had major depressive episodes as well. Bipolar I disorder can come with a most recent episode of manic, hypomanic, depressed, or mixed. In contrast, individuals with bipolar II disorder have had one or more major depressive episodes, have never had a full-blown manic (or mixed) episode in their lifetimes, but have experienced at least one of the more moderate hypomanic episodes. Cyclothymic disorder is characterized by more mild alternations in mood, with numerous periods of

hypomanic and depressive symptoms. Bipolar disorders I and II, and major depressive disorder, can also have psychotic features.

Changes in mood can also be due to medical and other physiological conditions (including substance or prescribed medication use), and the DSM-IV-TR includes groups of 'other' mood disorders attributable to general medical condition, and substance induced mood disorders. These are important for this discussion due to literature on physical illness in creative individuals and the relationship between medical illness and creativity. This possible connection in 'the wounded artist' is exemplified by Edmund Wilson's essay, 'The Wound and the Bow,' which discusses Sophocles' play *Philoctetes*, the story of a wounded and morbidly ill master archer, who had been a companion of Odysseus. (Note that *Philoctetes* is now also being read as a story of recovery from war-related trauma.) Linkages between physical illness and creativity have also been the subject of systematic study. Finally, mood symptoms can also occur with a variety of other psychological disorders. The focus here is on the bipolar affective disorders and hypomanic disorder, as well as major depression and dysthymia.

Bipolar Disorders

Some of the strongest statistical findings and conceptual arguments regarding the relationships between categories of mental disorder and kinds of creativity concern the bipolar mood disorders. Empirical research in this area started in earnest with the path-breaking work of Dr Nancy Andreasen, who studied creative writers who had attended the Iowa Writers' Workshop and found higher rates of affective disorders and symptoms in writers and their relatives than in control individuals. Dr Kay Jamison, who did extensive work emphasizing writers and composers, also documented an alarmingly high rate of suicide in these populations, something others found in abstract expressionist artists. She has also written a beautiful autobiographical account of life with bipolar disorder in *An Unquiet Mind*.

Dr Ruth Richards and her colleagues studied creativity in manic-depressive and cyclothymic participants (under DSM-II and DSM-III criteria), their normal relatives, and control participants. Richards' focus is on noneminent (what she calls 'Everyday') creativity, and this expands the debate away from famous geniuses, and somewhat away from diagnosed psychiatric patients as well. Her work also removes some of the confounds with social evaluation and self-promotion that can be introduced into evaluating creative work. Richards and her coworkers suggested nonlinear, 'inverted-U' relationships linking indicators of symptom intensity and levels of creativity. They made explicit connections between creativity and psychological health, as well as connecting the construct of everyday creativity to well-lived life in general and the overall makeup of human beings.

Especially important is Richard's and colleagues' work on 'inverted-U' relationships and Jamison's suggestions that optimal creative functioning is not associated with full-blown, extra high, manic states but may mainly occur between – not during – manic or depressive states, or at more moderate levels of affective and cognitive symptoms. In other words, while creativity may be associated with mood disorder, it does not necessarily occur at its peak levels in periods of maximally

'high' or 'low' affect. This suggests nonlinear relationships between symptom levels and creative functioning, perhaps with moderate levels of symptomatology as 'optimal.'

Depression

The term depression refers to the set of mood disorders indexed by the diagnoses of major depression or dysthymia. In addition, as noted above, the word depression also refers to 'normal' and nonpathological experiences of 'down' affect. A number of authors have suggested an association between depression and creative functioning. There are convincing anecdotal and biographical reports of how depressed states may sensitize someone to the nuances of the natural and social worlds; depression can seem to create an almost agonizing sensitivity. Graham Greene noted in *The End of the Affair*:

In misery we seem aware of our own existence, even though it may be in the form of a monstrous egotism: This pain of mine is individual, this nerve that winces belong to me and to no other. (1975 Penguin edition, p. 47)

This also touches on a sense of grandiosity and narcissism that may also be associated with creativity and with depression. (Note that while Aristotle's ideas regarding genius and madness referred to a 'melancholic' temperament, the relationship between this use of 'melancholia' and current ones is complex.)

The literature reports many individuals who have had high-level creative careers and also experienced severe depression. There is also a large literature on suicide and creative individuals, including painters, authors, and others. An important and unresolved question concerns the relationship between suicidal thoughts and feelings and creativity itself, and a crucial concern of treatment is managing the suicidal thoughts and feelings that can be dangerous symptoms of the mood disorders. Some artists fear that treating their depressive and other mood symptoms will compromise their creativity, but – writing as a clinician – I believe that it is important that the creative person continue to live!

Depression may not only contribute to a vividness of perception but also facilitate periods of incubation in the creative process, a role that has also been argued for physical illness. However, psychometric associations between depressive experiences and creative functioning – at least over the normal range of depressive symptoms – have been mixed. There is, however, important empirical work on 'paradoxical' positive effects of negative mood on creative functioning, finding that negative emotions can enhance creative performance.

Other Mental Disorders

Possible associations between the norm-breaking behavior of people who could be diagnosed with antisocial personality disorder and creativity have been mentioned above; there is conceptual overlap between a norm-breaking lifestyle, genre-busting creativity, unconventional and ground-breaking artistic products. There have also been associations suggested with narcissistic personality disorder, with the argument that to feel one's creative work is valuable and worth showing to the wider world it is necessary to have at least some narcissistic characteristics, such as belief in one's own worth, grandiosity, and

exhibitionism. There have also been suggestions that creative individuals are especially likely to demonstrate flamboyant, exhibitionistic, and emotionally and interpersonally labile characteristics of borderline or histrionic personality disorder. Asperger's syndrome is also an area of intense current interest.

Recent work has extended historical accounts of traumatic or abusive childhoods in eminent creatives and posited a connection with post traumatic stress disorder (PTSD). Linkages with substance and alcohol abuse have already been mentioned, and there is a rich anecdotal literature on associations between alcoholism and the use and abuse of other substances and creative functioning. However, a more recent and popular stream of literature has focused on the documented ill effects of addiction on creativity, creative individuals, and those around them, and on the role of recovery from substance abuse in tapping personal creativity and also recovering from traumatic events.

As noted, over time and the course of study in this area, focus has shifted from characteristics of personality disorder to those of schizophrenia and then mood disorders. The question of which specific mental health diagnoses or which symptoms may be most associated with creativity is complicated by several things. First, diagnostic categories overlap substantially; this has been referred to as the 'horizontal spectrum' of disorders. For example, symptoms of depression may occur in a number of different diagnoses. Second, a number of diagnoses often tend to co-occur, to be 'co-morbid.' Thus, affective disorders and substance abuse often co-occur, as do depression and PTSD. Finally, we are coming to realize that there are distinctly different forms of creativity in different fields or domains, in different cultures, and during different epochs; there does appear to be some specificity in the linkages between particular diagnoses and symptoms and creativity of particular kinds in particular endeavors, something investigated by Arnold Ludwig and Robert Prentky.

A More Fine-Grained View

Psychometric Indices of Psychopathology

Research on diagnosed mood disorders has been summarized above, and it is important now to extend this discussion to symptoms and characteristics of mood disorders more broadly construed, including subclinical intensities and experiences. Symptoms can be viewed on continua, as ranging from non-significant to normal-range to subclinical to severe. This is sometimes referred to as the 'vertical spectrum' of mental disorder. When symptoms and related characteristics are viewed as varying in intensity along different continuous dimensions, they can then be measured using psychological tests and rating scales. For example, hypomanic and schizotypal characteristics, as well as depression, can be assessed in this way.

There is an extensive literature which looks at these psychometric indices of psychopathology rather than at all-or-none categorical diagnosis. Some of this work also looks at creativity test scores that vary along continua in normal people, rather than using fame, eminence, or nominations of others as criteria of creative endeavor. This research has found positive correlations between test indices of mood disorder symptoms and experiences – generally below the clinical threshold for

diagnosis – and indices of creativity. The research also finds associations between psychometric indices of schizophrenia-like thought disorder (again at subclinical levels and in normal, nondiagnosed individuals) and functioning on paper and pencil measures of creativity.

Types of Psychopathology-Like Experience and Varieties of Creativity

Positive and negative affect

Motivational and affective factors, for example willingness to go out on a limb and take risks, self confidence, and energy, are important components of the creative process. However, a creative product is more usually viewed as coming from thinking or perhaps (in such cases as 'unconscious' or 'automatic' writing or painting) from behavior alone. While the focus of this entry is on affect, much research has focused on specific aspects of cognition and their relationships to creative functioning, which is often viewed as a cognitive process, for example, divergent thinking. The mood disorders appear to be associated with particular types of thinking as well as with affect, and it was noted earlier that both manic and depressive disorders have cognitive and behavioral, as well as emotional, symptoms. 'Primary process' contains both affective and cognitive elements; emotion and reason are intertwined. Sandra Russ has explored both of these aspects of children's play in relation to creativity. The treatment approach of cognitive behavior therapy emphasizes the linkages among thoughts, feelings, and behaviors and tends to focus on thoughts in framing interventions. It is now becoming apparent that 'thought disorder' is not limited to schizophrenia and schizotypal personality disorder and can occur in mood disorders as well.

Nevertheless, it is possible that an important connection between bipolar disorder and creativity is specifically related to the affective factors found in the forms of this disorder. A number of authors, notably Alice Isen, have found relationships between positive affect and creativity. The speeded-up quality, productivity, ideational fluency, and verbosity all associated with manic and hypomanic states may facilitate creative output by increasing the number of new ideas and the amount of raw material a person has to work with. D. T. Campbell suggested a theory of creativity based on 'blind variation' and selective retention; in this model the generation of large numbers of ideas that can then be evaluated and edited, with some discarded and some selected to be retained, would facilitate creativity. Quantity allows later selection of items of high quality.

It is also important to note work finding associations between negative affect and creativity as well, although this research is somewhat puzzling at this point. While Schuldberg generally found negative correlations between creativity test scores and measures of both subclinical depressive symptoms and subclinical 'flat' affect, others have found so-called 'paradoxical' effects. These are situations where negative affect facilitates creativity, job performance, and other positive outcomes (including health-related variables).

In general, negative affect has gotten an undeserved 'bad rap' among psychologists, especially in the new field of positive psychology, and further work needs to be done on the positive effects of so-called negative emotions (and 'negative' cognitions).

There are also suggestions that being able to experience positive and negative emotions simultaneously is important in psychological health, and it may be that such 'bitter-sweet' mixed emotions play an important role in creativity. The 'mixed' episodes that can occur in bipolar I may emerge as especially important.

Manic cognition and speech

While much of the earlier work on creativity and madness focused on the disordered and sometimes psychotic cognitions of schizophrenia and their similarity in form (although perhaps lower quality) in relation to novel, productive, and creative ideas, there is now much more known about cognition in the mood disorders. Manic and hypomanic thinking generally involve interpersonal engagement with another person or audience, self-confidence, free flowing if not agitated sequences of ideas, and pressured and rapid thought and speech. One approach to distinguishing schizophrenic and manic or hypomanic cognition and language looks at measurements of formal thought disorder based on cognitive tests, ratings of language behavior in interviews and other procedures, and especially at verbalizations during the Rorschach inkblot procedure. Earlier research suggested that high levels of the thought disordered type of 'deviant verbalization' described by David Rapaport are specific to schizophrenia and related conditions. However, we now know that formal thought disorder on the Rorschach also occurs in people with manic, hypomanic, or depressed symptoms. Thought disorder specifically in people with bipolar diagnoses is characterized by combinatory responses ('fabulized' and incongruous combinations), cognitive sophistication and complexity, affectively-tinged content, and interpersonal engagement with the examiner. In contrast, people with schizophrenia tend to manifest more idiosyncratic or personal and unusual verbalizations, 'autistic' (highly personal to the point of being unshareable) thinking, completely individual logic, confusion, and interpersonal detachment or disconnection.

Specificity

There do seem to be different flavors of thought disorder associated with both schizophrenia and the affective disorders. This leads to the suggestion that there are differing types of both pathological and creative cognition and affect, varieties of functioning better suited to different sorts of creative endeavors, whether in literature, music, art versus philosophy versus military leadership or attainment in business. This work suggests the existence of separate domains and types of creativity. In addition, it will be useful to explore both between and within-person variations in style. This approach fits well with the original work of Guilford, and with the work of Howard Gardner, Robert Sternberg, and others who argue for and measure multiple components of creativity and other forms of intelligence.

More Complicated Models

Creativity and Health

This brings us to the subtlety and complexity of the relationships among health, creativity, and psychopathology, and to a reconsideration of the question of the connections between genius

and madness. A number of more complicated models have been suggested for linking creativity and psychopathology. Ruth Richards, in a pioneering 1981 paper, explored various different possible forms for these relationships, including the possibility of creativity causing psychopathology, psychopathology causing creativity, and a number of interesting and more complex combinations, such as a common factor causing both.

Two factor models, originally put forward by Frank Barron, posit additional health or resilience factors which, in combination with features of psychopathology, lead to creativity or to health as opposed to debilitating mental disorder. One 'pathology' factor may be access to 'primary process' experience or 'disordered' cognition, mentioned above. The second factor may be 'ego strength,' something Barron attempted to measure with his own 'ego strength' scale on the old version of the Minnesota Multiphasic Personality Inventory (MMPI). Ego strength is described as a personality characteristic that allows dealing with adversity, managing external stressors and internal distress, and bouncing back from setbacks. Barron found that creative individuals, specifically highly creative writers, tended to be very similar to people with diagnoses of schizophrenia and other mental disorders in terms of their scores on a number of clinical scales of the MMPI. However, the highly creative writers also had high scores on ego strength, a trait presumably allowing them to manage, deal with, communicate, share, and utilize unusual experiences productively, rather than being overwhelmed by them. There are also suggestions that creativity may be a key component of psychological health itself, even related to physical health. Creativity may be a marker or component of health and well-being.

Creativity and Psychopathology: Nonlinear and Dynamic

It is useful to consider creativity and psychopathology not only as existing along continua (as opposed to being dichotomous and categorical), but also as fluctuating and unfolding over time; they are dynamic, not static. People may well phase in and out of creative zones and also phase in and out of states that are more or less psychopathological. Future research and theoretical work on the relationship between genius and madness will benefit from focusing on both as dynamic processes within individuals, in flux at all times rather than representing life's endpoints. It is also important to consider the nonlinear causal relationships linking many different traits, characteristics, and behaviors, with positive or not so positive outcomes in people's lives: more of a good thing – be it wheat germ or cheerfulness – is not always better. Nonlinear relationships generally connect attributes and behaviors that may be viewed as healthy, unhealthy, or pathological with positive outcomes of attainment, achievement, or quality of life.

A dynamically changing system that contains nonlinearities is also capable of chaotic behavior, something artist, psychologist, and theorist Tobi Zaussner and others have suggested as an attribute of both creativity and well-lived life. Notably, the experiences of bipolar disorder also change with time and have specific phases, and some authors believe that the disorder includes chaotic variations in mood, although this assertion is currently controversial.

It is also very important to reiterate that it may be during the more moderate, regulated, and less extreme phases of mood

disorders that an individual is most creative or productive, something explored in the work of Jamison, Richards, and others. It is crucial not to over-idealize – and this is a failure of the philosophy and aesthetics of romanticism – extremely disturbed and painful psychological states because they are presumed to be associated with creativity.

Implications for Treatment

A number of potent and effective pharmacological treatments are available for the mood disorders, as well as empirically-supported psychotherapeutic treatments, notably cognitive behavioral therapy (CBT) and interpersonal psychotherapy (IPT) for depression. For depressive disorders a combination of medication and psychotherapy is likely to have the best results, although many people use one or the other. For bipolar disorders psychological treatment is often combined with or secondary to medication management if the client is willing to utilize pharmacotherapy. A variety of empirically supported psychological treatments are available for the bipolar disorders, including psychoeducational interventions to enhance medication compliance, CBT, marital and family therapy (including Miklowitz and colleagues' family focused treatment), as well as interpersonal and social rhythm therapy.

Some productive and creative individuals suffering from mood disorders may be reluctant to engage in treatment using either medications or psychotherapy, fearing that it may interfere with or decrease creativity or productivity, or that a greater degree of happiness or satisfaction may be incompatible with art. Research is unclear and opinion somewhat divided on the relationship between quality and quantity of creative output and treatment, but there are strong hints that support the substantial value of thoughtful treatment. First, there are a number of creative individuals who have reported favorably – in the scientific literature and elsewhere – on the positive effects of pharmacological treatment on their creativity, especially in reducing severe manic or depressed episodes. There is other research documenting a general satisfaction with treatment for bipolar disorder. I also want to argue that at least partial and episodic happiness is not incompatible with creativity and that – if undertaken with serious attention to the creative process on the part of both client and therapist – both pharmacological and psychological treatment can increase, rather than interfere with, good creative work. Support for this comes from Jamison's work that suggests that creativity is associated with periods between extreme swings of mood and from Richards' and colleagues' work on the inverted-U. There is additional work on the creative potential inherent in psychotherapy itself.

Andreasen argues for careful treatment of the creative individual with a mood disorder, paying attention not to over-treat (and hence produce excessive damping down of mood that may interfere with the creative process and encourage noncompliance with treatment), and avoiding undertreatment that allows breakthroughs of mood extremes that can hamper creativity and severely interfere with day to day functioning. Torrey and Knable make suggestions regarding dosage and other issues in pharmacological treatment. Richards argues that treatment may help the person experience more moderate intensities of mood and cognitive symptoms, staying in the

zones of experience associated, in much research, with higher creative output. Of particular concern is the risk of suicide. It is critically important not to minimize the risk and pain associated with these disorders when discussing their possible connections to creativity, nor to idealize the experience of mental disorder to the point of losing the creative person.

Conclusion: Creativity, Disorder, Health, and Human Nature

Considering the overlap and intertwinement, as well as the possible causal links, among forms of creativity and psychopathology deepens our perspective on deviance and nonnormative behavior and can lead to questioning the notion of 'normality' itself. 'Unusual' thoughts, feelings, perceptions, experiences, spiritual activity, and behaviors can either be socially devalued and viewed as problems and illnesses, or they can be valued and viewed as socially desirable. They are also strikingly widespread. It can sometimes be difficult to tell the difference between valued and nonvalued characteristics and behaviors just on the basis of the behaviors themselves. They sometimes overlap and mix, just as illness and health can mix, for example in people with chronic physical illnesses.

Ongoing debates regarding the relative importance of characteristics of mood disorders, schizophrenia, or other mental and physical disorders in creativity also suggest that there is a false dichotomy between cognition and affect, that our thoughts and evaluations of situations influence our feelings and that our feelings influence our supposedly 'objective' thoughts; there is generally no such thing as 'dispassionate' or 'cold' cognition.

In addition, we need to become more sophisticated in distinguishing among various types of clinical and sub-clinical psychological experiences and among different forms of creativity and achievement. This is an important area of ongoing research. Many experiences similar to ones considered pathological in a mainstream culture, or experiences that in fact imply a diagnosable syndrome, are quite common and widespread across individuals, in other cultures across the world, and over the life span. This is another reason to shift away from viewing mental disorders as disease categories and toward considering human experience as falling along continua, with intensities along different trait dimensions. This also points toward human existence as including fluctuation and variability.

In this view human nature and the human condition are dynamic, fluctuating, nonlinear, and inclusive of mixed characteristics and experiences. Some traits are considered socially desirable and positive, some negative, but all are mixed together in the living of everyday life, and in creative activity as well. This also suggests a reevaluation of which human characteristics may be helpful and which unhelpful, over the course of human history, when (and in what context) they are more or less useful to us, and at what intensities. The currently developing field of positive psychology, which emphasizes human strengths, capabilities, and assets, will benefit from continuing to scrutinize the very notions of positive and negative, particularly in the contexts of deviance, originality, and health.

There can be a little bit of madness in all of us, for better and for worse. It is important neither to overlook nor to glorify the pain and suffering that can be caused by severe mental

illness. But, it is also important not to ignore the positive contributions that disorder makes to human diversity. In addition, although very few of us become famous or are geniuses, recognized or unrecognized, everyday creativity plays an important role in nearly everyone's life, helping with solutions to everyday problems and in enriching the quality of normal life in relationships, work, recreation, hobbies, avocations, creative contemplation, and aesthetic appreciation.

See also: Bipolar Mood Disorders; Chaos Theory and Creativity; Cognitive Style and Creativity; Deviance; Divergent Thinking; Dreams and Creativity; Eminence; Emotion/Affect; Everyday Creativity; Janusian, Homospatial and Sepconic Articulation Processes; Mad Genius Controversy; Multiple Intelligences; Schizophrenia and Psychosis; Sociobiology; Substance Abuse and Creativity; Suicide; Therapy and Counseling (Creative Process in); Writing and Creativity.

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Mentors

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Glossary

Attention deficit hyperactivity disorder

(ADHD) Symptoms include heightened activity, inattentiveness, and impulsivity.

Creative achievement The process of original thinking that results in actual creative outcome.

Creative potential Possessing the capability to generate ideas that are novel and appropriate, but not yet doing so.

Mentee A person who is being mentored, a protégé.

Mentor A teacher, guide, or sponsor who serves as an example and can be trusted and relied upon.

Definition of Mentor

According to Greek methodology, Mentor was a guardian and a teacher of Telemachus, guiding him throughout his life's adventures. Today, the word 'mentor' refers to an advisor or a guide who can be trusted and relied upon. A mentor serves as an example to a mentee. Most mentees admire their mentors, and wish to follow in their footsteps. Synonyms for mentor are guide, sponsor, or teacher. Mentoring is usually an intentional, committed, and nurturing relationship between two persons, with the focus on both professional and personal development. Mentors give moral, and sometimes financial, support to their mentees, and help mentees discover their talents and realize their dreams.

Mentors and Creativity

Needs for Mentoring Creative Individuals

Exceptionally creative students have unusual personalities, which may lead them to experience social and personal difficulties. Exceptionally creative children's thoughts are more divergent, seeing connections where others do not. They may encompass both feminine and masculine characteristics equally. Exceptionally creative students tend to be rebellious and nonconformists, ready to express their creative ideas to peers and adults. At the same time, they may be more sensitive, reactive, and experience deeper and larger range of feelings. Therefore, if their unusual ideas are ignored or ridiculed, they may become disturbed and withdraw, leading them to be more cautious next time they have a creative idea or an unusual question. Eventually, ridicule may discourage their desire to pursue their interests, and result in mediocre knowledge and achievement.

Research shows that teachers' judgments of their favorite students and creativity are negatively correlated. That is, teachers do not like students who possess creative characteristics, seeing them as disruptive and bothersome. Rather, they prefer students who conform to teachers' rules and orders without questioning teachers' authority. If asked for preferences between highly intelligent and highly creative students, teachers choose the students with higher IQ who are more studious, think logically, and are more responsible. This is

not surprising, since these types of students are easier to manage in the classroom, which makes teachers' jobs easier. Finally, teachers' preference for conformity and order is so strong that they may even mistake creative behavior for behavior associated with attention deficit hyperactivity disorder (ADHD).

However, a highly creative student will not succumb to the teacher's desire for conformity. In fact, pressure to conform may even drive him/her to express a higher degree of nonconformity (remember, creative children are rebellious), exploring ideas and concepts of interest.

Teachers are not the only ones who influence creative children's attitudes and behavior. Parents are just as likely to play a significant role in impacting their children's creativity. Parents would also prefer their children to be quiet and behave, and may punish them when a child's behavior is inconvenient to them for some reason. But creative behaviors are often perceived just as such: inconvenient and difficult to manage. Constant questioning and wild ideas can be annoying. Creative behavior may even be interpreted as aggressive or hostile. All this makes parents, and society in general, uncomfortable. Stifling creativity in a highly creative child may lead to lack of enthusiasm, nonadaptive behavior, and ultimately to underachievement.

Both typical masculine and typical feminine characteristics are essential to creativity, and creative students tend to be more androgynous. Rather than fitting into society's gender role expectations, creative children diverge from these roles, and exhibit sensitivity as well as independence. In some circumstances, however, expectancy for stereotypical gender roles and peer pressure might influence creative students to conform in order to fit in. This may impact their emotional well-being, and can cause their creativity and academic achievement to plummet.

Creative students often find themselves as part of a minority group – they are different from others, and are either unnoticed, or teased by their peers. They can turn into loners, reluctant to express their original ideas. It is possible that they become completely isolated from their siblings, peers, parents, and/or teachers. A supportive adult can help a highly creative student to accept being different from others, to be comfortable with their independence, and to stand up against group pressure.

Benefits to Mentees

A study by Christine Bennetts in 2002 found that creative people such as poets, painters, actors, sculptors, writers, musicians, and dancers are aware of their abilities at a very early age, and cannot separate the concept of 'self' with the concept of creativity. Therefore failure by others to recognize the importance of their creativity is seen as denying their 'self.' Mentors play a valuable role in recognizing and accepting creative people's abilities. They push their mentees towards new opportunities, and serve as role models of what it is like to live as a creative individual. Mentors develop a critical aesthetic sense in their mentees by challenging them intellectually in reasoned debate, and acting as exemplars in the field. Mentors can also provide an invaluable model of living and working for those creative people who choose to follow an unusual career path.

Mentor guidance reinforces and enhances the potential for new creative works, and serves as a guide for creative development, self-actualization, intellectual accomplishment, and individual independence and autonomy. It has been observed that there is a meaningful mentor-mentee relationship behind many creative achievements. Mark Twain, for instance, was mentored by the writer Bret Harte, while Sally K. Ride, the first American woman in space, was mentored by Arthur Walker, a Stanford University physics professor.

In 2006, Cropley pointed out new creative ideas can be unappreciated or even ridiculed. Mentors provide examples of how to communicate creative ideas in ways that the society can accept. They offer new perspectives, a safe space where creative ideas can emerge without punishment, offer a positive social perspective on themselves, and help to communicate ideas to others. Mentors help creative people gain courage to pursue their own individual paths, while testing the limits of the acceptable. They learn that their creativity does not make them an outcast, and this knowledge can instill feeling of self-confidence.

Mentees often follow in the footsteps of their mentors, acquiring similar characteristics and leading similar lifestyles. This does not affect mentees' creativity, however. Indeed, many Nobel laureates had Nobel winners as their mentors. For example, George J. Stigler, a Nobel Prize economist, was a mentor to Gary S. Becker, a Nobel Prize economist as well. These mentors provided intensive intellectual and research guidance, increasing mentees' potential for success and creative productivity. It is not necessary, however, that mentees agree with their mentors' philosophy. Rather, they develop their own standards by comparing their own principles with those of their mentors. Mentors are encouraged to help students find their own niche, their own love of a discipline, and not try to turn them into disciples who will directly follow in their footsteps.

Benefits of having a mentorship relationship abound. These include, but are not limited to: creativity enhancement, career advancement, an increase in knowledge and skills, development of known and undiscovered talents, development of a personal ethic, and establishment of friendship. Mentors may also display unconditional belief in the mentee; express ideas freely; and uphold high expectations. These benefits can enhance self-esteem, self-concept, and self-confidence.

Often the process of mentoring is more of an indirect teaching, akin to modeling the courage to express and pursue

creative ideas. Some mentors do not explicitly teach a certain academic skill, but rather attempt to push the mentee to discover his/her own creative talents. Sometimes mentors even help mentees discover talents that they were not aware of or simply never had the chance to use. Outstanding mentors tend to be nonjudgmental and flexible in their interactions with their mentees. Mutual respect is descriptive of a mentor-mentee relationship, where one listens to the other with admiration, and values the other's thoughts and ideas.

Creative unusual ideas require risk-taking, and are often met with ridicule. A safe and supportive environment is essential, therefore, for creative ideas to emerge. Mentors teach their mentees on how to evaluate their creative work and deal with rejection. They respect and support their mentees, while providing support for experimenting with ideas and risk-taking. Errors and mistakes can be made safely within the relationship without fear of being judged as inadequate. Mentors provide valuable experiences to their mentees, such as enriching their career and providing support for their future career goals. Mentees feel comfortable in their uniqueness while with mentors, and this comfort may translate into other relationships. Mentors also provide opportunities for meaningful experiences and share with their mentees joy of creative achievement. In addition, mentors can sometimes provide material support, such as books, computers, laboratory facilities or trips to conferences, concerts, theater, and museums. They may also offer support in getting scholarships, awards or jobs.

Great mentors serve as a channel for guidance and wisdom, always moving out of the way of the growing competence of the mentee, not expecting imitation, but serving as a vehicle for growth in a direction best suited to the mentee.

Benefits to Mentors

Benefits to mentors may not be as tangible as for mentees, but they are powerful nevertheless. Mentors develop long-lasting meaningful friendships with their mentees, leading to a greater quality of life. They experience lasting satisfaction of contribution, which may result in increased confidence and a sense of well-being. Through their mentees, mentors become exposed to fresh new energy and curiosity, and to a new way of looking at things. With the help of mentees, mentors may become energized themselves, revitalizing their own career and receiving creative stimulation. The process of learning and achieving, as well as creativity, are enhanced for both people in the mentoring relationship. In addition, mentees often collaborate with mentors, leading mentors to higher productivity and future success.

Implications for Mentor and Adult Leadership for Creativity in Education

Some mentorship relationships happen spontaneously, and others are created. Matching students and mentors requires sensitivity to personal differences in style of working and personality. Parents and teachers are encouraged to seek experts as mentors for the students with whom they work, or to serve as mentors themselves.

In 2004, Davis identified goals for creativity training: raising creativity consciousness and teaching creative attitudes;

improving students' understanding of creativity; strengthening creative abilities through exercise; teaching creative thinking techniques; and involving students in creative activities. In addition, it is important to minimize the use of assessments in making social comparisons while fostering creativity. When students focus on self-improvement, they are more likely to take risks, seek out challenge, and persevere in the face of difficulty. Conversely, students will feel inhibited in expressing their creative ideas if they are being evaluated or monitored. Pressure caused by evaluation can cause anxiety that distracts from the creative task. However, this does not mean that challenges should be completely removed from academics. Meaningful challenges are necessary for development, especially if they take place in a secure environment and are personally relevant.

In 2002, Torrance found that the top 120 talented American people in six professions all had mentors who introduced them to the joys and challenges of their domain while allowing them the freedom to cultivate their personal style. Mentors don't need to be famous or powerful figures. Highly creative school teachers or college faculty members help creative students by allowing a wide choice of topics, welcoming unorthodox views, interacting with their students outside of class, and conducting classes in a more informal manner. Parents and teachers who are supportive give their students the freedom to pursue their interests and encourage the development of questioning, experimentation, and research. Teachers who make a difference help students fall in love with a subject so intensely that it becomes the center of the students' future career image. Torrance also found that future career image and passion are the best predictors of future creative achievement. Additionally, Torrance found that mentors are most helpful in achieving creative individuals' potential. Torrance's 'Manifesto for Children' reflects 7-, 12-, 22-, and 40-year longitudinal studies, and show the importance of a child pursuing his or her own interests. The manifesto is as follows:

1. Don't be afraid to fall in love with something and pursue it with intensity.
2. Know, understand, practice, exploit, take pride in, and enjoy your greatest strengths.
3. Learn to free yourself from the expectations of others and to walk away from the games they impose on you – Free yourself to play your own game.
4. Find a great teacher or mentor who will help you.
5. Don't waste energy trying to be well-rounded.
6. Do what you love and can do well.
7. Learn the skills of interdependence.

Torrance also suggested that the goal of guidance is not to promote individuality and creativity, but to encourage a healthy balance of individuality, creativity, and conformity. Excessive conformity and excessive nonconformity hinder creativity, but a balance between creativity and conformity can enhance one another.

Mentoring Programs

Major Components of Mentoring

Individuals who have mentors are more satisfied with their jobs and with their careers in general, and also receive

promotions and compensations more frequently. Successful mentoring has been described by Crisp and Cruz, in 2009, as consisting of four major parts: supporting a mentee psychologically and emotionally, setting goals and choosing a career path, advancing academic subject knowledge in a chosen field, and being a role model.

Supporting a mentee psychologically and emotionally

Psychological and emotional support involves actively listening to the mentee with encouragement and understanding, addressing his/her uncertainties and fears, and providing support in building self-confidence. It also includes paying attention to mentee's ideas, thoughts, and questions, and establishing trust and personal connection. It is important to be have a genuine interest in a mentee's achievement and success.

Setting goals and choosing a career path

Support in setting goals and choosing a career path involves discussing and providing advice to a mentee regarding his/her chosen career path. It is important that a mentee's strengths and weaknesses are assessed and are taken into consideration prior to setting academic and career goals. A successful mentor asks specific questions in order to provide the best possible advice. It is also important to provide detailed advice and explanations of which goals are worth pursuing, and which ones are best to avoid in helping a mentee develop their career.

Advancing academic subject knowledge

Advancing academic subject knowledge in a chosen field involves tutoring the mentee in both academic and life-learning skills. Evaluating, and challenging the mentee academically is important in helping acquire necessary skills and knowledge. It also includes providing a mentee with visibility, nominating him/her for awards and promotions, and discussing mentee's accomplishments. In some cases, taking the blame for a mentee and shielding him or her from negative publicity may be necessary.

Being a role model

A mentee needs to have a chance to observe the mentor in interactions with other professionals in the field. Being a role model involves serving as a guide and as an exemplar to the mentee, discussing not only the mentor's successes and achievements, but also how mistakes and failures were handled. In addition, it is important to understand how a mentor handles professional and personal demands. Such sharing will enrich the relationship.

Elements of Successful School-Based Mentoring Programs

Several keys to successful school-based mentoring programs as shown by Randolph and Johnson in 2008 are as follows:

1. Expectations for mentors' overall time commitment and contact frequency between mentors and mentees are specified. Most of the programs require mentors to commit to weekly contact for at least one school year.

2. Training for mentors is provided before they enter into relationships with mentees. Some type of monitoring is also conducted after relationships start.
3. A framework is followed, which predetermines structured activities between mentors and mentees, and address the specific goals of the program.
4. Support for mentors is included, such as screening and training before the match, and support and supervision after the match. Post-match monitoring procedures are provided, with ongoing training to monitor the relationships between mentors and mentees. Either a mentor support group, or individual supervision to mentors can be employed.
5. Some programs do not have any formal expectations for parental involvement, and coordinators act as liaisons with parents or between parents and mentors. Other programs promote formal parental involvement by hosting parent activities during the school year, and mentors are invited to attend these meetings in order for parents and mentors to meet each other. However, in 2002, Millar found that there are programs which discourage contact between parents and mentors. In any case, it is important for a mentor to provide a mentee with a different, but noncompetitive perspective from parents.

The studies above examined the effect of mentoring on attitudinal and behavioral outcomes that ranged from school connectedness or academic engagement to involvement in bullying and fighting. Although most of the programs included tutoring as a part of the mentoring activities, only a few programs examined the effects of mentoring on academic performance. In several studies, the effects on outcomes in multiple domains were examined. The primary benefit for students participating in the mentoring programs was increased connectedness at school, in the family, and in the community. Evidence of mentorship on prosocial peer relationships and on graduate point average was inconclusive. The effects of the mentorship may be dependent, however, on the quality and length of the mentoring relationship, as discussed by Randolph and Johnson. For example, in 1999 Lee and Cramond found that only students mentored for longer than one year have significantly higher aspirations than those who mentored for a shorter period.

Main Process Considerations for Mentoring Programs in Education

There are also eleven key themes that should be considered for successful mentoring processes as shown by Ewing et al. in 2008:

1. **Pairing process.** This is the greatest challenge. Several pre-program meetings with meals are helpful to allow an informal opportunity for the potential mentors and mentees to get to know one another. Paring with a mentor from a mentee's discipline or areas of interest is preferred in some cases. In other cases, paring with a mentor from another discipline or areas of interest is best as it provides the mentee with a different perspective. Thus, making the list of potential mentors with detailed information about each mentor and about each mentee should be available

in order to facilitate pairing. However, mentees must take ownership and control of the pairing process while pairing is facilitated by the program.

2. **Entry participation barriers – recognition and time.** Time constraints of the mentors should be recognized. Support from senior mentors who have less time constraints is helpful. Any mentors, regardless of junior or senior level, should be recognized or rewarded for his or her participation.
3. **Ongoing participation barrier – time.** Flexibility to schedule meetings should be considered and less than five hours a month on mentoring activities is recommended.
4. **Participation incentives – rewards.** Participation incentives and rewards, such as receiving funding for participating in the mentoring process, is encouraged. Although mentors are not usually motivated by external recognition or money, it can seal commitment from the mentor and mentee and prevent them from drifting away.
5. **Cultural compatibility.** When people attempt to get to know one another, there may be many barriers, including age, personality, ethnic or cultural background, etc. Thus, it is important that a mentee has some common ground with a mentor. In 2002, Millar showed that mentors need the facility to celebrate the individuality of disadvantaged or withdrawn students.
6. **Gender.** A mentor's and mentee's preference should be taken into consideration.
7. **Goals.** From the beginning, general and specific goals should be discussed, documented, and shared with other mentors and mentees in order to evaluate progress. Examples of goals include improving time management, balancing different priorities, building an academic or career identity, overcoming fears and other negative emotions in making progress, and being able to refuse to take on additional work.
8. **Intended and unintended outcomes.** Comparing the goals set by individuals in the program to the outcomes achieved is important. Additional positive outcomes not specifically stated as goals may include emotional support, developing broader formal or informal networks, increased sense of direction, taking more time for reflection, etc. Achievement of goals and attainment of concrete and specific outcomes can help shape mentees' future goals.
9. **Nature of relationships.** Some relationships and meetings can be informal, whereas others may have set agendas, action items, and meeting notes. Relationships can provide important personal and individual support for mentees. For some mentees, simply having another senior person to listen and offer support can be rewarding. For others, they can develop strategic goals and processes with the help of their mentors.
10. **Structure of program.** Formal whole-group meetings can add information and ideas to the mentoring process besides a mentee's regular meetings with a mentor.
11. **Mentoring agreement.** It is important to set an agreement between a mentor and a mentee as a means of regulating and monitoring progress. There needs to be structure to the mentoring process. An agreement can help mentors and mentees set aside time in order to meet and take mentoring more seriously.

Mentors and Mentees' Commitment for Successful Mentoring Programs

Commitment to the mentoring relationship plays a significant role for both mentors' and mentees' satisfaction, as discussed by Poteat and colleagues in 2009. The nature of the satisfaction is similar – the higher the personal commitment, the greater the satisfaction. In addition, commitment leads not only to a greater satisfaction with the mentoring relationship, but it also can lead to the greater effectiveness of the mentoring program and future mentee's success.

Mentors are usually busy people, and mentoring takes time and energy. Therefore, if mentors see a high commitment on the mentee's part, they will be more likely to invest themselves further. Mentee's commitment may enhance mentor's ego justifying the time and energy placed into the relationship. Thus it is best that counselors and educators help their students develop and exhibit commitment to their mentors.

Summary and Conclusions

Early writings concerning the importance of mentoring in creative achievement were based upon analyses of biographies and autobiographies of high achieving, notable creative people, case studies, or psychometric studies of eminent scientists. Since then, a number of empirical studies emerged including a 40-year-longitudinal study examining the effects of mentors on creativity of their students. Results from Millar in 2002 indicated having a mentor related significantly to improvement of all the measures of creative achievement both in high school and in post high school years.

Creative individuals need a mentor to realize their full potential. Research has shown that eminent creators, including the Nobel Prize winners, have had at least a formal or informal mentor. Mentoring has long been valued in the literature and in practice. It has even become a national priority, as evidenced by hundreds of formal programs and institutional practices that include a mentoring component.

In one mentor program for at-risk middle school students, overall failure rate of students in the program declined from 28% to 12% over a period of three years. This indicates that at-risk creative students also can benefit from having a personal mentor. The psychological dangers are severe if creative needs

are strong and suppression is severe or prolonged. The stifling of creativity cuts at the very roots of satisfaction in living and may ultimately create overwhelming tension and breakdown. Such students experience difficulties with feelings of social stress and estrangement. The power of peer pressure and conformity coupled with a student's wavering sense of being predictable can easily lead to denial of even an already recognized ability. We cannot afford to neglect creative individuals who need a mentor.

See also: Education and Creativity; Giftedness and Creativity; Teaching Creativity.

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Relevant Websites

- www.mentoring.org – Mentor - expanding the world of quality mentoring.
- <http://www.hsph.harvard.edu/chc/wmy/> – Who Mentored You? Thank them...and pass it on. Mentor a child. (Harvard website).

Metacognition

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Glossary

Epistemic cognition Includes the individual's knowledge about the limits of knowing, the certainty of knowing, and the criteria for knowing. It further includes the ability to identify and choose between the forms of solution appropriate for different problem types.

Feeling-of-warmth (FOW) judgments Method for studying problem solving. Subjects are asked to indicate how near they believe they are to the solution.

Metacognition Knowledge and cognition about cognitive phenomena.

Monitoring process Includes knowledge about oneself and others involved in the problem solving process, knowledge about problems, and metacognitive experiences.

Strategy A general plan of action in which the sequence of solution activities is laid down.

Thinking aloud methodology Respondents are asked to verbalize their thoughts as they work on a problem. The method is used for studying processes involved in problem solving and thinking.

Tip-of-the-tongue states (TOTs) Refers to the experience of feeling certain that one knows a word, but being unable to retrieve it.

Definitions of Metacognition

The term metacognition was introduced by John Flavell in the early 1970s, based on the term metamemory previously conceived by the same author. Metacognition is viewed as learners' knowledge of their own cognition, defining it as knowledge and cognition about cognitive phenomena. Metacognition is often referred to in the literature as thinking about one's own thinking, or as cognitions about cognitions. It is usually related to learners' knowledge, awareness, and control of the processes by which they learn, and the metacognitive learner is thought to be characterized by the ability to recognize, evaluate, and – where needed – to reconstruct existing ideas.

Metacognition consists of two components: knowledge and control. Metacognitive knowledge pertains to one's knowledge about how one's cognition operates ('I know that I do not memorize names well'), whereas metacognitive control pertains to how one controls one's cognitive operations ('To facilitate remembering I will try some mnemonic technique'). Some authors have conceptualized metacognition as operating at two levels: the objective level and the meta-level. The objective level carries out cognitive operations, whereas the meta-level controls activities that occur at the objective level. Terms also used in the literature to describe metacognition are: self-appraisal and self-management of cognition, metalearning, deutero-learning, and mindfulness. The number of definitions, terms, and analyses of what metacognition stands for has been the cause for some confusion in the literature.

In an attempt to clarify some of the obscurity covering what metacognition stands for, Flavell proposed a taxonomic categorization of the components of metacognition. In doing so, he distinguished between (a) metacognitive knowledge and (b) metacognitive experience. Metacognitive knowledge is that part of one's knowledge that refers to cognitive matters.

It comprises knowledge of person variables (knowledge concerning what human beings are like as cognitive organisms), task variables (referring to knowledge about how the specific information encountered affects and constrains the way in which one deals with it) and strategy variables (knowledge about cognitive strategies or procedures for achieving various goals). Metacognitive experience, by contrast, comprises conscious experiences that can be either cognitive or affective and are pertinent to an ongoing cognitive situation or endeavor.

The definition is extremely broad. In most cases, however, metacognition refers more narrowly to monitoring one's own cognitive processes and the influences on them while one focuses on a specific task. The monitoring process includes three parts:

- knowledge about oneself and others involved in the problem solving process,
- knowledge about problems, and
- metacognitive experiences which lead to the re-evaluation of strategies.

Some researchers have noted that the definition of metacognition overlooks the distinction between what are called executive one and executive two strategies. Executive one strategies refer to knowledge about the particular task, whereas executive two strategies refer to knowledge of whether a particular strategy is appropriate for being applied in a problem solving situation. An even more precise distinction can be made between on the one hand knowledge about one's own cognitive processes and when to apply them, and on the other, knowledge about knowledge and the validity of truth claims in general. A critical difference exists between knowing that a specific strategy is appropriate for solving a problem, and knowing that for some problems we can never determine the absolute truth or correctness of a solution. This second aspect

of metacognition relates to the meta level of monitoring and was given the name epistemic cognition. It is important in creative problem solving, where no single and correct solution exists, and where the criteria for evaluating a possible solution are limited. Creative problems are solved on three levels of cognitive processing. On the first level, individuals enter into problems by reading and perceiving them. On the second level, metacognitive processes are involved in monitoring the first level of cognition. These processes mainly include knowledge about problems, strategies that may be used to solve specific problems, knowledge of when and how a strategy should be applied, and the evaluation of these processes. The third level is epistemic cognition. It includes the individual's knowledge about the limits of knowing, the certainty of knowing and the criteria for knowing. It further includes the ability to identify and choose between the forms of solutions appropriate for different problem types. The ability to see the difference between problems which have only one correct solution, and problems which have no absolutely correct solution, but only better or worse ones, is an important developmental characteristic of the late adolescent and adult years.

A more operationalized classification of metacognition has been proposed by researchers involved in a psychometric approach in studying problem solving. These approaches distinguish between several metacomponents, such as selection of performance components for task solution, selection of one or more representations upon which these components are to act, selection of a strategy for combining the components, decision about whether to maintain a given strategy, selection of a speed-accuracy trade-off, and solution monitoring – the keeping track of progress being made toward a solution. Loosely speaking, metacomponents are responsible for figuring out how to do a particular task or set of tasks, and then making sure that the task or set of tasks is done correctly. Most of these metacomponents refer to level one and level two cognitive processes.

Metacognitive Research

Research on metacognition has its roots in two distinct areas of research: developmental psychology and cognitive psychology. Metacognitive research in the area of developmental psychology can be traced back to the theory proposed by Jean Piaget and Lev Vygotsky. However, metacognitive research in a pure form did not emerge until the 1970s, when Flavell and colleagues investigated children's knowledge of their own cognitions. They were interested in finding out if the improvement in children's memory abilities was a function of greater conscious understanding of the rules that govern memory and cognition. Thus, the studies trace the development of metacognitive thinking, that is, the ability to reflect on one's own cognitive processes.

In the area of cognitive psychology, work on metacognition was initiated by the investigation on feeling of knowing experiences (FOKs). First, people were given a recall test, of either newly learned information or general knowledge. For example, participants might have been asked, "What is the capital city of the Bahamas?" (Nassau). If the participant was unsuccessful at recall, the participant was asked to make a feeling-of-knowing

judgment, predicting the answer would be recognized in a multiple-choice format. Finally, the participant received the recognition test. It was shown that feeling-of-knowing judgments did indeed predict the likelihood of correct recognition for general knowledge materials, an observation replicated many times. However, in mainstream cognitive psychology, metacognition still lingered at the fringes. Indeed, at most conferences, metacognition researchers presented their papers in memory sessions not metacognition sessions. In the twenty-first century metacognition has emerged as an important subfield of cognitive psychology. Perhaps in part, the emergence of metacognition into the mainstream reflects the greater focus of cognitive psychologists on the experiential aspects of memory.

Research in metacognition has covered mainly three components: (a) knowledge about strategies (knowledge about when, where, and why different strategies should be used); (b) strategy use (the actual use of metacognitive strategies); and (c) cognitive monitoring (an acquisition procedure needed for evaluating and changing strategy use and for determining the limits of the knowledge). Among the conclusions reached by metacognitive research to date are that: (a) knowing about knowing develops; (b) both children and adults often fail to monitor cognitions; and (c) some strategies are difficult to learn and easy to abandon.

The fact that the link between metacognition and thinking skills, which encouraged application of the former to improve the latter has resulted in a number of researchers focusing on groups with learning difficulties. The view that metacognitive processes of self-monitoring and self-regulation are fundamental determinants of competent functioning in the real world has resulted in several research studies relating metacognitive dysfunction to schizophrenia.

Others, on the contrary, focused on the importance of metacognition for general aptitude and giftedness. Several researchers have reported significant differences in metacognitive strategy usage between intellectually gifted and average students.

Methods and Techniques Used in Analyzing Metacognition

The central problem related to metacognition research is its estimation in the individual's cognitive process while solving a problem or learning. This is a practical obstacle caused by the fact that metacognition is an inner awareness or process rather than an overt behavior, and because individuals themselves are often not aware of these processes. In employing interviews for educational purposes, for instance, there is difficulty in judging whether a pupil who takes some time before replying to a question is unsure and unconfident about his/her response, or whether that silent interval is a sign of one's effort to reflect back on his/her learning and retrieve the answer in a metacognitive manner.

The most frequently used approach is thinking aloud methodology, where the respondents are asked to verbalize their thoughts as they work on a problem. This method was used by many early investigators. It gained popularity in problem solving studies during the 1960s. Use of the method in

information processing research led to its utilization in many related areas of psychological research. The thinking aloud method requires no more than that the subjects during their thinking activity provide an account of what they are doing. The subjects thus report problem solving behaviors, rather than mental states. The latter being the characteristic of introspection and retrospection which require the subjects to analyze the composition of thought processes. The comparison of introspective and thinking aloud methodology revealed several characteristics being in favor of the thinking aloud methodology. The thinking aloud protocols are more complete and contain more information than the introspective protocols. A second characteristic is that the thinking aloud protocols are more present oriented, have a more elliptical form, and contain more indefinite referents.

Although there is evidence to suggest that the instruction to think aloud does not significantly alter the sequence of the cognitive process, the method has its limitations: verbal protocols include only the events and operations of which the subject is aware at the time; additionally, they are sensitive only to sequential operations. Another source of error could be the analysis of thinking aloud protocols with different taxonomies. No matter how carefully designed, the chosen scheme for both data collection and data analysis will not only influence what the investigator observes, but will to some degree determine the regularities and laws which might be identified. It seems that these methodological shortcomings affect above all research into metacognition. Metacognitive processes occur infrequently in thinking aloud protocols (about 1% of all statements can be identified as metacognitive).

Recently, a different method for investigating the individual's metacognitions during problem solving has been introduced. The technique requires the subjects to give judgments repeatedly about how close they feel to the solution of problems – called feeling-of-warmth (FOW) judgments – in the course of the problem solving. These judgments are called 'warmth' judgments, after the searching game in which one person hides an object and then directs others to where the object is by telling them that they are getting warmer – closer to the object, or colder – farther away. Subjects are asked to indicate how near they believe they are to the solution. The 'feeling of warmth' procedure was used to examine the subjective phenomenology of different problems. It could be shown that the patterns-of-warmth ratings differed for insight and non-insight problems. Non-insight problems showed a more incremental pattern in the course of their solving than did insight problems. The conclusion drawn from these findings was that insight problems were solved by some nonanalytic, sudden process, in contrast to an analytic process of reducing the difference between the initial and goal state, which characterized the solution of non-insight problems. Some researchers opposed this conclusion as being rather vague and speculative. The finding that subjects cannot predict their performance on insight problems does not logically necessitate that solutions to such problems occur as a sudden flash of illumination.

A similar technique for studying metacognition requires subjects to make assessments about the likelihood that they know the answer to a question, or will be able to solve a problem (feeling-of-knowing judgments – FKJ).

These judgments are based on episodic memory which, for its optimal function, requires a subsidiary monitoring and control system that assesses the familiarity of incoming events, and adjusts attention. Cognitive energy is assigned to events on the basis of novelty – devoting little energy to old and already well-known events, and much attention to novel events. It is assumed that the values of novelty assessed by such a monitoring-control system are feelings that are available to consciousness, and that they may be used for making feeling-of-knowing judgments. Many researchers have stressed the importance of such a judging system for creativity, especially for problem finding. Identifying differences between a schema and the environment is also important for the process of conceptualization.

In order to gain a deeper insight into metacognition, the tip-of-the-tongue states (TOTs refer to the experience of feeling certain that one knows a word, but being unable to retrieve it) were also studied. In the metacognitive view, TOTs are viewed as an imperfect monitor of ongoing cognitive processes. That is, TOTs are subjective experiences that allow rememberers to monitor and control their retrieval processes when lexical retrieval breaks down. However, as mentioned earlier, it is difficult to observe these processes, and defining them with FOW ratings and TOTs is a circular endeavor.

To overcome the mentioned methodological problems related to FOW, TOT, and thinking aloud methodology some researchers have suggested the use of moderating variables. Activation parameters like heart rate and blood pressure, electroencephalograms (EEG) and even functional magnetic resonance (fMRI) techniques were used. The typical reaction to mental work or active coping is tachycardia and a redistribution of blood flow from skin and viscera to skeletal muscles. In contrast, passive coping is associated with an unchanged or perhaps lowered cardiac output. The characteristic of EEG patterns in a relaxed mental state is a higher amplitude in the alpha band (regular 7–14 Hz wave pattern). Some speculations exist that the so-called late components in event related potentials (an ERP is a complex EEG wave form that is related in time to a specific sensory event), like the transient wave in the range of 200–300 ms, and even the slow wave that develops 500–1000 ms after stimulus onset, are related to an orienting response. This response has been described as the consequence of a comparison between a sequence of neural events representing the incoming stimulus and stored neuronal models of past events. The explanation is similar to the assumptions that are based on FKJ, which can be observed at the behavioral level. The fMRI is an imaging tool that measures the amount of blood traveling to various regions of the brain as a means of assessing the amount of neural activity in those areas. MRI produces a picture of any structure showing differences in tissue density. It is based on the principle that hydrogen atoms behave like spinning bar magnets in the presence of a magnetic field. When the magnetic field is turned off and a pulse of radiation is beamed across the atoms, they emit detectable radio waves that are characteristic of their density and their chemical environment. MRI can be used to assess changes in blood oxygenation, which is an fMRI. Some recent research data indicate that a network of brain areas is more activated in the insight solutions when compared with the search solutions during the initial moments of problem solving. Especially right prefrontal

activation, along with anterior cingulate activation, may be important for metacognitive components of insight solutions, including attention and monitoring of the solution. These are important first steps in the study of insight from which hopefully future research can build.

Metacognition and Problem Solving

Concepts such as executive control and monitoring are important for problem solving in order to manage problem complexity and to evaluate progress towards goals, yet not many empirical studies have been made on the influence of metacognition on problem solving, and they have also failed to give undivided support to the hypothesis.

Several lines of research are consistent with the notion that incompetent individuals lack the metacognitive skills necessary for accurate self-assessment. Work on the nature of expertise, for instance, has revealed that novices possess poorer metacognitive skills than do experts. In physics, novices are less accurate than experts in judging the difficulty of physics problems. Some of the strategic misfunctions of college students engaged in mathematical problem solving were described as failures of goal setting, monitoring, and the evaluation of plans, which is the essence of metacognitive proficiency. The majority of students so engaged embark on a course of action that can be described as: read a problem, pick a direction, and then work on it until you run out of time. Experts, by contrast, have metacognitive knowledge that leads them to ask themselves, and to answer, three kinds of questions:

- What (precisely) are you doing?
- What is the reason for doing it? and
- How will the result be used later in the solution?

In chess, novices are less calibrated than experts about how many times they need to see a given chessboard position before they are able to reproduce it correctly. In tennis, novices are less likely than experts to successfully gauge whether specific play attempts were successful. On the other hand, experts in physics, for instance, give fewer metacognitive statements than novices, the explanation being a more automatic process among the experts.

Because some controversy exists around the relation between metacognition and general ability, it has also been investigated whether high levels of metacognitive knowledge about problem solving could compensate for overall aptitude. There are three, mutually exclusive models for describing the relation between intellectual ability and metacognitive skillfulness. The first model regards metacognitive skillfulness as a manifestation of intellectual ability. In a second, contrasting model, intellectual ability and metacognitive skillfulness are regarded as entirely independent. Finally, according to the mixed model, metacognitive skillfulness is related to intellectual ability to a certain extent, but it also has a surplus value on top of intellectual ability. However, research has shown that highly metacognitive students outperformed less metacognitive students in problem-solving, regardless of their overall aptitude level. In fact, high-metacognitive/low aptitude children performed significantly better than low-metacognitive children with higher overall aptitude scores. This indicates that metacognitive

knowledge contributes to achievement above and beyond the contributions of knowledge and general ability.

Although the findings are mixed concerning the influence that metacognition has on problem solving, the results support the relevance of metacognitive theories for modeling intelligence and high-level reasoning. The careful monitoring of cognitive activities allows humans to control not only the search for a problem solution but also the search for an effective problem-solving strategy. The difference is that problem-focused attention of subjects improves local problem solving behavior, whereas metacognitive attention allows subjects to be flexible globally and thus have a greater chance of finding a more complex and effective problem solving strategy.

Metacognition and Giftedness

In recent decades research in the gifted literature has shifted from a focus on who the gifted are to how the gifted think. Studies have tried to relate metacognition and giftedness. The findings differ considerably. It was reported that students who were high achievers were better able to describe their learning strategies. On the other hand, no superior metacognitive knowledge in gifted grade four students could be found. It was concluded that gifted students might possess some metacognitive knowledge, but they would not necessarily utilize it appropriately.

The results of several experiments utilizing FOW rating have shown that able problem solvers differed in their FOW ratings when solving different problem types. These differences were less pronounced for average problem solvers. For low problem solvers no such differences were obtained. These findings suggest that able problem solvers have a higher ability to estimate their closeness to the solution and they use it to decide on the next steps in the cognitive activity.

A second characteristic of gifted individuals is their ability to better classify problems according to the way in which these problems are solved. Thus, able problem solvers, because of their higher abilities in monitoring their own cognitive processes, are more successful in classifying problems according to the solution approach than are poorer problem solvers.

That high performers have a greater knowledge about cognitive phenomena was shown also by the comparison between the classification explanations given by high and low performers. The explanations given by able problem solvers were more abstract, and reflected knowledge about the cognitive strategies which were involved in the solution process. By contrast, the explanations of poorer problem solvers were more oriented toward concrete features of the problems solved (e.g., the modality of the problem, whether the problem was difficult, etc.). Similar differences were reported for procedural knowledge among experts and novices in different domains. The procedural knowledge of novices appears to be clustered around concrete phenomena. In contrast, the procedural knowledge of experts is organized around higher-order principles.

Support for the above conclusions comes also from EEG research. Gifted individuals, while solving different tasks, used processes which displayed a similar complexity of neural mass activity, by contrast, average individuals displayed a greater

diversity in the complexity of neural mass activity. The differences were extremely pronounced over the right hemisphere. The problems used did not greatly differ. All of them could be classified as well-defined, having one correct solution. Hence, there was no need for the strategy change displayed by the average individuals. It seems, further, that average individuals involved brain areas irrelevant for good task performance. Average individuals displayed the greatest complexity of neural mass activity over the right frontal and central areas for arithmetic tasks, and lower complexity for the analogy tasks. From a theoretical viewpoint the arithmetic tasks are solved in a more stepwise manner, in contrast to analogy tasks which require a more holistic approach. Research findings indicated that the right hemisphere specializes in holistic perception, and is primarily a synthesist, dealing with information input. The speaking, left hemisphere, by contrast, seems to operate in a more logical, analytic, stepwise fashion. The pattern of EEG measure displayed by gifted individuals resembled this difference.

It can be concluded that metacognition is an important factor in problem solving performance. Able problem solvers have higher abilities of estimating their closeness to the solution and they use them for deciding on the next steps in the cognitive activity. Capable students know much more about general cognitive strategies – how and when to apply them – than do less capable individuals. Poor problem solvers are also less efficient in monitoring their own cognitive process during problem solving than are able problem solvers. Poor students not only do not realize that they did not understand, in fact, they more frequently think that they had understood. Poorer college students are the ones who complain that they really knew the material but that they failed the examination. This may indicate that students who do badly on tests are also poor at monitoring their comprehension and at predicting their future memory for material.

Metacognition, Epistemic Cognition, and Creativity

What metacognitive processes might distinguish creative from less creative individuals? To answer this question one must first understand the creative process. Probably one of the oldest models describes creative thinking in four stages – preparation, incubation, illumination, and verification. Preparation includes the whole process of intellectual education. During this stage individuals are laying the foundations of their later creative acts by acquiring the knowledge and skills of their field. In this preparation stage metacognition and epistemic cognition may have a central role. Epistemic cognition refers to the individual's knowledge about the limits of knowing, the certainty of knowing, and the criteria for knowing. Loosely speaking, individuals must know that some things can be known and others cannot, or that they can be known only probabilistically, and that one knows the answer to a question if it can be conclusively verified scientifically. Creative individuals must also know if their knowledge is full, rich and flexible enough to allow for creative restructurings. Furthermore, creative individuals must understand that problems do not always have one solution, that cognitive strategies are sometimes limited and even reasoning correctly about a problem does not necessarily

lead to an absolutely correct solution. Epistemic cognition is important for solving ill-structured problems which require creativity. If a subject is not aware of the above mentioned limitations, he or she will approach an ill-defined problem as if it were a puzzle. Average students approach creative problems in a similar way to that in which they solve the well-defined problems. By contrast, the thinking aloud protocols of gifted students reveal statements which indicate epistemic cognition. They evaluate creative problems as being one of the problems for which no absolutely correct solution exists, where the solution requires a lot of thinking which would not necessarily produce a correct solution, and where there are no firm criteria that could be used to verify the answer scientifically.

During the incubation stage the problem is not consciously pursued. Incubation is characterized by the free working of the unconscious and partly conscious processes of the mind. One can only speculate about the work done during this phase – apparently the knowledge acquired in the preparation phase is being restructured into new knowledge. Metacognition in the incubation stage is unconscious or not present at all. Attempts to guide and control creativity too early seemed doomed to failure as described in several biographies of artists and scientists. Recently support for this anecdotic description was found by a functional magnetic resonance imaging (fMRI) study examining the possible neurological underpinnings of the highly creative and spontaneous activity known as improvisation. It was found that when the musicians improvise, their brains turn off areas linked to self-censoring and inhibition, and turn on those that let self-expression flow. A large region of the brain involved in monitoring one's performance is shut down, while a small region involved in organizing self-initiated thoughts and behaviors is highly activated. It is suggested that this and several related patterns are likely to be key indicators of a brain that is engaged in highly creative thought.

Illumination is the final flush or click, it is the culmination of the incubation stage; it is inspiration, revelation, and insight; it is the Eureka and Aha experience in the creative process. What has been unconscious becomes fully conscious, and requires metacognition, one must know that the idea or product is a creative one, and decide upon the strategies to verify and evaluate the solution.

Can Metacognition Be Trained?

A second approach to study the importance of metacognition for creative problem solving is to study the trainability of meta-processes. In this way it is confirmed that these processes exist and that they are important for problem solving. Comparing training approaches aiming at different processes, like flexible knowledge, contextual knowledge, intuition and similar, has revealed that the greatest improvement in problem solving was achieved when students were instructed in the domain of metacognition. Numerous classroom studies have shown that explicitly teaching metacognitive strategies in the context of a specific domain (e.g., physics or mathematics) can improve learning outcomes. Strategies taught in these studies integrate metacognitive activities with cognitive and seek to make the steps of analyzing, planning, assessing, and reflection habitual

in the learner. Studies have also shown that learning is more effective when learners explain worked out solutions to themselves – known as the self-explanation effect. More recently, computer tutors focusing on teaching metacognitive skills have shown positive effects on learning behaviors.

The greatest improvements were observed when metacognitive instructions were aimed at the solution of well-defined problems, less effective were instructions which aimed at enhancing creative problem solving and analogical reasoning. This seems understandable, as much more is known about the domain of well-defined problems than is known about ill-defined problems.

Instructions used in metacognitive training usually aim at one or more of the following elements of metacognition:

- Knowledge about problems. Students are taught to distinguish among problem types. They are introduced to the main difficulties individuals are confronted with when solving a problem. Some suggestions are provided about how to avoid perceptual and response set, and how to increase the capacity of working memory by making chunks more abstract, or by changing the modality of representation of the problem statement.
- Knowledge about strategies. Students are introduced to strategies like modeling, subgoaling, working backward, making inferences, goal discovery, and analogies.
- Knowledge of when and how the strategies should be applied is provided.
- Knowledge aimed at monitoring one's own cognitive processes during problem solving. Self-regulation is a skill which is independent of subject-domains, that is, once a learner masters the skill, he can apply it across domains and even in domains where he has little prior background knowledge. So, the skill is important for improving a

learner's competence. Some learners develop the skill by themselves; but some learners do not. The former are intelligent novices who can plan how to solve a problem, apply their knowledge to authentic tasks, and monitor and regulate their problem solving process; the latter may have difficulty in learning, especially if it is difficult for them to apply their knowledge to authentic tasks, and to monitor and regulate their thinking process. So, it is necessary to help a learner develop his/her self-regulation skill to allow him/her to become an intelligent novice.

See also: Cognitive Style and Creativity; Giftedness and Creativity; Improvisation; Insight; Knowledge; Problem Finding; Problem Solving; Schizophrenia and Psychosis.

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Metaphors

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Glossary

Conceptual metaphor A mental mapping in which knowledge from one domain of experience (the target) is understood in terms of information from a different and usually more structured, domain.

Poetic metaphor A linguistic expression that instantiates in some creative novel manner, some metaphorical mapping between diverse domains of experience.

Speaking and understanding The psychological processes of designing utterances for particular

audiences and inferring what speakers intended to communicate.

Teaching creativity Facilitating people's engagement in thinking about topics in new ways, often through trying to metaphorically relate ideas from diverse domains of experience.

Verbal metaphor A linguistic expression that usually reflects some preexisting conceptual metaphor.

Metaphors for Creative Thought

Metaphor is apt to flourish when people talk about creativity. Consider how several authors describe their creative processes when writing fiction. For example, the novelist John Gardner once characterized his creative process of composing fiction in the following manner,

Sometimes what happens is that you poke your pick into a piece of respectable earth and silver shows up in an iron-ore vein and God knows where you're heading. You follow it and you have to review everything in the light of the silver. (Tomlinson, 2005: 54)

A different variation on this theme of writing as mining is seen in a statement from the novelist James Dickey about revision:

I work . . . on the principle of refining low-grade ore. I assume that the first fifty ways that I try it are going to be wrong. I do it by a process of elimination. No matter how backbreaking the shoveling is and running it through the sluices and whatever you have to do to refine low-grade ore. You have the dubious consolation that what you get out of it is just as much real gold as it would be if you were just going around picking up nuggets off the ground. It's just that it takes so damn much labor to get it. (Tomlinson, 2005: 55)

Not surprisingly, poets also reflect on their creativity in metaphorical ways. Consider the final verse of a poem titled 'Digging' by Seamus Heaney.

The cold smell of potato mould, the squelch and slop
Of soggy peat, the curt cuts on an edge
Through living root awaken in my head.
But I've no space to follow men like them.
Between my finger and my thumb
The squat pen rests.
I'll dig with it.

Heaney expresses the metaphorical idea that writing poetry is like digging, specifically like digging of turf and potatoes. We may understand several metaphoric thoughts about

creative writing from this excerpt, including creativity, like digging, is an activity that involves hard work; creativity, like digging, involves intense, concentration; creativity, like digging, is an activity with a long tradition within the community; and that creativity, like digging, requires a great deal of self-absorption.

Each of these statements and poetic examples use metaphor to describe the elusive nature of creative thought and action. Metaphor is traditionally defined as a rhetorical device in which a speaker or writer describes one domain of knowledge (the target) in terms of a different domain (the source), as in "Creative writing is mining for gold." Studies show that people employ metaphor thought processes, like this, in a wide variety of domains, including both scientific and everyday problem-solving domains. For example, scientists characterize electricity as a fluid, atoms as floating objects, or minds as machines which enhances their knowledge of, and sensitivity to, the metaphoricality of complex physical and biological phenomena, and become productive metaphors in generating new scientific research and thinking.

Creativity, more generally, is understood in terms of three central metaphors. First, *thinking is perceiving* (e.g., "I see what you mean") refers to how information is sensed, communicated and evaluated. Second, *thinking is moving* (e.g., "If I can get around this obstacle, we will reach the solution soon," "I was following what you were doing until you lost me at that point") describes the sequencing of mental actions, states, employed to arrive at certain goals. Third, *thinking is object manipulation* (e.g., "If we can just find this last piece, we will figure out it fits into the complete product") describes how we find and evaluate ideas and fit them together to form more cohesive wholes. Together, these three metaphors explain why creativity implies different things to different people, and why some approaches to creativity appear radically different from others, especially with people who are asked to describe their own creative processes. Yet this collection of metaphors shows how creative processes are not just the poetic language used to describe creativity, but may be fundamental to creative thought itself.

Conceptual Metaphors

Speaking metaphorically is not something that only great writers and scientists do, because metaphor pervades ordinary speech and writing. Many scholars now contend that the ubiquity of metaphor in language demonstrates the fundamental importance of metaphor in thought, called 'conceptual metaphors.' The primary source of evidence for conceptual metaphors comes from the systematic analysis of conventional expressions in different languages. Consider the following ways that English speakers sometimes talk about their romantic relationships.

"We're headed in opposite directions"

"We're spinning our wheels"

"Our relationship is at a crossroads"

"Our marriage was on the rocks"

Cognitive linguistic analyses argue that these individual expressions are not clichéd, expressing literal meaning, but reflect different aspects of the enduring conceptual metaphor *love relationship is a journey*. Each linguistic expression refers to a different entailment that arises from the mapping of familiar, often embodied, understanding of journeys onto the more abstract idea of a love relationship (e.g., difficulties in the relationship are conceived of as obstacles on the physical journey). Moreover, many individual concepts can be understood in terms of multiple, sometimes contradictory, conceptual metaphors. Thus, a love relationship can also be understood as a natural force as exhibited by the following conventional expressions.

"She swept me off my feet"

"Waves of passion overcame him"

"We were engulfed by love"

"She was deeply immersed in love"

People's ability to think of abstract ideas and experiences in alternative, metaphorical ways suggests more reasons why there may be different creative approaches to many of life's problems.

Part of the foundation for metaphoric thought and language is seen in 'primary metaphors' which refers to metaphorical mappings arising from positive correlations in people's bodily experience. Consider some of these and the linguistic expressions that reflect these primary metaphors.

important is big (e.g., "Tomorrow is a big day")

more is up (e.g., "Prices are high")

similarity is closeness (e.g., "Those colors aren't the same, but they're close")

organization is physical structure (e.g., "How do theories fit together?")

change is motion (e.g., "My health has gone from bad to worse")

purposes are destinations (e.g., "He'll be successful, but isn't there yet")

causes are physical forces (e.g., "They pushed the bill through Congress")

understanding is grasping (e.g., "I've never been able to grasp complex math")

Note how in each case, the target domain (e.g., things that are important) is typically closely associated, or correlated, in people's experience of the source domain (e.g., things that are big).

Different sets of primary metaphors underlie different conceptual metaphors. For example, the conceptual metaphor *theories are buildings* (e.g., "The theory lacks a good foundation" and "The theory collapsed") is motivated by two underlying primary metaphors, *persistence is remaining erect* and *organization is structure*.

In general, conceptual metaphors have embodied foundations, with these metaphors forming a vast number of people's conceptions of abstract ideas from numerous, diverse domains (e.g., time, causation, spatial orientation, political and mathematical ideas, emotions, the self, concepts about cognition, morality), which are found across languages and cultures. Embodied metaphor also provides the grounding for novel, poetic metaphors. For example, Turkish, similar to many other languages, conceives of life as movement along a path where birth is conceptualized as arrival, life is a journey initiated by the arrival, and death is the departure that ends the journey. Life is broadly conceptualized as a region bounded by two doors, one leading to life and the other to death, which gives rise to the following conceptual mappings:

Source domain	Target domain
Space bound by the two doors	Life
Being within the confines of a bounded space	Being alive
Physical threshold for change of location (e.g., doorway)	Threshold for change of state
Crossing a physical threshold into a space between two doors	Being born
Crossing a physical boundary to exit a space between two doors	Dying
A moving entity	Human body

The conceptual metaphor *life is a journey* is comprised of this system of relationships where a source domain (people's experiences of journeys) is used to better understand some aspects of a dissimilar target domain (life). Creative linguistic instantiations of some of these mappings can be seen in the following excerpts from two Turkish poems (Ozcaliskan, 2003: 285 and 286):

"Dunyaya ilk geldigim anda
Yurudum ayn zamanda
Iki kapt /t bir handa
Gidiyorum gunduz gece"
("The first moment I came into the world
I walked at the same time
In a caravanserai with two doors
I am going day and night")

"Otesi yok sehre ulasunca kaderin yolu
Pisman bir el kapayacak kapisun omrunun"
("When the road of fate reaches the city of no beyond
A regretful hand will close the door of your life")

Creative poets may have special abilities to craft metaphorical messages in spectacular ways but many of their poetic creations are grounded in widespread conventional metaphors that have roots in enduring aspects of bodily experience, ones that are perhaps universal.

Understanding Metaphorical Language

The empirical demonstration that metaphor pervades both ordinary and creative speech and writing is at odds with the

traditional view of metaphor as a deviant form of language or thought. Going back to the ancient Greeks, many scholars have assumed that literal language best reflects ordinary, rational thoughts, and that people must recognize the deviant nature of metaphorical utterances before determining their figurative meanings. For example, consider one instance of extended creative metaphor use, this time in the context of a newspaper article discussing the State of California's budget crisis in 2009 ('San Francisco Chronicle' June 1, 2009: B6):

Forget the idea of the budget ax chopping away at the deadwood of Sacramento (i.e., the State's capital where the Governor and legislature work and govern) – the next couple of weeks are going to be more like a raging forest fire, as programs and workers' wages go up in fiscal flames. . . . State worker unions and the disabled were out in force Thursday, clogging the Capitol and lobbying lawmakers in the hopes of blocking Gov. Arnold Schwarzenegger from striking the match.

How do people interpret the metaphorical meaning of utterances like "Forget the idea of the budget ax chopping away at the deadwood of Sacramento?" On the surface, this expression make no literal sense and one may suppose that readers have to recognize this literal incongruity before going forward and interpreting the intended, figurative meaning. This explanation, which echoes the traditional view of metaphor as deviant language, suggests that metaphorical language should always be more difficult to interpret than roughly equivalent literal speech.

But the results of many psycholinguistic experiments have shown this idea to be false. These studies investigated the amount of time it took people to read and interpret literal or metaphorical expressions in appropriate discourse contexts. Listeners/readers can often understand the figurative interpretations of not only metaphor, including novel metaphorical expressions, but also irony/sarcasm, idioms, proverbs, and indirect speech acts, without having to first analyze and then reject their literal meanings when these are seen in realistic social contexts. People can read metaphorical utterances as quickly as literal uses of the same expressions in different contexts or equivalent nonmetaphorical expressions. Even without a defective literal meaning to trigger a search for alternative figurative meanings, metaphors (e.g., "Surgeons are butchers" to take one famous example), can be automatically interpreted. Of course, people, such as literary critics, can slowly ponder the potential meanings of a creative metaphor, and speculate on which metaphorical meanings are most appropriate and perhaps author intended. But this more deliberate reading of metaphors should not be mistaken as demonstrating that metaphors always demand extra cognitive work to be readily understood.

Part of the reason why metaphors, even creative ones, are often easy to understand is because people appear to mentally simulate the actions described in metaphorical sentences, even when these actions are physically impossible to perform. For example, people's mental imagery for metaphorical phrases, such as "tear apart the argument," exhibit significant embodied qualities of the actions referred to by these phrases (e.g., people conceive of the 'argument' as a physical object that when torn apart no longer persists). Similarly, people's speeded comprehension of metaphorical phrases like "grasp the concept" are facilitated when they first make, or imagine making, in this

case, a grasping movement. Real and imaginative bodily processes appear to enhance the construction of simulation activities to speed up metaphor processing, an idea that is completely contrary to the traditional notion that bodily processes and physical meanings are to be ignored or rejected in understanding verbal metaphors.

Experimental findings like these emphasize that people may be creating partial, but not necessarily complete, embodied simulations of speakers' metaphorical messages that involve moment-by-moment "what must it be like" processes, such as grasping, that make use of ongoing tactile-kinesthetic experiences. One implication of this research is that people do not just access passively encoded conceptual metaphors from long-term memory during online metaphor understanding, but simulate what these actions may be like to create detailed understandings of speakers' metaphorical messages. Embodied simulations may be part of many higher-level creative activities such as problem-solving, decision-making, and novel language use.

Constraints on Metaphorical Creativity

Is metaphoric creativity unlimited or does it emerge from certain personal (including bodily) and cultural constraints? The study of metaphoric variation offers some challenges to prominent theories of creative metaphoric use. Consider the following examples of newspaper headlines used to talk about the outcome of sporting events, in this case, American college football games: "Cougars drown Beavers," "Cowboys corral Buffaloes," "Clemson cooks Rice," and "Army torpedoes Navy" (Kovecses, 2009). The nicknames of the college teams (e.g., 'Cougars' are the mascot for Washington State University, 'Beavers' are the mascot for Oregon State University, 'Buffaloes' the mascot for University of Colorado, etc.) are paired with verbs that metaphorically refer to defeat. Thus, beavers live in water and can be defeated when drowned, cowboys corral cattle, and therefore would defeat an opponent like buffaloes by corralling them, rice is considered 'done' or defeated when cooked, and a Navy ship is defeated when torpedoed. Clever headline writers take advantage of people's ability to know what literal actions can be metaphorically used to refer to the idea of defeating, and do so in humorous ways, inviting readers to chuckle at the puns.

These sports headlines illustrate how people's knowledge of, and personal experiences with, different concrete and abstract concepts is put to work in the process of creating new metaphorical ways of speaking. Creating new metaphors is shaped by two processes: people's differential experiences in the world, and people's differential access to certain cognitive processes. For example, people pay attention to their bodies differently depending on the physical environment and the social context. The immediate situation in which communicative action takes place is a more exact constraint that people take into account as they aim to be coherent in what they say. Consider the following newspaper headline from 'The Wall Street Journal Europe' (2003): "The Americanization of Japan's car industry shifts into higher gear." Why does this expression make sense and, again, seem particularly apt when talking about Japan's auto industry? The headline reflects the common conceptual metaphors that *progress is motion forward*, such that

in this context, we readily infer that Japan's car industry is making good progress, or is advancing. But we draw this inference from understanding the link between Japan's car industry and the idea that the forward movement of a car is accomplished through the shift into higher gears. Even though Japan's car industry is an abstract entity that physically cannot move forward, we can understand it as a metaphorical object that can move, and when it does so by shifting into higher gear, like the cars made by the industry, the expression seems coherent and apt.

The physical environment also shapes people's differential experience of their bodies and the world around them, and this too influences the creation of metaphors in talking about abstract ideas. For example, consider some metaphoric expressions used in talk about the economy like "healthy economy," "economic recovery," "sickly firm," "a financial injection," "arthritic economy," and so on. These expressions may arise from people's experiences of their bodies in particular environments in the form of the *economy is health* metaphor. One possibility is that people use more health metaphors in talking about the economy during times of the year when they were more likely to be ill, such as when experiencing common ailments of colds, the flu, pneumonia, and bronchitis. In fact, one 10-year analysis of *The Economist* showed that the use of health metaphors in talking about the economy was far more evident during the winter months of December to March, which is when people most often experience illness, compared to any other time period. Once again, the physical setting in which talk occurs, and what is most salient to people's bodily experience in those contexts, shapes the selection of metaphorical source domains when creatively describing abstract target domains such as the economy.

Another aspect of bodily constraints on metaphoric creativity is seen as an examination of synesthetic metaphors. These poetic metaphors are especially vivid because they express cross-sensory mappings that are constrained by a cognitive principle whereby mappings go from lower sensory modes to higher ones (e.g., touch > taste > smell > sound > sight). One analysis of synesthetic metaphors showed several instances of these preferred patterns in the work of the Chinese writer Mo Yan. For example, the following expression demonstrates the synesthetic transfer from touch (i.e., the source domain) to smell (i.e., the target domain): "The house was full of bubbling hot stench, like a dead chicken or duck being scaled by boiling water." This sentence conveys the idea of a horrible smell being something that is 'hot' to the touch. Another metaphor expresses a synesthetic mapping from touch to sound, "... the music was light and bright, exquisite and emotive, stroking people's faces, like a gentle breeze in warm and flowery March." The word 'music' referring to sound is understood in terms of an extended simile of a 'breeze' that can be felt, as if 'stroking faces.' A different sentence illustrates a touch to sight (color) synesthetic transfer: "For a minute it was murky in the house and then a damp, light yellow sunlight squeezed itself inside through the crack of the door." This statement evokes an image of the 'light yellow sunlight' as something that can be felt as 'damp,' creating 'a mixed sensation amid the seemingly semantic conflict between' touch and color (Yu, 2007: 25). Finally, consider an instance of a sound to sight mapping: "The sound of the water coming from the river was getting

brighter and brighter, as if it had shape as well as color, and not only audible, but also visible." In this case, we understand the sound in visual terms, something the writer explicitly notes, which is perhaps the most common type of synesthetic metaphor.

These examples of poetic metaphor beautifully articulate how systematic patterns of cross-sensory mappings have great aesthetic appeal, which is surely one of the important rhetorical functions of some metaphors, especially when seen in literary contexts. Moreover, this examination of synesthetic metaphors demonstrates how the vividness of some creative metaphors is not purely visual, static, or 'mental,' because many vivid metaphors involves knowledge from many modalities, as well as kinesthetic experiences more generally. Furthermore, this study of synesthetic metaphors shows how bodily experience, and the relative prominence of different sensory modalities in our experience, constrains the creation of specific literary metaphors.

This analysis of creative metaphors also suggests that many metaphors arise not from source-to-target domain parallelism, but from extensive, contextually-driven source domain inferences that are both local and personal. Consider the following excerpt from the Nick Hornsby novel *'High fidelity'* (1995: 12).

I tried not to run down Phil too much – I felt bad enough as it was what with screwing his girlfriend and all. But it became unavoidable because when Jackie expressed doubts about him, I had to nurture those doubts as if they were tiny, sickly kittens, until eventually they became sturdy, healthy grievances with their own cat-flaps which allowed them to wander in and out of our conversation at will.

How do we understand the creative use of metaphor in this example, where 'grievances' were first conceived of as 'sickly kittens,' and soon became 'healthy' with their 'own cat-flaps'? Consider the case of 'cat-flaps,' which generally conveys the idea that the grievances about the boyfriend could freely enter the conversation as a kitten may enter and leave a house at will through the cat-flap. There does not seem to be a single source-to-target domain mapping between cat-flaps and the idea of freely talking about the boyfriend's problems. Instead, cat-flaps contribute to the further development of the source domain of grievances as kittens, or cat-like, and provides a richer scenario for thinking about the grievances as kittens, with their own free will.

Even if people initially attempt to establish clear source-to-target domain mappings for interpreting creative metaphors, people may fail to draw these inferences, and still extract additional information from the source domain (i.e., all things related to kittens and their behaviors) to create contextually relevant interpretations of the metaphors. But more importantly, the ubiquity of nonparallelism in metaphor, both conventional and novel, also suggests that understanding metaphoric language is not a matter of finding some independent meaning for each and every bit of target domain meaning. Whenever a metaphoric view of some topic is provided, as in the Hornsby passage, only some of the word choices may have direct relations to the target domain, with others acting to fill out, often in creative ways, our understanding of the source domain.

Context opportunistically selects which aspect of a source-domain scenario ends up being mapped or transferred to the target domain, and thereby when metaphorical sentence or parts of sentences end up with target-domain meanings of their own, leaving other related metaphorical chunks merely to contribute toward building the source scenario. (Barnden, 2009: 92–93)

Much of the creativity in metaphoric language arises from turning familiar, established metaphoric ideas and expressions and twisting them to create something new, but with an echo to the past. For example, the metaphorical proverb “Different strokes for different folks” originated in the 1950s reflects the cultural ideal of people’s need for mutual acceptance. Creative forms of this proverb over the years include “Different spokes for different folks” (from a book on bicycles), “Different smokes for different folks” (from a cartoon showing a picture of a businessman smoking a cigar and a hippie smoking a marijuana cigarette), “Different slopes for different folks” (from an Air Canada ad promoting ski vacations in Canada), and “Different Volks for different folks” (from a Volkswagon ad highlighting that it sells cars other than the Beetle). In each case, people appear to recognize the allusion to the original proverb, and find humor in the slight twist on that old piece of wisdom so blatantly being used for entertainment, commercial purposes.

Literary authors have also created novel versions of familiar proverbs to represent unusual (e.g., ironic, satirical, absurdist) perspectives on life’s enduring themes. Consider the following examples for the literary text ‘Proverbs from Purgatory’ (Schwartz, 2002; itself an allusion to Blake’s ‘Proverbs from Hell’):

A bird in the hand makes waste.
It’s like killing one bird with two stones.
Two heads are better than none.
A friend in need is worth two in the bush.
A stitch in time is only skin deep.
Too many cooks spoil the child.
I’ll have him eating out of my lap.
Let’s burn that bridge when we get to it.
A friend in need opens a can of worms.
Don’t cross your chickens before they hatch.
He’s just a chip of the old tooth

These twisted proverbs blend together parts of familiar metaphorical expressions to creatively convey new insights on old ‘pearls of wisdom.’ Each phrase expresses a satirical view, or the dark side, of common metaphorical themes that play such an important role in shaping people’s beliefs and actions. Thus, “A stitch in time is only skin deep” provides a rather profound alternative view of the worthy reminder that “A stitch in time saves nine” (i.e., even our most conservative actions taken to protect us from future harm may not guarantee that we always remain safe).

One important proposal suggests a metaphor, and all other forms of figurative language, may be ‘optimally innovative’ or optimally creative if it provokes a novel response, that:

differs not only quantitatively but primarily qualitatively from the salient response(s) associated with the stimulus and, at the same time, allow for the automatic recoverability of a salient response related to that stimulus so that both responses make sense (i.e., the similarity and difference between them can be accessible. (Giora, 2002: 180)

For example, the phrase “a peace of paper,” referring to a peace proposal, is seen as more being optimally innovative because it automatically generates a salient meaning (i.e., ‘a piece of paper’) that can be compared in some accessible manner to the novel meaning (e.g., both ‘peace’ and ‘piece’ are pronounced the same). Studies show that people find phrases like “a peace of paper” more pleasurable than familiar phrases (e.g., “a piece of paper”), variant phrases (e.g., “a single piece of paper”), and pure innovations (e.g., “a pill of pepper”). Similarly, novel metaphors (e.g., “a geometrical abstract painting” referring to one’s eyes), whose intended meanings differed significantly from their salient interpretations, are more pleasing than literal interpretations of these phrases, while novel metaphors are more pleasing than more familiar metaphors (e.g., “big eyes” referring to having a big appetite). In the end, highly novel and creative language will be less attractive, and less appreciated, than are optimally innovative metaphors that are creative extensions which allow for the recovery of the familiar.

Enhancing Creativity Through Metaphor

We enjoy the creative products of writers who twist and turn metaphors for new purposes. But these talents can also be taught. Art critics, for example, often use metaphor extensively in their writings, and some art educators have explicitly trained students to use metaphorical language to enhance their critical interpretation and appreciations of artworks. For instance, one project asked a group of students to write about small sections of Willem De Kooning’s famous 1952–1956 painting ‘Woman 1,’ by imagining themselves as colors going from the bottle or tube to the surface of the canvas. Some of their descriptions include (Rentz, 2003: 11):

I emerge from beneath, glowing through thin layers as a beacon of burning luminous, burning, light.

My life was safe, nice, safely contained within a glass jar. I could see and enjoy life. I could watch creation and think about concepts. My colour kept me warm and sensuous – the lid is off – the palate descends. Pain – anguish. I’m splattered over the surface, scrubbed, pushed, rubbed out. I feel thin, less than myself. Now I’m being overlaid – red and black are added to me?

I am the red oil paint squeezed from the tube. I have been tinted, scrambled, scrubbed, and dragged sometimes unwillingly and other times with an abandon, that just pushed other colours into submission. I become a bra strap, rouge roughly smudged onto a gaudy face, a tart, a mother’s womb, and a tinted pink pair of socks. I feel used like my subject.

These metaphorical understandings of DeKooning’s painting demonstrate how much of people’s appreciation of artworks is tied to the imaginative projection of themselves into the elements of artworks. There is very likely a symbiosis between how artists, of all kinds, create artifacts by thinking of themselves as the paint, music, clay moving toward more abstract artistic ideals, and audiences’ understanding of artworks imagining themselves, through embodied simulation, as part of the elements and actions perceived in artworks.

Indeed, the claim that people can creatively use metaphor to discover and express important ideas is increasingly seen in educational studies of students’ leaning of complex math and physics concepts through different embodied activities that bear

both concrete and metaphoric relations to the concepts being acquired. Studies of scientists' metaphoric gestures (e.g., mathematicians using their clenched fists to represent different 'sets') is consistent with the idea that embodied action is critical to the learning and continued development of abstract ideas that are often fundamentally structured in terms of embodied conceptual metaphors (e.g., *arithmetic is motion*, as is "Count up to 20 without skipping any numbers").

Finally, marketing scholars have explored several methods for engaging people's creative metaphorical understandings of consumer products to enable small firms, not-for-profits, and social enterprises solve a wide number of marketing and advertising problems. For example, the 'Zaltman Metaphor Elicitation Technique' (ZMET) is a qualitative methodology that uses in-depth interviews to probe people's thoughts and impressions of advertising. Informants are asked to bring images, in this case of advertising, that interests them, and to describe how each picture related to his or her impression of advertising (i.e., story telling). Later on, informants described their impressions of advertising using the different senses of sight, sound, touch, smell, taste, as well as emotional feelings that arose from these impressions. Informants then imagined a short movie that described their thoughts and feelings about advertising. Finally, the informants created a composite of their thoughts and feelings about advertising. This was done by first having informants select specific images from the various pictures that they wanted to include in the summary image. A graphic artist then scanned these images into a computer, and worked collaboratively with the informant to create a summary image.

The purpose of this procedure is to increase the likelihood of uncovering important facets of people's unconscious understandings of certain advertisements. Following data collection, all of the verbal protocols were analyzed to determine the metaphors that structured people's knowledge and impressions of advertising. First, researchers search through the protocols for instances of metaphoric words, phrases, and expressions. Next, these verbal metaphors were compiled and analyzed to identify a set of thematic categories that indicated something about people's overall impressions of advertising. The next step linked the thematic categories to specific conceptual metaphors. Finally, a smaller set of deep metaphors were identified that represented a higher-level of abstraction from conceptual metaphors.

This analysis revealed that there were three deep metaphors (resource, force, and the essence) that structured people's broad interpretations of advertising. Under these three deep metaphors were several groups of specific conceptual metaphors. The deep metaphor of resource, for example, was organized in terms of five conceptual metaphors: advertising as hostess, teacher, counselor, enabler, and magician. For instance, the hostess metaphor is associated with the thematic category of advertising serving to introduce how products and services have different benefits and values, as seen in one informant's comment in reference to an ad for motor oil, "in an ad I read that need certain oil in the summer and certain oil in the winter. I feel good . . . knowing that I am going to using the right product at the right time." Advertising as a counselor goes beyond the hostess metaphor to suggest emotional and cognitive benefits with a product or service, as seen

in the comment "advertising helps me to know which products will and will not reflect the sort of person I am." The magician metaphor describes advertising's ability to make people think differently, beyond the ad content, as seen in the comment that ads "stimulate your imagination" or "suggests avenues, opens doors of thought," or "evokes memories of happy things."

The deep metaphor of advertising as a force refers to advertising's powerful presence in contemporary culture, with conceptual metaphors (i.e., omnipresent being, a noisy neighbor, a broken record, a con-man, and seducer) mostly expressing negative views about advertising. For instance, informants commented that ads are things "you just can't away from" (omnipresent being), or are like "a horse sticking his nose through the fence" (nosy neighbor), that "are on again, and again, and again . . . pretty soon you tend to tune out" (broken record), or can "set a trap for me" to "get you to do what they want" (con-man), and "encourage me to buy things that I do not need" (seducer).

The final deep metaphor evident in this analysis was of advertising as an essence, providing idealized images of people and products. The main conceptual metaphor at work here is advertising is an evil therapist, as seen in the comment that ads "create within the individual feelings of anxiety, need, longing, desire, hunger, loss, helplessness, and anger that can only be relieved through the consumption of the product or service" being offered.

In general, ZMET elicited a wide range of metaphors, suggesting how people's understandings of ads are deeply organized around different patterns of metaphorical thought. The beauty of the technique is that it systematically prompts people to creatively think and say more about what they conceptualize of particular knowledge in metaphorical ways.

See also: Poetry; Writing and Creativity.

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Michelangelo 1475–1564

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Glossary

Fresco A painting technique in which pigment is applied to wet plaster, which reacts with the pigment to seal it and prevent it from flaking off. Fresco compositions were planned in advance with the use of detailed full-scale charcoal drawings, whose main outlines were pricked and transferred to the wet plaster. Once the plaster was applied, rapid execution was essential. Artists had to reliably assess how much they could paint in a single session and constantly sprinkle water on the unpainted plaster to keep it damp and receptive to the pigment. Since most frescoes are architecturally situated, they often demand compensation for unusual vantage points and far viewing distances – complications that are absent from easel painting. Michelangelo's frescoes on the Sistine Chapel *Ceiling* and the *Last Judgment* on the Chapel's altar wall are widely regarded as the high point of this medium.

Humanism A worldview or perspective that attaches importance to human dignity, concerns, and capabilities, particularly emphasizing rationality. Humanism contrasts with the supernatural or appeals to authority and was a major stimulus to the Italian Renaissance. By Michelangelo's time, humanist scholars were honored as major intellectual figures. The tension between the humanistic reverence of

pagan antiquity and Catholic religious orthodoxy was a major factor in Michelangelo's character and art.

Nonfinito An Italian word meaning 'unfinished.' In the literature on Michelangelo, this term is used to denote the rough-hewn appearance of many of his sculptures. Sometimes this quality derives from Michelangelo having been prevented from working further due to circumstances; otherwise, scholars are divided as to whether the *nonfinito* quality represents deliberate satisfaction or unresolvable dissatisfaction with a work.

Ontogenetic heterochrony An embryological term describing how large differences in the morphology of organisms can arise from small changes in the timing of developmental events. Artistic novelty can emerge from a similar mechanism, by which traditional methods for art-making are modified. Many artists have used heterochronies as part of their creative process, with Michelangelo among the earliest and most effective exponents.

Pietà An artistic motif in which Mary, the mother of Jesus, holds the dead body of Christ. Michelangelo made at least three life-size marble Pietàs, including his last two sculptures. His earliest rendition, completed at age 25 for the Vatican, remains the most famous Pietà, a unique fusion of Gothic and Classical sensibilities.

Introduction

Michelangelo Buonarroti (6 March 1475 – 18 February 1564) was an enormously productive and influential Italian sculptor, painter, architect, and poet, and one of the supreme creative personalities of all time. His career and temperament have strongly influenced Western popular and scientific conceptions of genius (and religious conceptions of divinity), and he is widely regarded as the single greatest figure in all of Western art. The subject of numerous biographies and critical studies, even in his own lifetime, Michelangelo informs the study of creativity in many ways, but perhaps mainly in understanding the nature of the creative process.

This article is divided into two main sections. The first outlines Michelangelo's life, career, and works. His continual productivity and the sheer scale of his achievements necessitate emphasizing only certain themes (his most important works, the technical demands of his media, and his exploration of the creative process), while downplaying others (e.g., his politics, sexual orientation, possible psychopathology, personal relationships, etc.). The second section addresses how Michelangelo informs the study of creativity, with a special focus on understanding his creative processes and more general implications for process models of creativity.

Life, Career, and Works

Michelangelo's Early Life and Works in Florence

On 6 March 1475, Michelangelo Buonarroti was born in the Apennine village of Caprese. His father, a proud but impoverished aristocrat, governed Caprese for the city of Florence, to which the family relocated less than a month after Michelangelo's birth. He grew up in Florence and showed an early and intense desire to become an artist, despite his family's aristocratic aversion to manual labor – which, at the time, absolutely included painting and sculpting.

In the late fifteenth century, Florence was probably the single best city in Europe for an aspiring artist to launch a career. It was a political and economic powerhouse; it had a first-rate cultural and literary tradition, being the birthplace of Dante and Boccaccio; it also boasted much of the best painting, sculpture, and architecture anywhere. A very short list would include: several major fresco cycles by Giotto and Masaccio (arguably the two most important European painters of the previous 200 years); frescoes and panel paintings by a host of other great artists, including the young Leonardo da Vinci; Ghiberti's relief sculptures on the North and East sets of Baptistery doors (Michelangelo dubbed the East doors the 'Gates of Paradise'); many of the finest statues by Donatello (probably Michelangelo's greatest sculptural predecessor); and

the famous dome atop Santa Maria di Fiore, the largest since antiquity, designed, like many of Florence's finest buildings, by Filippo Brunelleschi. Brunelleschi also shared in the invention of linear perspective with Leonbattista Alberti. Michelangelo grew up surrounded by these works, and these manifestations of genius would all play substantial roles in his career.

Perhaps even more astonishing than this sheer cultural density is the fact that, except for Giotto's frescoes, all of these revolutionary artistic masterworks had been created within one lifetime of Michelangelo's birth. They represented the first major wave of what we now call the Renaissance, which was in full swing by the late 1400s. By then, painters, sculptors, and architects had solved many of the major problems of realistic depiction – for instance, lifelike proportions of figures, shading techniques to give the illusion of three-dimensional form, and a consistent perspective space. Other depictive problems – such as a complete mastery of the details of human anatomy, convincing emotional expressions of the face and body, and transient natural and atmospheric phenomena – had been partially worked out. Such progress was made possible by many factors: a rediscovery of ancient knowledge, an influx of wealth from Florence's commercial hegemony, strong civic pride that deliberately sought to create lasting monuments to greatness, the emergence of humanism, and, more pragmatically, the development of a strong craft tradition in the arts. In this tradition, artistic knowledge was actively sought and promulgated through an apprenticeship system, in an effort to surpass the achievements of earlier generations.

In 1488, aged 13, Michelangelo became a part of that system when he prevailed upon his father and uncle (his mother had died seven years earlier) to let him be apprenticed to Domenico del Ghirlandaio, a leading Florentine painter. Unusually, Michelangelo drew a salary rather than having to pay for his indenture, suggesting he had already attained considerable skill – not surprising, in light of what followed. At this time, Michelangelo explored various artistic media, showing his technical versatility and hinting at his future greatness. Ghirlandaio introduced Michelangelo to fresco, probably the single most demanding painting medium; several figures in Ghirlandaio's frescoes in the Cappella Maggiore of the Church of Santa Maria Novella are traditionally ascribed to Michelangelo. His early pen-and-ink copies of works by Giotto and Masaccio have a naturalness and sense of three-dimensional form exceeding even these great predecessors. Also recently attributed to the 13-year-old Michelangelo is a tempera and oil painting copy of an engraving of *The Torment of St. Anthony* by Martin Schongauer, which, if authentic, reveals yet another potential stylistic direction.

Sculpting in marble soon became his greatest passion; indeed, despite his wide-ranging achievements, Michelangelo always considered himself foremost a sculptor – in his view, the loftiest type of art. After only a year in Ghirlandaio's painting workshop, Michelangelo had the opportunity to study in an art school in the house of Lorenzo de' Medici ('Il Magnifico'), the richest man in Florence and its virtual ruler. Presumably Michelangelo had already modeled forms in clay; in the Medici gardens, he had access to ancient marble sculptures and studied with Bertoldo di Giovanni, who had in his youth assisted the elderly Donatello. Legend credits the young Michelangelo with

a faun's head in marble that caught Lorenzo's attention, earning him a place among the superstar humanist scholars in Lorenzo's court. Exposure to Neo-Platonic ideas is supposed to have influenced the content of Michelangelo's art; certainly they provided a set of mental concepts which would have been unusual in an artist of that time and likely contributed to Michelangelo's sense of the intellectual potential of art-making. He stayed in Lorenzo's household for several years.

In that time, Michelangelo created his earliest two extant marble sculptures. The first, *The Madonna of the Stairs*, is a shallow relief in which the back and arm of the infant Jesus already show the developed musculature of his later style. This anatomical emphasis is developed dramatically in *The Battle of the Centaurs*, a deep relief with numerous active figures. This work of the 17-year-old Michelangelo has been characterized as perhaps the most advanced figural composition of the Renaissance up to that time; it far surpasses any model he would have had in the Medici gardens. Besides anatomical concerns, both works show a variety of textures and finish, likewise characteristics of his later style. Michelangelo's formidable personality also became obvious in this time; in the Brancacci Chapel, amidst Masaccio's greatest frescoes, he criticized drawings by his fellow student Pietro Torrigiani so bitterly that Torrigiani punched him in the face, breaking his nose and permanently disfiguring him.

Lorenzo died on 9 April 1492, aged 43, and was succeeded by his incompetent son Piero, whose only commission for Michelangelo was for a statue in snow. Michelangelo returned to his father's house for a time. Lorenzo's death coincided with the rise of the charismatic Dominican preacher Girolamo Savonarola, whose fire-and-brimstone sermons on the vanity of worldly wealth made him enormously influential. After the French invaded Florence in 1494, ousting the Medici, Savonarola emerged as virtual dictator of the city, until public opinion turned; he was burnt at the stake on 23 May 1498. Despite his Medici connections, Michelangelo had considerable sympathy for Savonarola's message, attentively reading his writings and listening to his sermons. The tension between the ultra-humanistic and the ultra-religious was a constant throughout Michelangelo's life and informed the intense emotionality and iconographic richness of his works. The same tension is evident in Michelangelo's anatomical explorations around this time; reportedly he carved a wooden *Crucifix* in exchange for permission to dissect corpses in the Hospital of Santo Spirito – a practice strongly discouraged by the Church.

Michelangelo in His Twenties: Early Major Works in Rome and Florence

Given the volatility of Florentine politics, Michelangelo traveled for much of this period: to Venice in 1494, Bologna in 1494–95, and most decisively to Rome in 1496. There he executed his first life-size figure, a very pagan standing *Bacchus* (1496–97). In 1498, he accepted a French cardinal's commission for a large marble *Pietà* for the Vatican, promising that it would be the most beautiful work in marble in all of Rome – and delivering on that promise in 1500. In this work, Michelangelo demonstrated unprecedented technical mastery on several criteria: anatomical detail, emotional expressiveness, and the overall conception of the work. The uniformly

high degree of polish and detail is unusual for Michelangelo. Much discussed at its unveiling, in part because of Mary's very youthful face, it is the only sculpture that he ever signed. At one fell swoop, the Vatican *Pietà* put the 25-year-old Michelangelo in the front rank of living artists; his next major work would solidify his reputation as probably the greatest sculptor of all time.

Having returned to Florence, which had just been declared a Republic, Michelangelo received a long-desired commission on 16 August 1501 to carve a colossal statue of the Biblical *David*. The gigantic marble block he had been given had previously been worked on and somewhat compromised by another sculptor and had lain outside the Florence Cathedral since the 1460s. Michelangelo began carving the *David* in the early morning of 13 September 1501, less than a month after getting the commission; the completed statue was unveiled on 8 September 1504. A committee decided to place it just outside the Palazzo Vecchio, the governmental seat of Florence.

The *David* may be the most famous statue in the world. Its renown derives from a number of factors. It is enormous – 5.17 m tall (about 17 ft), without the pedestal. *David* is completely nude – one of the first such statues since antiquity. It depicts an unusual moment in the Biblical story – *David* tense and defiant prior to the fight with Goliath, instead of afterwards, as in most other depictions. Despite unprecedented anatomical detail and precision, its proportions are idiosyncratic – the head and hands are far too large, partly a consequence of the original intent for the statue to occupy a position high up on the Duomo, overlooking the city. Less obviously, the *David* presented daunting technical challenges, requiring an unusual pivoting of the figure inside the block (to circumvent earlier chiselling) and careful planning of the distribution of the figure's weight (throughout all stages of the carving process) to avoid collapse. All told, the *David* reinforced the 29-year-old Michelangelo's unique and total mastery of all technical and conceptual aspects of marble sculpture and his ability to succeed on the grandest scale.

In the three years of the *David*, Michelangelo also undertook several lesser sculptural projects, and painted the circular *Doni Madonna*, his only mature panel painting. It features a foregrounded Holy Family and five athletic male nudes prominently occupying the entire background, with the infant John the Baptist linking the two groups. In 1503, he also accepted a commission for statues of the Twelve Apostles, though he only began only one – the barely roughed in *St. Matthew*.

Shortly after completing the *David*, the city commissioned a fresco depicting *The Battle of Cascina* on one of the inside walls of the Palazzo Vecchio. On an adjacent wall, Leonardo da Vinci had been asked to paint *The Battle of Anghiari*. Leonardo was a generation older than Michelangelo, the greatest painter in Florence, and one of the most creative persons in history. Leonardo conceived his painting as a cavalry engagement, allowing him to depict a range of visual effects and human and equine forms; Michelangelo played to his own strength in depicting male anatomy, depicting soldiers bathing just as the battle alarm was sounded. This was a unique opportunity – the simultaneous commission of two of history's greatest artists, both at their peaks (Leonardo had just finished the *Mona Lisa*), for large murals in the same room. Sadly, neither fresco appears to have been completed; both likely reached the

'cartoon' stage of full-scale working drawings, and Leonardo probably did some painting. These drawings garnered enormous contemporary fame, serving as instructive models for many artists; over time, they were dismembered by admirers. Today, only some preparatory sketches and copies by other artists exist – though there is a tantalizing recent suggestion that the remains of the frescoes are preserved behind a wall erected by Giorgio Vasari, the Renaissance artist biographer who painted the frescoes now inside the Palazzo. Final completion of the frescoes was compromised by Leonardo's chronic indecisiveness and Michelangelo being called to Rome by the new Pope, Julius II, who would now play a crucial role in his career.

Michelangelo and Pope Julius II

With his own mighty force of personality and generous patronage, Pope Julius II (1443–1513) was a key figure in the development of the Roman High Renaissance, which would displace Florence from preeminence. He first brought Michelangelo to Rome in 1505 to design his tomb, which was to be placed in the Old Church of St. Peter's. Of the several designs Michelangelo had submitted, Julius chose one calling for a three-story freestanding structure with at least 24 statues. Michelangelo spent the next year quarrying marble and began carving. Work on the tomb was suddenly interrupted in 1506, when Julius commissioned Donato Bramante to build an enormous new Basilica of St. Peter's in the Vatican. Michelangelo, offended at the suspension of his commission, returned to Florence in a huff. Living up to his reputation as the 'warrior' Pope, Julius then executed a military capture of Bologna and forced the outflanked Florentines to send him Michelangelo, whereupon he commissioned a monumental bronze portrait statue of himself. Despite his distaste for bronze, Michelangelo made the statue; it was vengefully melted down several years later, when papal forces lost Bologna.

Scarcely back in Florence, in the spring of 1508 Michelangelo was again called to Rome, ordered by Julius to paint the ceiling of the Sistine Chapel, adjacent to the construction site of the new St. Peter's. The Chapel was of considerable ecclesiastical importance: there the sequestered College of Cardinals elected new Popes. At the time, the ceiling, approximately 5000 square feet in area and 70 ft above the floor, was simply gold stars on a blue background. Michelangelo was to paint the figures of the Twelve Apostles. He scoffed at the commission, claiming he was a sculptor, not a painter. Indeed, his experience executing fresco was limited to his apprentice days more than 20 years earlier. However, the challenges of the site – a lofty viewing distance replete with unusual perspectives, further complicated by the curved surface of the barrel vault – echoed many considerations of the projected *Julius Tomb*.

Despite initial reluctance, Michelangelo complied, but rejected the Twelve Apostles as a suitable subject. Probably with the aid of a theological adviser, a far more ambitious program was devised, consisting of more than 300 figures organized into nine central illustrations of scenes from Genesis, flanked by Old Testament Prophets and pagan Sibyls, plus Christ's ancestors; interwoven across the surface would be twenty nude male youths and painted architectural elements. Michelangelo made several hundred preliminary drawings – some of which

are among the finest of all time – and imported artists from Florence to assist with the execution. Work began on the part of the *Ceiling* away from the main altar, with the chronologically later scenes from Genesis, depicting the story of Noah. After a short while he dispensed with the help, and thereafter worked largely on his own.

Executed between July 1508 and October 1512, when Michelangelo was in his mid-30s, the Sistine Chapel *Ceiling* marks a high point of human creative achievement. Often executed with remarkable speed – the figure of Adam in the famed *Creation of Adam* was completed in just three days, the entire panel of *God Separating Light from Darkness* in one – the *Ceiling* figures can be said to have anticipated (and essentially solved) virtually all of the issues in the depiction of the human body that would occupy the best artists in Europe for the next century. Given the undertaking's unprecedented scale, Michelangelo learned as he went, and his approach to painting evolved: an early scene of Noah had to be completely repainted when the plaster did not set properly; later-done figures occupy larger areas, to facilitate viewing from a distance, and show increasing compositional boldness and dynamism – culminating in the massive figure of *Jonah* above the altar wall. Michelangelo also appears to have relied progressively less on preparatory cartoons, executing some later figures with unprecedented freedom.

Shortly after the completion of the *Ceiling*, Julius II died, on 21 February 1513. Michelangelo returned to the *Julius Tomb*, recasting the overall design and working on several statues for it, including the famed *Moses* and two *Slaves* now in the Louvre. Work would again be interrupted when Michelangelo was summoned back to Florence in 1516. The so-called 'tragedy of the tomb' would span 40 years and involve five or six different designs for the mausoleum, interleaved between other projects, and repeated negotiations about the details with Julius's heirs. Its final incarnation, no longer a freestanding structure, would not be finished until 1545, when it was installed in San Pietro in Vincoli in Rome.

Michelangelo After Forty

Back in Florence, Michelangelo was given several major commissions by Julius's successor, Pope Leo X, a son of Lorenzo de' Medici. The first was for the façade of the great Church of San Lorenzo. This occupied him for several years; a wooden model of his design exists, but in the end it came to nothing – to this day, San Lorenzo's façade is bare. In 1519, Leo commissioned Michelangelo to design the *Medici Chapel* (or New Sacristy) and then the Laurentian Library (for which he provided a magnificent staircase), both in the San Lorenzo complex.

The grandest of these projects, arguably Michelangelo's greatest achievement, simultaneously unified and multi-media, was the *Medici Chapel*, which he worked on for over a decade. Initially intended to house four tombs for Medici family members, in the end the only monuments are those of Giuliano and Lorenzo di Piero de' Medici (respectively, a son and grandson of Lorenzo 'Il Magnifico'). For once, Michelangelo had complete control of the entire project, designing the monuments, statuary, and architectural elements – though work was not completed until after he had left Florence for good in 1534. After significant

changes to the design, the final installation consists of two tombs on opposite walls, each with a statue representing the deceased and flanked by two reclining figures, statues of Madonna and saints on another wall, and an altar on the remaining wall. The four heroic reclining tomb figures, *Day*, *Night*, *Dawn*, and *Evening*, break new ground in the process of marble sculpting, with bold varieties of texture. The Medici 'portraits' were controversial, as they bore no apparent resemblance to their subjects – though this seems not to have bothered Michelangelo.

While Michelangelo was still working on the *Medici Chapel*, in 1530, Florence was besieged by papal and imperial forces. After its capture, an assassination order was put out on the 55-year-old Michelangelo because he had been in charge of fortifications for the city. Fearing for his life, he hid in a cellar under the chapel for six weeks; there he created some magnificent charcoal drawings on the walls, which were rediscovered in 1975. Michelangelo was reprieved only after the intercession of Pope Clement VII and made several trips to Rome in the early 1530s. He was in Rome when Clement died in 1534, and, fearing his pardon would be rescinded, never returned to Florence, living in Rome throughout his remaining 30 years.

Michelangelo was appointed Supreme Architect, Painter, and Sculptor to the Vatican in 1535. His first task was a fresco of *The Last Judgment*, to be painted on the altar wall of the Sistine Chapel – over 1700 square feet. Painted between 1536 and 1541, it is his most terrifying work, packed with almost 400 figures. In the lower left, the dead rise; the blessed occupy the upper register; the damned, the lower right. In the center, a musclebound, beardless Christ raises his hand in a gesture of damnation, surrounded by saints with their iconographic symbols. Among the most interesting passages is the dangling flayed skin of the martyred St. Bartholomew, which features a tragic self-portrait of the aging artist. By now, Michelangelo's anatomical exaggerations inflate the figures beyond any semblance of optical realism; their relative size also reflects their theological status, rather than obeying any unified visual perspective. The almost total nudity of the figures offended many viewers' sensibilities; in the wake of the Counter-Reformation, strategically placed drapery was added by Michelangelo's pupil, Daniele da Volterra.

Shortly after *The Last Judgment*, Michelangelo painted his final two frescoes, *The Conversion of Paul* (1542–45) and *The Crucifixion of Peter* (1546–50), in the Pauline Chapel, next to the Sistine Chapel. Smaller than their Sistine predecessors (each is about 400 square feet), they continue the anatomical distortions of *The Last Judgment*. Rarely seen, as the Pauline remains the Pope's private chapel, critical opinion is divided as to their quality.

After these frescoes, Michelangelo's main occupation was supervising the ongoing construction of St. Peter's, though he seems to have no formal training in architecture. His most visible contribution to the Basilica is the grand Dome, echoing Brunelleschi's in Florence, and in the end slightly modified from his plans. Many of Michelangelo's most moving drawings also date from this period. Throughout the 1530s, he produced a number of exquisitely polished figurative compositions on mythological themes; in his final years, aside from architectural designs, his drawings focused on scenes depicting the death of Christ, attaining an unsurpassed depth of expression.

Sadly, near the end of his life, Michelangelo apparently destroyed a large number of drawings he found unsatisfactory.

Amidst his late frescoes, architecture, and drawings, Michelangelo's sculptural output declined markedly. Barring two minor figures for the *Julius Tomb* and a small wood *Crucifix*, he produced only three significant statues in his last 30 years. One was an imposing bust of *Brutus* (1540). Another was a multi-figure *Pietà* (c. 1550–55), featuring a self-portrait as Joseph of Arimathea. During its creation, imperfections in the marble led Michelangelo to smash and subsequently abandon the group, though he permitted it to be reassembled. Last of all was the *Rondanini Pietà* (c. 1552–64), on which he is said to have worked just 6 days before his death.

Michelangelo died in Rome on 18 February 1564, probably of pneumonia, with the Dome of St. Peter's still only partly complete. His body was transported to Florence, and he is buried in the Church of Santa Croce, in the neighborhood where he spent his childhood. Inside the church, he lies near a monument designed by Vasari, his admiring biographer. His funeral was one of great pomp – an unprecedented honor for a visual artist, but fitting for the artist who, more than any other, lays claim to being the greatest of all.

Michelangelo and Creativity

General Aspects of Michelangelo's Creativity

As with all eminent creators, Michelangelo's superhuman achievements were made possible by many simultaneously interacting factors. The preceding biographical sketch has emphasized Michelangelo's rich knowledge base and mastery of the technical demands of his media – both of which contributed to his unusual exploration of the creative process, a theme which is further taken up below. Before discussing this in more depth, however, several other factors contributing to Michelangelo's creativity should be noted.

For starters, it is hard to think of anyone in history who had a significantly stronger motivation to create than Michelangelo. He aspired to artistic greatness as early as age 13, when he defied his family to be apprenticed to Ghirlandaio. As an adult, despite phenomenal success, he lived only for his art, largely forsaking friendships and basic comforts, sleeping in his boots, rarely washing, eating moderately, and taking on project after project that would require all of his energy. The *David*, the major frescoes, *Julius II Tomb*, *Medici Chapel*, and architectural work on St. Peter's each took multiple years of intensive and often lonely effort. Coupled with his high standards and strong opinions, Michelangelo's irascible, melancholy temperament isolated him even further. However, he continued to create even under the worst conditions, for example, while in hiding after the siege of Florence in 1530.

Besides motivation, Michelangelo also had phenomenal intelligence, particularly in visual and kinesthetic modes. In his youth, he apparently won a contest to make the worst drawing of a human figure (interestingly, not an easy feat for an expert), by vividly recalling some graffiti he had seen and copying the mental image. Kinesthetically, his dexterous draftsmanship speaks for itself; even in his seventies, he could carve marble with unmatched vigor and precision. Interestingly, his verbal intelligence was also very strong: he had allegedly memorized

virtually all of Dante's 14 000-plus-line *Divine Comedy*, and his own sonnets and madrigals rank among the very best Italian poetry of his time, earning a place in the Western literary canon.

More generally, tensions between opposing tendencies are manifest throughout Michelangelo's work, and they certainly energized his creativity. Perhaps most salient is the incompatibility of the paganism of classical antiquity versus Catholicism. This friction permeated the entire Renaissance, and in Michelangelo's case, it can also be cast in terms of his own likely homosexuality versus fear of damnation. Another tension, which his own career helped remedy, was the gulf between the lay perception of artists as manual laborers and his own view of art-making as a lofty, intellectual enterprise. Another, partly the result of his historical position, is the tension between the technical mastery of visual realism and the expressiveness that could be achieved by over-emphasizing some visual features – for Michelangelo, usually anatomical mass and movement, which grew in exaggeration during his career.

In all of these tensions, a comparison can be made between Michelangelo and his great rival Leonardo da Vinci (1452–1519). Leonardo's interest for students of creativity is mainly in his 'Renaissance man' diversity, contributing to a dozen domains in the arts and sciences. Michelangelo's diversity was less far-ranging but still extraordinary. He excelled in virtually all of the artistic media of his age, poetry, and engineering – having designed his own scaffold for the Sistine *Ceiling*, the fortifications during the siege of Florence in 1530, and the great Dome of St. Peter's. Curiously, however, within the domain of art, Michelangelo had perhaps the narrowest subject matter focus of any great artist. All of his work celebrates the human figure, particularly the heroic male nude; background elements, like the landscapes on the Sistine *Ceiling*, are absolutely perfunctory. In contrast, Leonardo pioneered improvements in the expressiveness of faces and moving human bodies, and introduced unprecedented nuances of light and shadow and atmospheric perspective in landscape. Both Leonardo and Michelangelo also made extraordinary innovations to the process of art-making, which greatly inform the nature of the creative process, and to which we now turn.

Michelangelo and the Creative Process

Art historians have always noted the important differences between Michelangelo's artworks and those of his predecessors and contemporaries – in terms of Michelangelo's dynamic power, his virtuosity of foreshortening and modeling, mastery of anatomical detail and musculature, the often overt emotionality of his figures and faces, and generally noble, heroic conception of humanity. While these are key aspects of Michelangelo's mature style, they are primarily features of his final products. Though fewer direct claims about his creative process have been made, such a process-oriented perspective probably better informs the basic nature of creativity than a reliance merely on final products.

The creative process is a major topic in contemporary creativity research. Virtually all scholars agree that it is highly complex and involves numerous subprocesses: generating and elaborating ideas, combining and expanding concepts, devising metaphors and analogies, evaluating a work-in-progress, etc. Because of this daunting complexity, researchers

usually heuristically divide the process of creation into several discrete but iterative stages or emphasize interactive component mechanisms. However, both approaches deprive the creative process of systematic structure, which might lead to a more profitable mode of understanding its rich dynamics.

Some guidance on this issue, particularly in the context of understanding Michelangelo, may be had by conceptualizing the creative process in more domain-specific terms, considering the technical requirements of the media in which he worked, how these constrained his activity, and how he violated traditional constraints. In Michelangelo's time, art-making techniques involving specialized knowledge of different media, perspective, and anatomy, were well articulated and passed along through workshop practice. Thus, the standard way of creating a work in a traditional medium can be understood, as can departures from the standard.

Looking at Michelangelo's work in this way reveals Michelangelo's radically different approach to art-making, compared to his contemporaries. The degree and variety of finish and textures, in unexpected ways, is unprecedented. Interestingly, few subsequent sculptors seem to have picked up on this, at least till Rodin, almost 400 years later. Likewise, while Michelangelo's '*nonfinito*' is a recurrent theme in the art historical literature, few conclusions have been drawn about how to understand it; scholars are divided as to whether the *nonfinito* quality represents satisfaction or dissatisfaction with a work.

However, one can recontextualize Michelangelo's *nonfinito* in terms of his active manipulation of the process of creation itself, a striking but underappreciated artistic innovation. This manipulation primarily involves introducing changes of sequence and timing into the basic methods of art-making, analogous to the embryological process of 'ontogenetic heterochrony,' by which small changes in the timing of developmental events can lead to large differences in final morphology. To illustrate this point, take Michelangelo's oft-quoted statement about sculpture essentially involving carving away excess marble to reveal a preexisting statue from a marble block. This remark is sometimes interpreted in a way that suggests Michelangelo had a completely preconceived idea of the final product and that he merely needed to remove extraneous parts of the block. The process of removing marble does require careful planning of the distribution of weight as a statue is carved, to avoid collapse; however, many degrees of freedom remain. Ongoing removal may reveal possibilities that can give new directions to a work, which may have little relation to one's initial conception. Indeed, Michelangelo sometimes radically altered a statue as he worked, and this tendency increased with age. For instance, his very last sculpture, the *Rondanini Pietà*, seems at one point to have been nearly completed; then the torso and head of Christ (its most important parts) were hacked away, leaving his right arm separated from the rest of the body and merging the head of Christ into the physical space of Mary's shoulder.

Other kinds of heterochronies, or changes in timing, are evident at other times of his career. He added unprecedented finish and detail to his early *David* and Vatican *Pietà*, extending the final stages of polishing beyond any of his predecessors' methods. In contrast, his subsequent *Prisoners* and *St. Matthew* are largely unfinished – perhaps for extrinsic reasons, though to great expressive effect. Other works, particularly those of the

time of the *Medici Chapel*, mix *finito* and *nonfinito*, even in adjacent passages. Perhaps most strikingly, the body of the *Day* statue in the *Medici Chapel* has a polished body but very rough-hewn face, a complete reversal of the usual degree of relative finish. Along these lines, Michelangelo's departure from traditional, planning-intensive modes of fresco painting have been noted above.

Conclusion

Michelangelo's awesome achievements in the visual arts represent a daunting case study of creative genius. In such a long, varied, and productive career, any single research approach must fall far short of fully explicating Michelangelo's depth and richness. Among the many possible perspectives, this article has emphasized a consideration of his expert technical knowledge base and active manipulation of the creative process as ways in which the titanic contradictions and tensions of his life and times were realized into transcendent works of art. Variations in the very process of creation have not really been addressed by creativity researchers, but the topic likely represents a fruitful avenue for future research. Half a millennium after he lived, Michelangelo remains in many ways ahead of his time, and a careful scholarly study of his artistic methods will no doubt continue to inform the nature of creativity in new and powerful ways.

See also: Eminence; Motivation.

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Relevant Websites

- <http://en.wikipedia.org/wiki/Michelangelo> – Wikipedia entry on Michelangelo – basic biographical information.
- http://www.artcyclopedia.com/artists/michelangelo_buonarroti.html – List of works by Michelangelo, museum by museum.
- <http://www.michelangelo.com/buonarroti.html> – Biographical information, links to other websites relevant to Michelangelo.
- <http://www.graphics.stanford.edu/projects/mich/> – The Digital Michelangelo Project – Interesting information on how Michelangelo's *David* was scanned into a 3D digital model.

Mindfulness

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Glossary

Causation The doctrine that events are linked by cause-and-effect relationships; a category of perception that structures our understanding of the world as a chain of causes and effects.

Construction of knowledge The process of forming beliefs, theories, and models of the world that shape our perceptions of the world.

Discovery The act or process of articulating some new fact about the world that is true independently of the presence or mind of the observer.

Induction The process by which singular statements or statements about singular events are used to lend support to universal statements, or statements that are true for all events of a particular type.

Mindfulness A state of active cognitive and emotional engagement with lived experience, leading to the creation of new categories for structuring our understanding of the world.

Mindlessness A state of passive acceptance of concepts and observations, usually involving the categorization of new perceptions in entrenched categories that are not responsive to new experiences.

This article introduces and elaborates the idea of a mindful state of being, and applies this idea toward a new understanding of the processes of creation and discovery. A mindful consideration of the world involves the conscious and continuous challenge of the categories and values we use to structure our experience, understand observations, and generate reasons for our actions, and the reconstruction of new categories, values, and concepts to replace old ones. We will show that the processes of creating new patterns of thought and breaking down old patterns are essential features of both processes of artistic ‘creation’ and processes of scientific ‘discovery.’ The sharp line that is so often drawn between the ways in which the artist and the scientist approach and relate to the world needs to be reconsidered. Recognizing the elements of artistic creation present in what we now call the process of discovery leads to a new and useful reframing of the work of the scientist, as well as a new perspective of the relevance of the work of the artist in the evolution of knowledge.

The article is structured in four parts. The first section introduces the concept of mindfulness and discusses its role in the way we use concepts to refer to objects, people, and events. It examines the implications of mindful consideration for the meaning, universality, and coherence of those concepts. The second section explores paths to mindfulness, in part by tracing the roots of the concept to the line of philosophical inquiry into the nature of our knowledge of the external world which began with the works of Hume and Kant. The third section reviews the phenomenology of mindful and mindless states, by reviewing the experimental record of mindfulness research, and establishing the relations in which mindfulness enters as a dependent and independent variable. The last section argues that mindful involvement with a phenomenon is a property of processes of creation and discovery alike, and that the line used to distinguish these processes from one another sets forth a misleading distinction. The benefits of seeing discovery as a creative process – rather than a process of passive observation of a ‘new’ phenomenon – are discussed.

Prelude

If the barber shaves all and only those who do not shave themselves, then who shaves the barber? It cannot be the barber himself, because then *he* would be shaving himself, and he is *only* supposed to shave those who do not shave themselves. Nor can it be someone else, since the barber shaves *all* those who do not shave themselves. By the law of the excluded middle, either the barber shaves himself or he does not (assuming that he is shaven to begin with). Since either statement seems to be excluded by the premises of the problem, we are left in a bind. The logician that we call on our cellular phone tells us the example represents a paradox – a problem whose solution process starts from true premises and reaches false or untenable conclusions by procedurally impeccable steps of reasoning.

To ‘solve’ the paradox, which we can do by claiming that there is no such barber, requires us to step ‘outside’ of the premises as stated and to question the assumptions inherent in the problem statement – to ask whether or not these assumptions are true or unique. To do so, we must resist the temptation to believe that what is said is more relevant or useful than what is left unsaid, as well as the temptation to mechanically apply the laws of logic in a repeated – but futile – search for an answer. Overcoming these temptations represents the step that takes us from a mindless to a mindful involvement with our experience.

Mindless and Mindful States

Mindfulness involves the creation of new categories for organizing our awareness of the world. A precondition for the unfolding of this process is an awareness that the concepts which we currently hold to be coherent are only tentatively and therefore temporarily so. Just like the idea of phlogiston – which was held by seventeenth century chemists to be the

substance given off by a burning object – turned out to be incoherent in view of subsequent stoichiometric analyses of oxidation, so the ideas we currently hold about the foundations of physics and chemistry, and the inferences we draw from these for biology and the social sciences, may turn out to have a far looser grasp on reality than we now think is the case. The predictive imperfection of physical laws may turn out to be related to the nature of the mental objects which we use to formulate those laws. If concepts are tools with which the mind picks up and handles objects, people, and events rather than direct consequences of the availability of and involvement with certain sensory experiences, then there is no reason to think that these tools are not perfectible – that they cannot be continuously and perpetually improved upon. Improvement of these concepts is a continuous process in which the destruction of old ways of thinking and relating to the world must precede – or at least accompany – the creation of new concepts and ideas. Implicit in this process is an awareness that the categories we are currently using are fallible and potentially incoherent, and that their usage is potentially self-defeating, in the sense that using them leads us to undertake actions which diminish our well-being – by our own definition of it.

Seeing the height of a car as predetermined by constraints outside of our control deprives us of the possibility to navigate through a tunnel whose ceiling is too low for its passage – which we could have accomplished by letting the air out of the car's tires. Seeing a problem as an exercise in the application of the laws of logic prevents us from solving it by challenging its underlying assumptions. Seeing a lamppost as just a lamppost deprives us of a safe place to which we can chain our bicycle. Seeing a piece of chalk as a mere writing implement deprives us of a means to soak up the ink we have spilled on a manuscript. Seeing a dog as a domesticated animal subject to the commands of her owner prevents us from picking up the small child when a Rottweiler is charging with a bizarre look on his face. Seeing a screwdriver, a screw, and a pair of pliers found in the back of the car as a trio of implements with no apparent connection to each other deprives us of an elegant way to open a wine bottle while on a picnic to which we have forgotten the corkscrew. Seeing a wire coat hanger as just a wire coat hanger deprives us of a means of getting into the car in which we have locked our keys. Seeing a can of shaving cream as a mere bathroom implement deprives us of a quick and effective method of removing a fresh red wine stain from a beige carpet. Seeing the instructions for an assignment as given and undiscussable prevents us from proposing – perhaps successfully – to write an essay on a subject which we feel passionate about. Seeing a policeman as the robotic representative of an objectively formulated and immutable body of laws deprives us of the possibility to negotiate a lower penalty for our unwitting infraction. Seeing a cigarette lighter as something we light cigarettes with deprives us of the possibility of using the organic compound in its reservoir to set aflame some damp wood on a cold night. Seeing the apple in our lunch bag as a piece of food deprives us of a projectile with which we could have dislodged the badminton butterfly stuck in a tree.

A mindful state involves the active drawing of distinctions between different raw sense data, and therefore the active creation of categories with which we structure our experience. It involves an openness to new information about the world,

especially to information which refutes inherent hypotheses and causal models, and which provides test cases for our concepts and ideas. It also involves an awareness of different perspectives or interpretations of the world – usually corresponding to different minds which 'see' in different ways. By contrast, a mindless approach to experience involves a cognitive commitment to inherited categories and causal models of the world, which may be invested with properties like truth and absolute certainty. Necessarily, when we are in a mindless state, we are likely to discount new information, and especially information which challenges or does not fit neatly into the hierarchy of concepts and values we use to understand the world – or to 'force fit' the new information into the inherited categories, by coding it, or committing to one understanding of it. Alternative ways of 'seeing' the world are threatening to our mindsets, since they directly challenge the conceptual framework used to categorize observations. Jon Elster's distinction between active and passive negation neatly applies here: a commitment to a rigid mindset represents a passive negation of an alternative point of view, which the subject implicitly – or passively – denies by virtue of not being aware of it. The transformation of passive negation into active negation is already a passage to a more conscious state – which acknowledges the existence and perhaps the threat of the alternative point of view, albeit in a negative sense. Active negation represents, relative to passive negation, an awakening to a more mindful state.

In the section that follows, we shall examine the characteristics which distinguish a mindful from a mindless state by discussing the nature and value of categories, with respect to their universality, verisimilitude, and communicability. We will seek to show that mindfulness and mindlessness are useful concepts for describing the evolution of concepts and categories, and can be used to predict the nature of the knowledge of the world which obtains at the end of an unfolding process of cognitive evolution.

On the Nature and Evolution of Categories

When speaking or thinking of our experiences and observations, we inevitably represent real objects, people, and phenomena by words or propositions which act as placeholders for these experiences in our minds. We refer to a person who periodically places some pieces of paper in our mailbox as the mailman; to a person who periodically brushes her teeth for at least 20 minutes while rolling her eyes at a mirror as an obsessive-compulsive; to a vast set of interactions between many people in which some end up with money and others end up with goods and services as a market; to a collection of events involving measurements of kinetic and potential energy in a small region of space as an electron; and to a beautifully shaped collection of viscera, bones, nerves, and muscles which is seemingly capable of thought and feeling as a self or a person. The names that we give our observations are the categories that we shall use to organize our experiences.

Categories have greater or lesser universality, depending on the sharpness of the criteria that we use for deciding whether or not an experienced object or event is an instantiation of a categorical class. Whether we consider the events of August 1991 in the former Soviet Union a coup d'état or a debacle,

for instance, depends on whether or not we define a coup d'état by the intent of the protagonists or by the ultimate outcomes of their actions. Whether or not we consider a group of people who are sleeping in the same house a family depends on the properties of the relationships between them – genetic relatedness, mating behaviors, psychological closeness – which we choose to ascribe to members of a family.

We discover, by examining the levels of universality at which a category can be applied, that our commitment to various categories is contingent on the criteria that we use to include an observation or experience in a category. At one end of the spectrum, all observed behaviors may be examples of a particular category. Some economists, for example, find instantiations of the maximization of personal utility in all observed human behaviors. By definition, if someone undertakes an action, it is in virtue of some interest or intention which she has had prior to taking it. The action therefore is taken to further the actor's interest – and therefore it is an example of self-interest-maximization. At the other end of the spectrum, there are 'categories' which contain a single element – the event or person or object from which they draw their substance. Barring time travel, there is only one initial charge of the French infantry at the battle of Waterloo.

It is only by maintaining a skeptical attitude toward the categories which we are currently using that we can retain the capability to improve upon them, and to make our own ways of expression more truth-like or verisimilar in nature. For example, once the momentum associated with a moving mass has been 'defined' as the mass of the object times its velocity, we cannot speak of the 'momentum' of a mass traveling at relativistically significant velocities, since the classical definition of momentum does not include a correction for the mass of the particle as a function of its velocity. Once we have settled upon an understanding of a person's actions as instantiations of the axioms of rational choice, we cannot accommodate phenomena such as weakness of will or susceptibility to biased perceptions and judgments. The first essential feature of a commitment to a flexible and renewable – rather than immutable – set of categories is openness to new information, or the willingness to continuously test existing categories using data to which they purport to be relevant. Just as under a microscope of increasing power solid cells visible to the naked eye give way to intricate structures which in turn give way to more structures, so testing available categories by increasingly nuanced situations to which they are applicable will often reveal that the categories in question give way to fresh – and perhaps predictively more competent – ways of looking at the same information. For example, categorizing a person in terms of his or her personality profile will give way to new understandings of that person once we debrief her on the workings of her mind while she was answering the questions of a personality inventory. At risk, of course, are the categories used to identify various personalities, which may become meaningless or incoherent upon dialogue or reflection.

The universality of the categories we have devised creates the illusion that our thoughts are more communicable through language than is actually the case.

People believe that others understand the same meaning that they have intended for a given word or concept, and that others use words the same way in which they use the

same words. Deborah Tannen's work has documented important differences in the interpretation of the same situations by men and women. A woman's allusive references to the shortcomings of a project, when sandwiched between laudatory remarks, may be taken by a man to be wholehearted endorsement of the project, contrary to the expectations of the woman interlocutor. When many blind men give their separate accounts of a single elephant after feeling different parts of the animal, their accounts may give the semblance of the presence of many different animals. When clear-sighted people speak of the feelings and the thoughts that the sight of the same elephant arouses in them, they may be misled into thinking that they are experiencing the same feelings by the fact that they are looking at the same elephant and uttering the same words. It is therefore possible for them to find 'corroboration' for the validity of the concepts they are using by confounding the phonetic similarity of their words with a similarity or identity of the experiences and thoughts on which those words are based. An awareness of more than one possible perspective or interpretation of the world involves, therefore, a minimally presumptuous approach to the expressions of others. Our understanding of what someone meant when she said something must remain open to refutation by her subsequent expressions and actions. A mindful interpretation of others' expressions involves a continuous search for the meaning of their sentences, rather than an early commitment to a particular image, or 'psychological profile' of that person, and is therefore closely related to a commitment to listening as part of the ethics of a conversation. By contrast, mindless interpretations of others' expressions involve a cognitive commitment to a particular set of motives or circumstances or properties which we impute to a speaker, and which is dispositive of any meaning that she gives her words. For example, we might say that it is in someone's best interest to take a particular view of the world, given her socioeconomic background (wealthy, well educated, never prospectively homeless). This 'interpretation' thus provides an excuse for thinking of ways to rebut her arguments, even while she is still talking, instead of listening for new nuances or ways to interpretation.

The Phenomenology of Mindful and Mindless States

Experimental research by Ellen Langer and her colleagues has documented the precursors and effects of mindless states as well as the conditions that make possible a mindful approach to the world. This section reviews her experimental results by considering mindfulness and mindlessness in turn as dependent and independent variables. In this way, the precursors and benefits of mindful approaches, and the precursors and drawbacks associated with mindless states, can be considered side by side.

The Consequences and Precursors of Mindlessness

Mindless behavior can often be distinguished by its consequences and effects, which means that it is often available to scrutiny only retrospectively. Locking ourselves out of a car or throwing socks in the garbage can instead of the laundry basket jolts us awake. William James once told a story of starting to get

ready for a dinner and ending up climbing into bed. Two routines that began the same became confused and he mindlessly followed the more familiar one. The phenomenon of mentally locking ourselves into routines and scripted behaviors is – by introspection – pervasive, and seems to have been so at least since the time of Henry David Thoreau, who despaired of the possibility of meeting someone who was truly ‘awake.’

Langer argues from experimental and anecdotal evidence that mindless behavior can be induced by a commitment to a particular role or label given to a person by himself or by others. In a study that pretested the ability of participants to solve simple arithmetic problems, and then assigned participants to roles of ‘boss’ and ‘assistant’ for an impromptu set of interactions, the post-tested ability of the participants labeled ‘assistants’ was significantly less than on the pretest. The label ‘assistant’ undermined the participants’ view of their abilities, which impacted performance.

Mindless behavior can also be induced by a commitment to a mindset, perhaps one that generated some good results in the past. Abraham and Edith Hirsch Luchins led participants of an experiment to the discovery of an optimal solution to an arithmetic problem, and then changed the problem so that the initial solution was no longer optimal, but could nevertheless be adjusted to give the required answer. They found that participants were reluctant to ‘let go’ of the initial solution to the problem, even when that solution became nonoptimal. Janice R. Kelly and Joseph E. McGrath asked participants to solve two problems, the first under a significant time constraint and the second under no time constraint. They found that the time pressure experienced by the participants during the first problem carried over to the second problem. It seemed as if the participants had committed themselves to the requirements of the first task.

Mindsets that people use to prejudice a particular state of being or activity can influence their enjoyment of that activity. Labeling an amusing task – playing with the form and content of cartoons – as either ‘work’ or ‘play’ influences the self-reported enjoyment of the process of performing the task. Those to whom it was suggested that the activity was a form of play were more likely to report enjoying the activity than were those to whom it was suggested that the activity was a piece of work.

Cognitive commitments were also shown to influence people’s performance on tasks designed to measure presence or awareness. Participants in an experiment were given a description of an imaginary perceptible disorder in which it was implied that they may be suffering from it without knowing it. Some participants were given information which suggested that it was likely that they were affected by the disorder, and others were given information which suggested that it was unlikely that they were suffering from the disorder. Participants who were led to believe that they were probably not subject to the disorder were more often subject to the (simulated) symptoms than were those who thought that they might have the disorder: people in the former group performed more poorly on a task of aural perception than did people in the latter group.

The Phenomenology of Mindful Awareness: Some Experimental Results

The most remarkable regularity that emerges from the experimental record is that people are sensitive and open to

‘awakenings’ which challenge them to question their own assumptions and to break down their precognitions. As Langer points out, mindlessness is very different from Freud’s conception of willful-notknowing, which involves the will to actively repress or banish a particular thought. Langer’s experiments point to some of the possibilities for opening up inherited categories and mindsets to new information and fresh perspectives. These range from mere promptings to avoid labels, to the conditionalization of propositions and hypotheses about the world.

It has been shown that the label given to a person sharply influences the evaluation of that person even by trained therapists. Participants in an experiment were asked to provide evaluations of a man whose interview was presented to them on videotape. Half the therapists were told that the man is a job applicant, whereas the other half were told that the man is a patient. Those therapists who had been trained on the use of labels saw the man as well adjusted, regardless of the label that he was given by the experimenter. Those therapists who had received no such forewarning were strongly influenced by the label they were given at the beginning of the experiment: they found the ‘patient’ to have serious psychological problems.

The direct exposure of a person to a concrete problem – as opposed to the exposure to a problem after a period of training in the use of a particular solution – was also found to increase the likelihood that the problem solver will arrive at several possible ways of solving the problem, relative to a person that has received training. College students asked to use a set of building blocks to build a bridge over an imaginary river, and who had no prior exposure to the use of the blocks, came up with a greater number of possible solutions than did students who were shown examples of how the blocks could be used.

The use of conditionalization of concepts and causal relations was also found to lead to a more mindful consideration of the information received. Students to whom a model of urban development was presented in a conditional way (i.e., in which concepts were presented using the construction ‘A could be B,’ rather than the construction ‘A is B’ or ‘A is a model for B’) were more successful in making use of the information presented to them than were students who were presented with the information in absolute terms (i.e., using either constructions like ‘A is B’ or constructions like ‘A is a possible model for B’).

In another study, students were given different versions of a typical examination given to stockbrokers. Some versions presented the information in deterministic and closed-ended terms. Other versions presented the information as a set of stylized facts, whose statistical nature was apparent. The students who were presented with the versions of the ‘facts’ that were more open to criticism or to revision generated more creative answers – and reported enjoying reading the material to a greater degree – than did the students who were presented with the deterministically framed information. The implication is that the presentation of models of the world in ways that indistinguishably conflate objects with their representations – which underlies the vast majority of undergraduate curricula in the natural and social sciences – is self-defeating if the purpose of such a presentation is to encourage the creative application of the models to real-world situations.

Empirical investigations have also revealed some effects of mindful consideration on the attitude and motivation of people

toward certain activities, other people, or states of being. People asked to engage in an activity which they initially thought of as unpleasant – such as listening to rap music – were more likely to find the activity pleasurable after performing it if they had been asked to notice several novel aspects of the activity than if they were not given instructions before engaging in it. These findings suggest that the myth of well-defined preferences which do not change over time – a staple of normative and positive economic theory for the past 50 years – may be the outcome of a self-fulfilling prophecy, which breaks down when people engage in the activities mindfully.

Mindful Health

A quick review of some recent health findings suggests that when we create new categories and give up limiting mindsets, the control we have over our health is enormous. Mind/body dualism created the problem of the search for mediating mechanisms. How do we get from the nonmaterial mind to the material body? If we give up this dualism and put the mind and body back together, the problem goes away. Langer and her students did just that in several studies with dramatic results. Essentially they 'put the mind' in different places and took physical measures to see if the body registered the difference. For example, eye charts have progressively smaller letters, thereby creating the expectation that soon we will not be able to see. Reversing these charts so the letters become progressively larger, led subjects to be able to see what they previously could not see. In another investigation chambermaids were questioned about their exercise. Despite the fact that they exercise all day long, they did not see themselves as getting exercise and consequently they were relatively unhealthy. They were told that their work was exercise. A month later, they reported no changes in how hard they worked, what they ate, or how much they exercised outside of work. All that changed was their mindset: work for them now was exercise. They lost weight, showed a decrease in body/mass, and waist/hip ratio and a drop in blood pressure. Placebos and spontaneous remissions may be explained the same way. Archival research found similar results. When the mind felt old, the body did as well. For example, balding is a cue for old age. Men who bald prematurely, also have premature prostate problems. Clothing serves as an age-related cue: those who wear uniforms and thus have fewer age-related cues stay 'younger' longer than those without uniforms. For example, Korean taxi drivers who wear uniforms live longer than Korean taxi drivers who do not wear uniforms. Many studies confirm the idea that if the mind is cued to be healthy, the effects are measurable and often dramatic. Many seemingly unavoidable damages to our body can be reversed or ameliorated by the conscious application of the mind.

Mindful Approaches to the World: Some Links to the Philosophy of Knowledge

The 'paradox' of mindfulness is that if the attainment of a mindful state could be enacted by following a prescription, an algorithm, or a program, then that state would cease to be

mindful. Analogously to self contradictory impulses like 'be spontaneous' or 'try to forget her,' the injunction 'be mindful by following these simple rules' is self-defeating, for it is precisely in the escape from rigid rules and rule-based behavior that the essential characteristic of a mindful state lies. The path to mindfulness must itself be created, and therefore is itself the outcome of a mindful state. As noted previously, a precondition for the unfolding processes of cognitive creation and destruction is a skeptical or at least modest appraisal of the current concepts and ideas which we use to understand the world. Occasions for learning to be modest are to be found even in our daily experience. As Rupert Riedl has shown, a visit to the house of a new friend can throw doubt on intuitions about causes and effects which are so evident that they seem necessary or inescapable:

It is late in the day and the shadows have fallen. The house we enter is unknown to us, but the situation is familiar. It is too dark in the entrance hall to read the name plates. Where is the light switch? There – three buttons. It's probably the top one. We push it and immediately jump back: for as long as the finger was on the switch, a bell shrilled through the whole house (and then the fluorescent light flickers on as well). Embarrassing! It must have been the doorbell (or did we also cause the light to come on?) A door opens behind us. Have we roused the tenants too? But no! It is the front door. "Excuse me" says the person coming in, "I thought the door was already locked." Did he then cause the bell to ring and did we turn the light on after all? Apparently. But why do we expect to be the cause of an unexpected coincidence, namely, the simultaneous occurrence of the touching of the switch and the sound of the bell?

Riedl has similarly shown that seemingly unimpeachable intuitions and expectations about causes that underlie our most indignant moral sentiments may turn out to be lamentably erroneous:

People are getting on a streetcar in Vienna. Among the passengers is a working class woman with her young son. The boy has an enormous bandage wrapped around his head. (How dreadful! What happened to him?) People give up their seats to the afflicted pair. The bandaging is not a professional job, it was obviously done at home and in a hurry; they must be on their way to the hospital (people secretly search the child's face for an explanation, and the bandage for traces of blood). The little boy whines and fusses (signs of sympathy from everyone). The mother seems unconcerned (how inappropriate!); she even shows signs of impatience (that is amazing). The little one begins to fidget; his mother pushes him back in his seat. The passengers' attitude changes from discrete observation to manifest concern. (The mother's behavior is disgraceful!) The boy cries and tries to climb the bench on which they are sitting. His mother pulls him back so roughly that even the bandage is beginning to shake. (The poor child! This is terrible!) The passengers' mood turns to open confrontation. The mother is criticized, but for her part rejects all interference. Now she is criticized again, and more openly. Thereupon she tells them to mind their own business and questions the competence of all those who criticized her. (That is too much! An outrage to human decency.) Emotions run high, and things get noisy and turbulent. The child is bawling; his mother, red-faced and furious, declares she is going to show us what is the matter and begins (to everybody's horror) tearing off the whole bandage. What appears is a metal chamber pot that the little Don Quixote has pushed so tightly on his head that it is stuck; they are on their way to get help from the nearest plumber. People get off the streetcar in great embarrassment.

It is possible, and desirable, to go further and to seek an explanation of the very nature of causation, rather than merely

challenge various proposed causal links. Philosopher David Hume criticized our knowledge of causal relations by first arguing that we are rationally justified in believing that one event (a B event) will follow another event (an A event) if we are justified in believing that nature is uniform – that the laws of nature are invariant across time. We are justified in believing that nature is uniform either by a priori reasoning (of the type, ‘axioms of real axis mean that $(2\ 1\ 2) \bmod 10\ 5\ 4$ could not possibly be false’) or by our own experience. A priori reasoning fails because we can imagine a set of axioms which imply that nature is not uniform (one axiom could be, ‘nature is not uniform, although it seemed that way up to time 5 T’).

We are left to our experience, which means that we are justified in believing that nature is uniform only if we are justified in believing that our past observations of uniformity imply that nature will be uniform in the future. But we are justified in believing this statement only if we are justified in believing that nature is uniform. So we are justified in believing that nature is uniform only if we are *already* justified in believing that nature is uniform, which we are not. Hume characterizes causation as a habitual construction of the mind.

Mindless approaches to choice involve the acceptance of inherited categories, either from one’s own experience, or from other minds. These categories can be of the type, ‘an A event is of the type that causes a B event,’ given some inductive evidence for this relationship. This inductive evidence can be very scarce: a chance observation, the opinion of a person which the mind has labeled as an expert, and so forth. Therefore a mindless approach to choice is equivalent to the mechanical acceptance of a view of causation which Hume has criticized.

Another aspect of mindless approaches to choice which can be understood from a Humean perspective has to do with propositions of the form, ‘an A event in the world will cause a B event in the mind.’ This sort of causal reasoning can lead to inferences of the sort, ‘being with person *x* has made me feel bad. I will feel bad next time I am with person *x*. Therefore being with person *x* is undesirable.’ Here ‘T’ is using inductive evidence to predict her own affective response to a stimulus which she has experienced before. This is a form of mindlessness. One cannot ‘know’ how one will feel, but can only suppose that one will feel in a certain way. By developing a cognitive commitment to that ‘guess,’ one may be precluding the possibility of feeling in a different way (or taking a different action).

Now let us turn to mindful approaches to choice. How do we draw distinctions anew? By referring to properties of objects, events, and phenomena. How do we know of these properties, and how do we know that these properties will ‘hold’ in the future? By a mechanism akin to induction. We use spatiotemporal boundaries to categorize events, and we assume a Euclidean geometry of space, coupled with a Newtonian conception of time (flowing equably from an absolute past to an absolute future). How do we know that such a mechanism for categorization will work in the future? Because it has worked well in the past. What are the logical grounds for our belief in this regularity? Again, our experience. We reach the same sort of circularity which was reached by Hume in the case of causation, which requires some antecedent justification for the concept of causation not to be found in the elements or the temporal sequence of the elements of a presumed causal chain.

The idea of causation is also useful to an understanding of the nature of categories, and to their limitations and boundaries. Quite often, what makes the properties of objects or people what they are, and therefore what makes objects or people what they are, is their causal powers. The causal powers of a piece of chalk, for example, can be used to distinguish between properties that seem essential (like solubility in water and white color) and properties that seem inessential (like being in the left pocket of a person’s skirt, or being 300 miles south of a Ford Pinto – these properties can be altered by changing anything about the objects that they describe, for example, by shaking the skirt or moving the Pinto).

The category in which we place a person or an object has something to do with what we believe its properties to be – otherwise we would treat categories as mere conventions and would stop seeking to ‘make sense’ to one another in a more than conventional sense. Queries about causation will therefore also be queries about categories, to the extent that we use the causal powers of an object to draw the boundaries of a category to which that object belongs. If we challenge the notion that causation is ‘objective,’ or that it reflects a property of reality that is independent of our minds, then we will simultaneously challenge the notion that the categories which we are currently using to organize our experience are objective, and accept the role of the mind in determining what we refer to as real. In as far as the history of people’s presence in the world is also a history of people’s ideas about the world and therefore of the relationship between their minds and their experiences, we are interested in mindfulness as a way of looking at the evolution of ideas. Mindless approaches to experience map onto dogmatic perspectives, whose exponents seek to ‘prove,’ verify, or justify their theories by means of repeated confrontations of the theory and data sets that emerge from preplanned programs of empirical investigation. Mindfulness, on the other hand, does not entail a single approach to the evolution of consciousness or awareness of the world. A commitment to any particular epistemological program entails a commitment to a particular set of categories, and to a discursive form of referring to those categories. Such a commitment therefore runs contrary to an unconstrained way of knowing the world, and to a fallibilist approach to knowledge.

We shall consider, in what follows, the two most well-known approaches to the historical evolution of concepts: Karl Popper’s description of the evolution of ‘objective’ knowledge by a repeated process of trial and error carried out by many (like-minded, fallibilist) people over a long period of time, and Georg Wilhelm Friedrich Hegel’s description of the evolution of consciousness through a dialectic process, by which ideas are refuted or negated, and expanded and turned upon themselves by confrontations with their antitheses and transformations into syntheses. These descriptions of the passage of the mind through the world are illuminating, but not unique or necessary. We will argue that they *describe* possible mindful approaches to the world – in the sense that they incorporate openness to new information and alternative points of view and leave open the creation of new categories – but do not *define* or otherwise constrain such approaches. Furthermore, neither has a built-in mechanism for excluding a mechanical, automated, or mindless application of its form to the problem of reconciling our cognitions with our experiences. We shall

explore – in order to illustrate this antinecessitarian point – some alternative descriptions of the evolution of ideas in time.

Popper and the Discourse of Trial and Error

Popper wanted to portray the evolution of human thought as a sequence of trials and errors, which leads to a ‘growth’ of the knowledge we have of the world. The ‘scientific method,’ which his *Logik der Forschung* is credited with making explicit, is a process by which a person faced with a concrete problem offers, tentatively, a theory by way of a solution to that problem.

He then proceeds to criticize that theory, most importantly from an empirical standpoint, by comparing the predictions and empirical statements of that theory with empirical observations of the phenomenon one is trying to predict, influence, or control. A theory withstands or does not withstand such criticism according to whether or not the empirical statements it generates are *logically* contradicted by the empirical statements generated by the experience of the person in question.

The logical law of the excluded middle – by which a statement is either true or false, but not both, nor neither – is therefore the engine of progress in the history of knowledge, in Popper’s model. Theories that have withstood the most vigorous criticism of this sort are accepted only provisionally. Their ultimate truth or falsity remains forever an open question.

The only apparent constraint which the scientific method places on the scientist is that of adherence to a particular form of criticism – that of empirical testing – which requires that theories be expressed in a falsifiable form, or a form which makes them refutable by empirical observations. The scientist is free to use any association of thoughts and ideas, any conceivable ontology, and any means of generating empirical statements from these thoughts, in order to arrive at the empirical statements required by Popper. Furthermore, one of the desiderata which the scientific method seems to strive for is that of openness to new information, which it accomplishes by requiring that theories be put through the most rigorous empirical tests, and accepted only provisionally when they have passed these tests.

It must be observed, however, that the application of the scientific method critically depends on the application of the law of the excluded middle in order to adjudicate between alternative hypotheses. The disappearance of this ‘engine of natural selection’ among competing theories is what makes the dialectic, to Popper’s mind, unappealing as a description of the evolution of knowledge. He argues that the simultaneous acceptance of thesis and antithesis via their incorporation into the synthesis, in the case in which they contradict one another, amounts to the acceptance of *any* proposition whatsoever, by a straight application of the laws of logic. This criticism, however, is based on the assumptions that the collective, shared consciousness of the world which is generated by the application of the scientific method is in fact an objective knowledge of the world – a knowledge whose truth-likeness is not dependent on the interpretative acts and thoughts of a person possessing it, and that the progress of objective knowledge is ‘powered’ by the application of the law of the excluded middle for the purpose of criticizing theories. The first assumption is required because Popper

makes knowledge itself – rather than the consciousness of the knower – the subject of his criticism.

Describing knowledge as an objective, independent entity requires us to create a rule separating actuality from mere possibility, whereas saying that only states of consciousness – combining knowledge with the will to know – exist does not entail the rejection of contradictions on the grounds that they can generate any statement, unless we also assume that there exists the will to apply the laws of logic to that end. One must *want* to generate the universe of all possible statements from a contradiction in order for this universe to come into being. Accepting either of these assumptions is the outcome of an act of will – their acceptance is not required by any sort of precognition or ascertainably true precondition.

That such an acceptance of the assumptions underlying the scientific method *must* be the outcome of an act of will – rather than the inevitable consequence of the aim of arriving at truth-like descriptions of the world – is supported by the proof that Popper’s definition of verisimilitude cannot be used to discriminate between two false theories so as to judge one theory to be more truth-like than another theory. In conjunction with Popper’s fallibilist doctrine – which states that all theories are sooner or later shown to be false – the result entails that there is no ‘progress’ in scientific knowledge – at least not to the extent that progress is defined by the evolution of more truth-like theories out of less truth-like theories.

Hegel and the Dialectic Process

The dialectic evolution of thought is based on the interplay of three concepts. The thesis is an idea or a proposition that emerges or is put forth; the antithesis is a refutation or negation of the thesis. It springs forth against the thesis, seeking to deny its substance. The synthesis represents the merging together of the thesis and the antithesis, perhaps with the aim of recognizing the merits and limitations of both. The synthesis then itself becomes a thesis, and the process begins anew. Hegel introduces the idea of the dialectic by way of an example which suggests that he did not think of the thesis and the antithesis as propositions which may be connected by a logical relationship like mutual contradiction, and reminds us that he did not hold fast to the definition of truth as a correspondence between the content of a statement and the content of an observation.

The bud disappears in the bursting-forth of the blossom, and one might say that the former is refuted by the latter; similarly, when the fruit appears, the blossom is shown up in its turn as a false manifestation of the plant, and the fruit now emerges as the truth instead. These forms are not just distinguished from one another, they also supplant one another as mutually incompatible. Yet at the same time their fluid nature makes them moments of an organic unity in which they not only do not conflict, but in which each is as necessary as the other. . . .

Whereas the scientific method assigns a predominantly *critical* role to the mind, Hegel’s view assigns the mind a creative and generative role. Not only does consciousness of the world change over time, but the criteria for demarcation between illusion and consciousness also change. No such freedom is available to one who follows the scientific method, who must conform to a correspondence theory of truth and

to the law of the excluded middle in order to keep the engine of criticism running.

Two Alternative Views of the Evolution of Mind

The processes of dialectic reasoning and of trial and error are two of several possible approaches to the evolution of thought. The following two are put forth as examples based on loosening two of the constraints which logical structure places on the method of trial and error proposed by Popper. Because Hegel's broader conception of the evolution of consciousness by a process of turning-upon-itself can be seen to subsume both the idea of the dialectic and discursive alternatives to Aristotelian logic, the two examples can be interpreted as workings-out of that conception.

Necessity, possibility, and the openness of the past and present

If we were to replace the relation of necessity or entailment in logic with one of possibility or enablement, we would achieve a discourse which highlights the role of the processes of imagination and interpretation, rather than that of calculation. The reason for this is that the number of possibilities – or options for action or belief – that we can generate increases with the number of interpretations that we can give to our current psychological states. If an experience is categorized unconditionally, in a way which inhibits further, playful consideration of its meaning, penumbra, or resonance, and if the categories we use are, in our minds, linked by relationships of logical necessity, then the states that we are led to by a single experience will be determined or fixed by the working of the logical apparatus we have at our disposal. Increasing the number of interpretations that we are willing to give to a single experience therefore will also increase the number of possible options for action or the number of possible psychological states which we can take on following that experience.

The replacement of the logic of necessity with the logic of possibility can be accomplished by an exchange of the will to know, or determine or control the future for the will to play with our relationship to the present and the past. Popper argued persuasively, in the context of his numerous lucid presentations of the scientific method, that 'the future is open' in the sense that our subsequent experiences may at any time refute our current beliefs. Loosening the bolts of logical argumentation can lead to psychological states in which the past and present are also open to creative interpretation – at the cost of a decreased sharpness of the relationship of denial or refutation.

Participation, the interpretation of events, and the openness of ontology

If we replace the process of constataion or 'passive' observation that is supposed to provide the empirical tests of a theory with a process of participation or creative interpretation in the experience which we now describe as observation, then we will arrive at a 'story' about the evolution of knowledge that is markedly different from that embodied in Popper's account of the scientific method. The approach that emerges is based on the relationship between the observer's observation of an event and his conscious participation in his observation of

that phenomenon. For example, one could be observing an event, observing oneself observe that event, and observing the observation of the observation. The resulting state of mind can be reduced to a mere constative statement by the reductively minded scientist. However, such a reduction would prevent us from exploring the possibilities which the quality of reflexivity – or active participation in our own experiences – affords us. We could not, for example, gauge the effect of the observation on ourselves, or the effects of becoming conscious of that effect, and so forth.

A reductionist approach also truncates unnecessarily our representation of experience: if the essential properties of an object or person are connected to its causal powers, then the results of someone's experience of that object – her thoughts and actions, including the names she gives that object – are part of the causal powers of the object. Calling a facial expression a smile, for example, becomes part of the essential properties of that event – since a smile can be the cause of another smile or of a grimace.

Loosening the constraints we place on the link between experiences and statements about experiences leads us to an approach to descriptions which is reflexive as well as constative. In turn, this approach permits the incorporation of the process of interpretation and conscious participation of an event into the description of that event, and therefore makes the description open to revision after confrontation with additional information, or with the interpretations which others give to the same event. As in the case of the replacement of the logic of necessity with the logic of possibility, the replacement of descriptions closed to reflexive interpretation by descriptions open to reflexive interpretation must be the outcome of a will to replace a focus on predicting or expecting a particular future with a concern for an active participation in the present. The replacement of descriptions with reflexive interpretations leads to an ontology – a representation of what exists – that is itself open to evolution.

Mindfulness, Creation, and Discovery

We are accustomed to thinking about the process of artistic creation in sharply different terms from that of scientific discovery. On this view, the artist creates new forms and images from inherent or given elements, whereas the scientist breaks down his perceptions and observations into elemental components and systems, in order to understand them. Whereas 'reality' for the artist involves a component of active participation of her mind and is therefore created, enacted, or brought about by a conscious act of will, for the scientist 'reality' is an object of passive observation – of discovery through repeated observations and criticisms of those observations. In all instances, 'reality' stands independently of the will and imagination of the scientist, and his involvement in it is either passive or supposedly governed by the impersonal laws of rational discourse. Thus, just as reason and desire, or affect and cognition, are thought of as independent aspects of being, so the scientist's contemplation and analysis of reality is divorced from the artist's creation and interpretation of it.

We would like to show that this view is mistaken, by showing that the hypotheticodeductive method can be

understood as one possible instrument of interpretation, whose application leads to intelligible results by an act of will and imagination very similar to the artist's activity. Testing a hypothesis by comparing its content with that of empirical statements is a process whose outcome depends on the choice of hypothesis and the interpretation of an observation used to produce an empirical statement. Even simple empirical attributes like 'being red' are outcomes of an interpretation of a sense datum, rather than direct representations of that datum. Attempts to 'depersonalize' observations by substituting 'emitting radiation with a wavelength of $x \text{ nm}$ ' for 'being red' replace one act of interpreting a sense datum (i.e., interpreting a sensation by the proposition 'is red') by another (i.e., interpreting a visual perception by the proposition 'is equal to $x \text{ nm}$ ').

When by 'observation' we mean 'intelligible empirical statement,' there is no 'immediate' access to our experiences: the mind participates, to a greater or lesser extent, in the creation of an intelligible interpretation.

The process of generating hypotheses that can be tested against a set of empirical statements or theories which inspire new programs of empirical inquiry can also be interpreted as a creative process. We have, to begin with, considerable freedom to choose the elementary propositions – or axioms – which will lead to a set of mutually exclusive and collectively exhaustive hypotheses that can be tested against our 'intelligible empirical statements'. Events – in and of themselves – cannot refute or corroborate one another. It is only statements about events that can stand in such logical relationships *vis-à-vis* one another, and then only relative to a system of self-consistent axioms. If we were to admit contradictory axioms to stand side by side in a logical system, then we would have to accept any hypothesis as following with equal logical force from those axioms, and therefore would have to accept any hypothesis as being corroborated by any empirical statement.

To see this, consider how we might produce equally logically impeccable proofs of the statements, 'the president beat his wife' and 'the president did not beat his wife,' from the logically contradictory statements, 'today is Tuesday' and 'today is not Tuesday.'

First, from the premise 'today is Tuesday,' we can deduce the consequent, 'either the president beat his wife or today is Tuesday' (since $p \rightarrow p \wedge q$). Second, from the two premises 'today is not Tuesday' and 'the president beat his wife or today is Tuesday,' we can deduce the consequent, 'the president beat his wife' (since $\sim p \ \& \ (p \wedge q) \rightarrow q$). By an analogous process, we can prove the proposition, 'the president did not beat his wife,' or any other proposition that we choose.

It follows from this argument that the process of hypothesis testing only establishes the truth value of the tested propositions if the theory that generates the alternative hypotheses is self-consistent. If the theory contains a contradiction, then any hypothesis can be derived with equal logical force from it, and the test of a hypothesis will no longer provide an empirical test of the theory in question.

To illustrate the difference between creation and discovery, consider how we might describe the process of proving a hypothesis like 'there are no more than 220 prime numbers in the set of the first 1000 real numbers.' (A prime number is a whole number which is divisible only by one and itself.)

The aim of this example is to show that even cases of cognition that appear to sharply constrain the process of 'knowing' and to leave little room for the mindful will of the 'knower' can be thought of as creative processes, and leave room for the imagination of the 'problem solver' or 'innovator.'

The argument, as given by Gabriel Stolzenberg, may go as follows:

The number of primes that come up in the first 1000 natural numbers already 'exists', as a property of the system of whole numbers. Whatever this number is, it is only our imperfect computational powers and memory that is preventing us from knowing it at this instant. We can, given time and some computational resources, remedy this deficiency and produce an algorithm – like the sieve of Eratosthenes – which can produce the correct number of primes whose values lie between 0 and 1001. This calculation will then provide an answer to the problem – an answer which already 'exists', independently of our cognition of it. Therefore the act of producing that number is one of discovering the correct answer, just like we might discover an object hidden by a friend in a place known only to him in a crowded room.

This argument assumes that once we have constructed a logical structure, that structure has a series of properties which can be understood in a way which does not depend on the mind that is performing the process of understanding.

Stolzenberg further argues that the number of prime numbers lying between 0 and 1001 is a state of knowledge, not an objectively existing quantity. We create, by our counting of those numbers, or by applying a particular algorithm for generating the number of primes within a certain value range, a state of consciousness or a state of mind corresponding to the representation of a number. Once we have created that state of mind, we can easily communicate it, by means of a written or spoken word, to another mind, thus creating an inexpensive 'replica' of this state of mind. Without the will to create that state of mind – indeed, without the will which created the representation we know as the system of numbers – there would have been no 'matter of fact' about the proposition, 'there are at least 220 prime numbers lying between 0 and 1001.' The argument can be developed further, and in a way which highlights the advantages of seeing the proof of the proposition as a process of creation. Whereas the outcome of a process of discovery is a finite number or fact, perfectly matched to the demands of the demonstration or the question asked, the outcome of the process of creating a state of mind is a complex mental object which has many qualities. For example, part of the state of mind that is created by computing the number of primes that occur between 0 and 1001 may be the complexity of the algorithm used to calculate the number and the annoyance produced by the waste of time spent computing, or an appreciation for the aesthetic value of the algorithm. Part of that state of mind may also be a fresh insight into the distribution of primes in the natural number system, or an inspired guess at the proof of an 'unsolved' problem of number theory. If the problem solver reflects upon the state of mind that she has created as part of the process of answering a question put to her, she will be aware of these qualities and heed the temptations packed in each of them: to refine the algorithm used or to attempt to create a proof of an unsolved theory. By contrast, if the process is understood as one of discovery, then the quest of the mind is 'at an end' once it has reached an answer.

Concluding Comments

If one grain of sand does not suffice to change something from a heap of sand into a nonheap of sand, and if a 10 000-grain pile of sand is a heap, then a 9999-grain collection is also a heap. If we apply the process recursively 9999 times, we arrive at the conclusion that a grain of sand is a heap. If we start from the premise that a 1-grain collection of sand is not a heap and apply our little logical machine in reverse, we discover that a 10 000-grain collection is not a heap, which means that it is a heap and is not a heap simultaneously, from a logical point of view. But, since any statement follows from this contradiction, referring to 'heaps' presents a problem to those who want to test hypotheses about the properties of heaps.

Attempting to provide a logical justification 'from first principles' for categories formed by the mind on the basis of experience and expectation, and thus to 'ground' or even to constrain the process of forming categories, is a misguided enterprise: it is self-defeating by the standards of success of its own practitioners.

The transition from a view of experience as the chronic instantiation of the same 'forms' or categories to one which continuously creates new representations will most likely hinge on people's will to exchange the logic of necessity and the spirit of discovery for the discourse of possibility and the process of creation.

See also: Dialectical Thinking: Further Implications for Creative Thinking.

Further Reading

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Relevant Websites

- www.ellenlanger.com – Ellen Langer (author's website).
- www.emindful.com – Evidence-based mind body wellness.

Claude Monet 1840–1926

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Claude Monet (1840–1926) was a Painter whose works from major phases include: First – *La Grenouillere* (1869), *Regatta at Argenteuil* (1872); Second – *Wheatstacks* (1890), *Poplars* (1891), *Rouen Cathedral* (1894), Third – *Water Lilies/Grandes Decorations* (1920).

Monet did not independently invent Impressionism; however, he was the Impressionist who reinvented it, twice. The reinventions were both incremental and radical. Incremental in that they were based on gradual refining of Monet's goal criterion (show how light breaks up); radical, in that realizing the refinements eliminated the object as subject.

Monet's reinventiveness, in the face of (indeed flouting) success, raises two questions: why and how. Answers are suggested by work on habitual variability levels and constraint models of creativity. We begin at the beginning, when skills along with variability levels are acquired.

Apprenticeship: Learning and Learning to be Variable

Giftedness is the product of plasticity: the gifted child's brain responds more readily to particular aspects of the environment. From this responsiveness ensues early engagement, and accelerated pursuit of skill, in the domain of the gift. The key words here are early and accelerated. According to learned variability theory, learning *how* to do something (the skill) includes learning *how differently* to continue doing it (the variability level). Acceleration involves rapid progression from one aspect of skill acquisition to another. By precluding repetition, it promotes and rewards high variability at the time (early in exposure to a domain) when variability levels are established.

Once a level is established, a task demanding higher variability will produce anxiety, one requiring less will result in boredom. In either case, the individual is motivated to regain his habitual, therefore, comfortable level. Why Monet's radical reinventions? Habitual high variability is a possibility.

Consider. Monet's gifts were recognized early, rewarded often, and expanded rapidly. Text and exercise books margins were, the artist wrote in a letter, "garlanded ... and decorated ... with fantastical ornamentation." Profiles of his teachers, and prominent citizens of Le Havre, were caricatured: gigantic distorted heads atop tiny torsos and spindly legs. From caricature come two important aspects of Monet's work (on which we will later elaborate): elimination and exaggeration.

At the framer's shop where the young artist's caricatures were sold (i.e., recognized and rewarded), Monet met Eugene Boudin, a painter of small, airy, beach scenes. The year was 1858; it marked the start of Monet's painting apprenticeship. From Boudin, Monet learned how to paint (quickly, the product a colored sketch), what (nature), and where (outdoors, *en plein air*). Note the relationship of caricature and sketch:

both are reductions, selections. Note too, that Monet attributed Bodin's sketches to what he called 'instantaneity' or 'immediacy.' As we shall see, the immediate would morph into the moment, into a series of moments.

The remainder of Monet's apprenticeship took place in Paris, partly at the studio of Charles Gleyre (begun 1862); more importantly, in the company of three other Gleyre students (Auguste Renoir, Alfred Sisley, and Frederic Bazille) and outdoors, in Chailly (near the forest), Normandy (near the sea), and Paris (near the Seine). A pair of paintings done simultaneously by Monet and Renoir (*La Grenouillere*, 1869) introduced the early Impressionist style, and ended the apprenticeship.

Digression: Solution by Substitution

So far we have an answer to our first question about the repeated reinventions (why?): a high variability level acquired early in skill acquisition. Before continuing with the career, we discuss (briefly) the paired-constraint model used to answer the second (how?).

The model assumes that creativity is a problem, and that solution takes place in what is called a problem space. The space has three parts: an initial state (in painting, an existing style), a goal state (the new style), and between the two, a search space (to select elements of the new style – motifs, materials, etc.). The problem is solved incrementally, search is carried out step-by-step, in a series of substitutions. The substitutions involve paired constraints. One of each pair restricts (as in common usage) or precludes pursuit of a solution path in one part of the search space; while the other directs or promotes pursuit in another. As Monet's development will show, an initial substitution can generate a cascade of constraints that together constitute and define the new style.

Mastery: Inventing and Reinventing Impression

A key element in the invention of Impressionism – other than *plein air* painting – was the color wheel. Contemporary color wheels are crude by comparison to Chevreul's which broke the three primary and three secondary hues in 72 adjacent, but separate, segments showing complementary and contrasting colors. The latter (contrasting colors) were employed by Delacroix, whose diaries, recording their use, were read by Monet. A consequence of the wheel for early Impressionism was substituting contrasting colors for blacks and browns when painting shadows.

A lasting consequence was Monet's continually refined goal criterion: showing how light breaks up – on things, between things, and finally, by itself alone. The progression combines

goal criterion with Monet’s earlier strategy, derived from caricature and color sketch: eliminate and exaggerate.

Solution by Substitution I: How Does Light Break Up on Things?

Painting when Monet arrived in Paris depended on light–dark (i.e., value) contrasts to depict depth. Darks were muddy, browns and blacks. In an early Salon entry, *Woman in a Green Dress* (1866), Monet painted the floor brown, the background, an even darker brown-into-black. His model’s jacket is black trimmed with brown; the shadows under her brows, eye, and on her hand are also brown. Three years later, painting alongside Renoir, incremental changes appear: *La Grenouilliere* (1869) is a colored sketch; its subjects are simplified, its brush-strokes separate, but its shadows are still brown and black.

Regatta at Argenteuil (1872) shows how Monet realized his first goal. How does light break up on things? In clear, bright, clearly separated strokes of contrasting colors. The house at the far right of **Figure 1** (my much-simplified cartoon) is sketched in strokes of cadmium red and orange: in its reflection, the red and orange intermingle with the greens of tree and grass, and the blue of the sky. The cream colored sails are reflected in lozenges larger than those of house and tree. The shift in scale shows that they are closer, but both boat and house sit on the same surface – there is no depth of field between them.

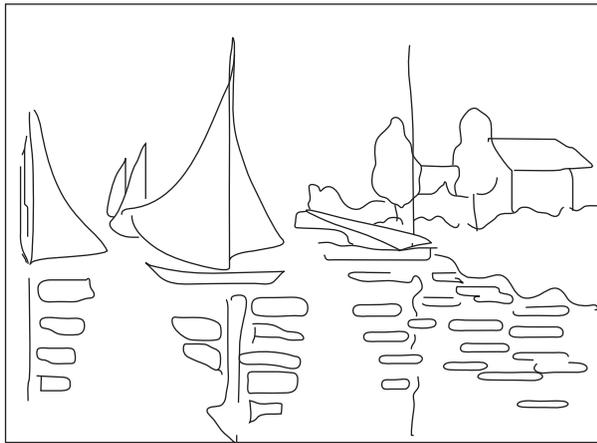


Figure 1 *Regatta at Argenteuil* (1872).

Table 1 Constraints for Phase 1

Category	Pairings
Subject	Preclude the object as subject → Promote the object as armature
Task	Preclude contrasts in value → Promote contrasts in hue
	Preclude sharp, precise edges → Promote soft, indistinct edges
	Preclude smooth finish → Promote mosaic of separate strokes
	Preclude depth → Promote surface

Table 1 presents the paired constraints that make this kind of painting possible. The constraints form a kind of cascade, one follows from, is necessitated by another. Given the goal, the subject is no longer the objects shown in the painting; they are now mere armatures on which light is to be broken. To do this requires substituting contrasts in hue for contrasts in value, which in turn precludes sharp edges. As indicated in **Figure 1**, objects with unmodeled surfaces and indistinct edges now merge and float to the surface.

Solution by Substitution II: How Does Light Break Up Between Things?

By 1891, Monet had become so sensitive to the slightest change in the light that he painted not one, but 23 versions of grainstacks. The titles tell the changes in time of day (*Grainstacks at the End of Summer, Morning Effect; Grainstacks in the Sunlight, Midday*), by time of year (*Grainstacks in the Winter; Grainstacks, White Frost Effect*). The same year also produced 24 versions of poplars; again at different times of day and in several seasons.

Monet was no longer painting light breaking up on things. His goal shifted along with his sensitivity. “The motif,” he told a reporter, “is secondary for me: what I want to paint is what there is between the motif and me.” The between was the envelope, ephemeral, every-changing. Boudin’s ‘immediacy’ (captured in the quick sketch) became Monet’s ‘moment’ (captured in a series of separate moments).

How does light break up between things? In *Poplars* (outlined in **Figure 2**), it breaks into the same hues, everywhere. The envelope is continuous, there are no local colors, only shared ones. The trees, their reflections, even the sky, share the same pinks and purples, greens and yellows. They are also equidistant from the viewer’s eye, interconnected, web-like, on the painting’s surface.

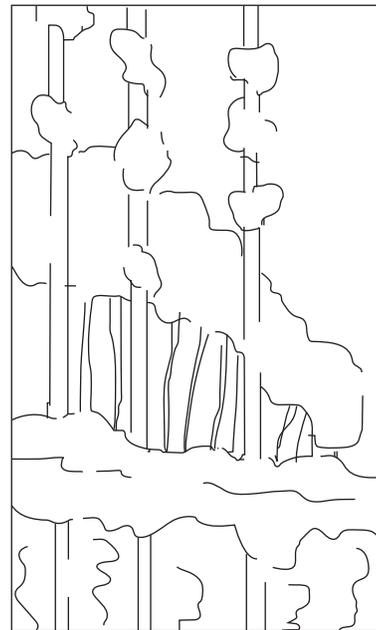


Figure 2 *Poplars* (1981).

Table 2 Constraints for Phase 2

Category	Pairings
Subject	Preclude the object as armature → Promote the ‘moment’
Task	Preclude change in motif → Promote variations of the same motif
	Preclude color of the object → Promote color of the ‘enveloppe’
	Preclude separation strokes → Promote interconnection, scumbling
	Preclude single point of view → Promote scattering of attention

The constraint pairs that accomplished this are shown in **Table 2**. Although the objects (grainstacks, poplars, later the façade of Rouen Cathedral) did not change, they were no longer the subject. Rather, their persistence allowed the painter to focus on the momentary, the every-changing light, quickly and summarily sketched in interconnected colors and brush-strokes that scatter our attention, purposefully diverting it from objects to atmosphere. Seen as a series, moment-to-moment, the paintings depict – in very slow motion – the passage of time.

Solution by Substitution III: How Does Light Break Up by Itself?

The large, late water garden paintings amplified everything Monet had done previously. Elimination and exaggeration are all. Instead of a series, the moment is extended in space. Indeed, as suggested by my sketch (**Figure 3**), it occupies all the space.

Objects (in Monet’s words, now ‘mere accessories’) loosen and lose their boundaries. Lily-pad fragments (ellipses in the figure) float on, and share hues (lavender, violet, teal) with the pond’s surface. Composition by shape is replaced with composition by color. Close-up, filling our field of vision, Monet’s color field redirects the eye (sans recognition) to the level of sensation. Light itself is breaking up, it is everything, and we are immersed in it.

Table 3 summarizes the final constraint cascade.

Applications and Summations

There are two things about Monet’s development that apply to all creativity of the domain-expanding kind.

One, early is important. Elimination and exaggeration are the essence of both the caricature and the quick sketch. The ‘immediacy’ of the later, became first, the ‘moment’ and finally, the immersion. Both strategy and goal were implicit in the initiation. High variability was sustained, and in turn, sustained the creativity.

Two, the radical is achieved gradually, incrementally. Each realization of Monet’s current goal led to its subsequent refinement. As the goal changed, so too the constraints that satisfied it. Importantly, it took time. Consider just the dates of the paintings we discussed: *Regatta*, 1872; *Poplars*, 1891; *Water Lilies*, 1920.

To demonstrate how early and incrementally combined in the career, we summarize, condensing steps that contributed to

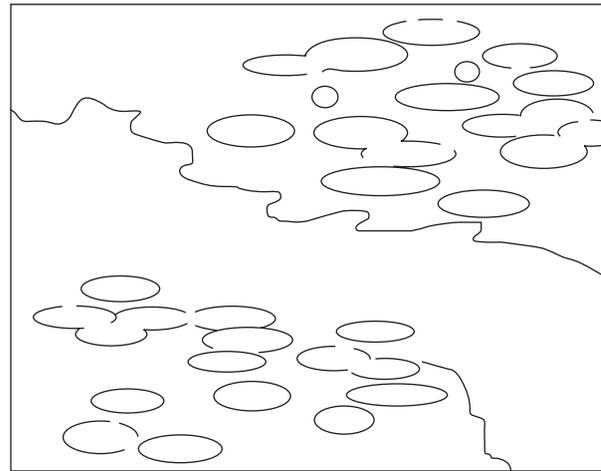


Figure 3 *Water Lilies* (1920).

Table 3 Constraints for Phase 3

Category	Pairings
Subject	Preclude series of moment → Promote extension of a single moment
Task	Preclude composition by shape → Promote composition by color
	Preclude boundaries → Promote color field
	Preclude recognition → Promote sensation
	Preclude attention → Promote immersion

the shift from the optically precise to the optically amorphous. Each step eliminated something and exaggerated its opposite.

- Obfuscating the object. In Phase 1, the object, broken into its constituent hues (eliminate the intact) was optically correct. In Phase 2, the object was camouflaged in the colors of the envelope (eliminate local color). By Phase 3, it was absorbed into the overall color field.
- Eliminating depth. In Phase 1, closely valued hues eliminated chiaroscuro, the dark–light contrasts that produced the illusion of three-dimensionality. Separate brush strokes floated to the surface. In Phase 2, the closely related values were common to all objects. Fore, middle and back grounds merged. In Phase 3, extreme close-ups eliminated everything but surface, of the pond and of the plane.

Concluding Questions

Was It Difficult?

This is a question I have asked before. Initially, my question was related to variability: more difficult constraints generate and maintain higher levels of variability. This time I am thinking about Csikszentmihalyi’s idea of flow. I do not think that it applies to creators like Monet, for whom it was very difficult, always, and never not.

Who said it was difficult? Monet himself, repeatedly, in letters from which we sample.

- In 1889, to his wife: “I’m back from work, a bad session, and I wiped out everything I did this morning; it wasn’t well realized or understood. It’s always like this to start with.”
- In 1890, to Gustave Geffrey: “I’m hard at it, working stubbornly on a series of difficult effects (grain stacks) . . . I’m getting so slow at my work that it makes me despair, but the further I get, the more I see that a lot of work has to be done in order to render what I’m looking for: the ‘instantaneity,’ the ‘envelope,’ above all, the same light spread over everything, and more than ever I’m disgusted by easy things that come in one go.”
- In 1893, to Alice: “Happy are the young people who believe it is easy.” And to Geffrey: “My stay here is advancing, which doesn’t mean that I’m near to finishing my Cathedral. Regretfully, I can only repeat that the further I get, the more difficult it is for me to convey what I feel and I tell myself that anyone who claims he’s finished a painting is terribly arrogant. To finish something means complete, perfect, and I’m forcing myself to work, but can’t make any progress; looking for something, groping my way forward, but coming up with nothing very special, except to reach the point when I’m exhausted by it all.”

Was It Flow?

Given the difficulty, it does not sound at all like flow, which is characterized as enjoyable. The enjoyment, moreover, is associated with clear goals, immediate feedback, and a balance between challenges and skills. While Monet did articulate his goals (e.g., paint the envelope), they were not clear in the sense of Csikszentmihalyi’s musician knowing “which notes to play next.” At best, Monet’s purposefully ill-defined problems may have become well-structured, in part, and temporarily. This is how Simon described ill-structured problems like designing a

house. During the solution process, the problem is broken down into subproblems which are well-structured and thus solvable, in part. The immediate feedback was, more often than not, negative. Finally, reread the last Monet quote: ‘groping’ does not sound like a skills-challenge match.

Ceaseless refashioning and refining of one’s goal criteria is rare. Most artists, like most experts, stay with (indeed are stuck in) successful solutions that (with minor variations) can sustain the conditions that support flow, but not domain-changing creativity. In short, most artists are not Monet.

See also: Behavioral Approaches to Creativity; Novelty.

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Moral Issues in Creativity

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Glossary

Creativity The generation of effective novelty.

Ethics Guidelines on how a moral person should behave.

Immoral creativity Creativity that places personal interests above the common good.

Infusion The entire school curriculum is influenced by a general principle (such as behaving in a moral way), rather than confining application of the principle to special, isolated lessons or activities.

Morals A framework for working out which behaviors are virtuous.

Moral creativity Creativity that seeks to promote the common good.

Moral development The process of acquisition of increasingly other-oriented, abstract, and general moral values in the course of personal development.

Moral education Education aimed at fostering moral development by instilling a sense of right and wrong into students.

Moral values Qualities of behavior that are regarded as inherently virtuous such as responsibility, fairness, integrity, sincerity, generosity, or fortitude.

Service learning Children learn by carrying out classroom chores, mentoring younger children, or performing service activities.

Wisdom The ability to balance individual and group interests.

The Nature of Morals

According to Marc Bekoff and Jessica Pierce, morality is "a suite of interrelated other-regarding behaviors that cultivate and regulate complex interactions within social groups." This definition directs attention squarely to the social nature of morals and, especially, to the central role of concern for the well-being of other people (morals are 'other-regarding'). Morals will be treated in this chapter in the sense of normative ethics: a framework for working out which actions are 'virtuous' and which are 'wicked' (e.g., good as against bad, right as against wrong, righteous as against objectionable, or worthy of emulation as against unworthy). Morals will not be examined in the sense of religious morality, where good and evil are defined by received beliefs and sometimes by specific rules dictating behavior in specified concrete situations, and transgressions are threatened with sanctions arising from divine displeasure. The focus in this article is on the implications of moral values for creativity. The core questions are: Can creativity be judged according to moral precepts of this kind? What can be done to ensure that creativity is moral (as against immoral) in the sense the term is used here?

Moral precepts are not physical laws or forces of nature such as gravity, but are ideals that have been worked out by philosophers, religious authorities or other thinkers, although they may have demonstrated their worth in people's practical experience of life (as the evolutionary view of morals discussed below particularly emphasizes). Morals and moral values are generally associated with a personal view of values, so that they are psychological rather than tangible. They often reflect the influence of religion or philosophy, culture, family, and friends. Morals are a matter of subjective internal conviction rather than concrete evidence or physical or even legal coercion. Although there is obviously a connection between them, morality and law are not the same thing. An example would be the use of creativity to persuade children to eat foods that

are harmful to their health (as in advertising). This is legal, but of dubious morality. On the other hand, cheating on your tax return is illegal, but is regarded by many people (perhaps most) as moral. (The relationship of law to morality will not be further dwelled upon in this article, because it lies outside the focus of the article.) Although moral transgressions may be punished by condemnation, rejection, public shaming, or other external sanctions, they are enforced at least as strongly by internal sanctions such as pangs of conscience or feelings of shame. The truly moral person behaves in a moral way out of personal conviction.

A sister topic to morals is ethics: Ethics is concerned with how a moral person should behave. Ethical behavior involves doing what is morally right and proper, and not simply what is legal or easy, that is, expedient. According to Plato, for instance, there are four 'cardinal' virtues (courage, temperance, prudence, and justice) which should guide actions. All other virtues are thought to spring from these. Immanuel Kant argued that there is a 'moral imperative' to treat other people with dignity, and never to exploit them as instruments of one's own satisfaction. According to John Locke, no-one should act in such a way as to harm anyone else's life, health, liberty, or possessions. For Locke, these were natural rights, given by God.

Unfortunately, despite Locke's attribution of moral principles to God, different observers' ideas of what is right and proper are highly subjective, and often differ sharply from person to person, from society to society, and, indeed, from era to era; Galileo's publication of his (factually correct) thesis that the earth rotates around the sun (and not vice versa) was regarded in his own time as so morally reprehensible as to constitute heresy, and led to years of house arrest. Thus, being factually correct does not guarantee moral or ethical goodness, especially where preexisting fixed sets of specific, concrete 'goods' and 'bads' exist, as was the case with Galileo. Nonetheless, some ethical values transcend cultural, religious, or ethnic differences, and thus involve something approaching

a universal moral worldview. Examples are responsibility, fairness, concern about the well-being of others, good citizenship, integrity, sincerity, trustworthiness, generosity, and fortitude, all of which are mentioned by numerous writers in the area. These writers are not all representatives of the Western, Aristotelian tradition. The Confucian construct of *ren* is an example of a broad definition of what is right and good that is widely accepted in Asian countries and beyond. *Ren* can be translated as 'righteousness.' It includes moral virtues such as loyalty, consideration, conscientiousness, or altruism.

Morality and Creativity

When applied to creativity, questions of morality are initially centered on whether creativity can be judged at all in terms such as 'good' versus 'bad,' 'virtuous' versus 'wicked,' or 'worthy of emulation' versus 'unworthy.' Robert McLaren pointed out that creativity has come to have a 'quasi-religious function' in modern life. He cited writers who emphasize that for many people it is, for instance, the new way of finding solace in an imperfect world in which religion no longer offers sufficient consolation. This spiritual tone was already present at the beginning of the modern creativity era. Jerome Bruner saw creativity as the last bastion of the human spirit in an age in which electronic devices are taking over most noncreative functions: It thus marks the boundary between the human being and the intelligent machine. Discussions along these lines have not infrequently argued that creativity is a primal force of nature, and that it is, by definition, a universal beneficial factor fostering growth and rebuilding in all organic systems, and is thus automatically good. Brian Henning referred to creativity along these lines as "the *dynamic process* of the universe [emphasis added]." As a result, according to Friedrich Nietzsche, creativity involves "*deification* of existence [emphasis added]" and is beyond all considerations of good and evil.

However, despite Nietzsche's dictum it is difficult to regard, for instance, the effectively novel systems for killing people in large numbers generated by Hitler or Stalin, or the undoubtedly novel – since such a thing had never been seen before – as well as highly effective – it led to a large number of deaths and caused widespread disruption to various aspects of life in the United States – attack on the World Trade Center as the same in principle as the works of, let us say, Shakespeare or Mozart. It is conceivable that the cognitive *processes* are similar in all four cases (for instance, generation of alternative ways of seeing things, linking of ideas usually kept separate, or branching out from the known in a new direction). However, apart from the differences in the nature of the *products* – works of art vs. technological and management systems – there is a clear difference in the effects of the creativity of Hitler and Stalin versus Shakespeare and Mozart: on the one hand, death and destruction for people not actively engaged in any directly hostile activity, on the other, things of beauty. Furthermore, and of central importance for this article, there were substantial differences in the intentions of the *persons* involved: on the one hand a desire to generate truth and beauty, on the other, a desire to do harm and wreak destruction for essentially political purposes.

Nonetheless, even monsters of evil such as Hitler and Stalin are regarded by some people as having been great leaders.

Robert Sternberg made the point that both these men did indeed introduce high levels of effective novelty (including previously unknown systems for murdering people that worked well), and had a very substantial impact on their societies. However, as he pointed out, those who praise Hitler and Stalin as great men focus only on the novelty and effective impact of what they did. Sternberg argued that, while it is true that they produced what he calls 'originality,' in the absence of moral goodness they cannot be said to have been creative. This is in accord with the intuitive feeling of many people that it is disgusting to refer to such monsters as 'creative,' despite the fact that they generated effective novelty and, in this sense at least, really were creative.

In order to find a way of distinguishing systematically between the creativity generated by Shakespeare and Mozart (to remain with these two examples), on the one hand, and Hitler and Stalin, on the other, and thus to understand creativity more fully, it is necessary to consider not just the novelty and effectiveness of products, or the degree of divergence of processes, but also the 'goodness' or 'badness' of the outcomes (products) and the motives behind them (person), as well as of the processes that led to the outcomes. These issues lie in the domain of morals, and imply that not everything that is creative is moral, thus raising the idea of immoral creativity. The introduction of morality into discussions of creativity expands understanding of creativity beyond simply generation of effective novelty, as does the addition of aesthetics: consideration of whether the results of creativity are pleasing, elegant, or beautiful. This is not just an academic search for ever more differentiated conceptualization of a scholarly concept. Being able to distinguish systematically between the creativity of an Osama bin Laden and a Mahatma Ghandi – both of whom were interested in developing novel and effective ways of persuading what they saw as an oppressive foreign regime to withdraw – is essential for understanding matters such as how to foster and support the creativity of the one and counter, suppress, or perhaps rechannel the creativity of the other.

Immoral Creativity

The most obvious examples of immoral creativity are to be seen in the generation of novel products that harm other people. This involves what Keith James called 'negative' creativity. The harm to others can be simply a collateral effect; an employee who devises a novel and highly effective way of avoiding work may expose other people to the stresses of overwork, but this is not the primary intent of the negative creativity. Even more obviously immoral is creativity which has the deliberate and planned primary intention of harming others, referred to by me and my colleagues David Cropley and James Kaufman as involving 'malevolent' creativity.

A gray area is to be seen the field of crime. As Lorraine Gamman and Maziar Raein pointed out, "resourceful offenders" constitute a group "... whose creativity is rarely acknowledged." According to them, some "... criminal 'projects' may exhibit the 'wow' factor," and even represent paradigm-breaking creative breakthroughs. For this reason, observers are tempted to admire such projects, even though their intention is antisocial. Gamman and Raein mention the Great Train

Robbery, which is often cited in the relevant literature as an example of a criminal breakthrough with the 'wow' factor. Ronald Biggs, probably the most famous of the Great Train robbers, showed enormous ingenuity in escaping and successfully evading capture for many years, until old age and physical infirmity persuaded him to surrender. Despite the fact that one of the train personnel was severely beaten and died after seven years as an invalid, Biggs and his colleagues were widely regarded with sympathy or even admiration, and Biggs was subsequently pardoned by the UK Government in 2009.

Russell Eisenman gave easily understandable examples of the generation of effective novelty by criminals in the form of brief case studies of the use of creativity by prisoners in the correctional system to manipulate supervisory personnel to their own advantage, for instance to make it easier for them to smuggle drugs, while Jennie Singer gave the example of creative use by prisoners of unusual materials to make, for instance, a knife, intended for use against other prisoners. Thus, evil intention may nonetheless attract grudging respect, so that there is a certain moral equivocation associated with creativity.

Some negative effects are very difficult or impossible to anticipate: the lifesaving discoveries of Louis Pasteur and Edward Jenner, for instance, laid the foundation for germ warfare. Some people may even create obviously immoral products despite generally having positive moral values and wishing to behave in an ethical manner. They may, for instance, consciously or subconsciously blind themselves to the immoral consequences of their work, be unable to or unwilling to anticipate negative consequences, or succumb to temptation. This may occur, for instance, because of their fascination with what they are doing, or because they are deceived or coerced by factors like the prospect of money and fame or the manipulation of a despotic government. Maria Zaitseva gives the example of how this happened with some participants in the Soviet Union's program for the development of weapons of mass destruction, while David Hecht made a similar analysis of the role of American nuclear scientists in the US atomic bomb program late in the Second World War.

A related moral issue in connection with creativity is described by Kevin Hilton. One person's acclaimed and highly respected artistic/esthetic creativity may inspire another person's antisocial behavior, despite the absence of any negative intention on the part of the creative individual. An obvious example is the copying of evil deeds depicted in imaginative works. Hilton gives the examples of a murder committed using a technique described in the novel *Shibumi*, and a double murder committed by copying a scene in a Clint Eastwood film. Another example is the 'Werther effect': a wave of suicides inspired by Goethe's book *The Sorrows of Young Werther*, which caused the book, a masterpiece by one of the world's greatest authors, to be banned in several countries. An artistic creation that is successful in informing, entertaining, even inspiring readers, listeners, or beholders (which seems moral enough), may simultaneously encourage, promote or provide models of behavior which should not be emulated. Perversely, it even seems that in such situations more novel and effective creativity is more likely to promote antisocial behavior: the greater the creativity, the worse the negative effect.

The Clash of Moral Creativity with Private Interests

The crucial event that started the modern creativity era was the widely felt need in the Western world for novel products capable of contributing to the welfare and safety of society during the Cold War. In other words, the initial impetus involved concern about the general good. With the passage of time, however, the beneficial effects of creativity came to be looked at mainly in terms of the advantages it brings the individual: personal growth, self-fulfillment, and similar aspects of individual well-being. The result was that the purpose of fostering creativity came to be seen as promoting the personal development of individuals, not fostering the common good. Margaret Boden pointed out that this involves the risk of making the main purpose of creativity 'glorification of individuals,' a goal far removed from justice, altruism, fairness, or promoting universal well-being, and therefore on shaky moral ground.

Indeed, the generation of effective novelty that contributes positively to the common good – moral creativity in the terms of this article – is not necessarily greeted with unrestrained approval by all parties concerned. Introduction of such novelty may conflict with private or narrow interests, and the two may clash. Sometimes selfish interests prevail, even when the effective novelty makes a massive and obvious contribution to the common good. In such cases, moral creativity is blocked by self-serving ways of looking at things. A historical example is to be seen in what happened to the Austrian obstetrician, Ignaz Semmelweis. In 1840, he dramatically and rapidly reduced the incidence of death from puerperal fever in the lying-in hospital in Vienna simply by requiring the obstetricians under his supervision to wash their hands before touching women who had recently given birth, thus avoiding cross-infection, although this concept did not exist in Semmelweis's time. However, this novelty, although highly effective in reducing the death rate, was seen by other doctors as implying that they were dirty. Far from showing gratitude, his colleagues labeled him a crackpot who was insulting their honor, and he was rejected and hunted into madness. The death rate returned to its earlier levels! The private interests of the other doctors prevailed despite the overwhelming evidence that the novel procedure was capable of making a substantial contribution to the common good.

Immorality Inherent in Creativity

Despite the conclusion of some writers such as Mark Runco that creativity or creative thinking processes are neither moral nor immoral in themselves, or even that creativity is above such considerations, the problems associated with morality in creativity are, to some degree at least, inherent in creativity itself. The essence of creativity is changing what currently exists. Among other things it:

- shakes the foundations of the received order and brings uncertainty for other people;
- questions the value of existing knowledge and skills (often laboriously acquired);
- threatens loss of status and authority for experts, leaders, or established creators;

- encourages dissatisfaction with the *status quo*, restlessness, or rebellion;
- encourages putting your own needs and resolving your own dissatisfaction ahead of the needs of others;
- opens the doorway to dark and destructive material that needs to be handled with great caution (see below).

These processes can easily become destructive, especially if they are self-centered and self-serving, or are applied recklessly. They yield moral results only when they promote fairness, justice, good citizenship, altruism, and the like, rather than furthering the narrow self-interest of an individual or a special group. Thus, the seeds of immorality are inherent in the very nature of creativity.

One of its potentially destructive aspects of creativity is that it involves dissatisfaction with what already exists and an inability or unwillingness to accept the *status quo*. Arthur Miller referred to Albert Einstein's description of how his recognition that existing theories of electrodynamics were inadequate motivated him to develop the special theory of relativity and then the general theory. Einstein continued to be dissatisfied with his own theory, and worked on it for much of the rest of his life. America's most distinguished inventor, Thomas Alva Edison, was never satisfied with his own inventions, and over the years took out more than 100 patents on the electric light bulb alone. Michael Mumford and Peter Moertl described two case studies of innovation in social systems (management practice and student selection for admission to university), and concluded that both innovations were driven by 'intense dissatisfaction' with the *status quo*. Thus, seeing that something is wrong with existing knowledge, criticizing this knowledge and seeking to overthrow it are core elements of the creative process. These can be very threatening for people around the creative individual.

Focusing on artistic and aesthetic creativity, Liane Gabora and Nancy Holmes gave examples of its destructive power, listing, for instance, numerous twentieth century poets, writers, musicians, and painters who committed suicide. They also reviewed discussions of the question of whether creativity causes psychological disturbance or psychological disturbance leads to creativity. They referred to the 'shadowy swamplands of the creative mind,' and suggested that creativity may lead people to delve into destructive elements of the unconscious in a process of 'deep mining into the darkness,' sometimes bringing to the surface material that less creative people – wisely – leave undisturbed. They suggest that precisely this process of going where others fear to go may lead to an 'allure of darkness' that makes the immoral side of creativity attractive to some creative individuals as well as to some of the people who admire their work, sometimes with ultimately destructive results. Is such creativity moral, or immoral, even if it yields works of great artistic merit?

Moral Creativity

Among other things, moral actions are responsible, promote fairness and the well-being of others, lead to justice, and contribute to good citizenship. The implications for creativity are obvious: moral creativity seeks to generate benefits for all,

and is motivated by the wish to promote the common good. The idea that moral creativity can be defined in such a straightforward and yet broad and sweeping way as generation of effective novelty that seeks the common good may seem excessively simplistic. However, it is consistent with the views of philosophers who have wrestled with the issues at stake. Immanuel Kant defined creativity as "the aspiration to create a perfect world for *everyone* [emphasis added]." He also defined creative genius in terms of producing ideas that are both original and *exemplary* [emphasis added]. By 'exemplary' he was referring to the categorical imperative to fulfil one's moral duties. Brian Henning worked out a number of 'obligations' for moral creativity from the writings of Alfred North Whitehead: The obligations include beauty (to bring about the *widest possible* universe of beauty [emphasis added]), love (to maximize the intensity and harmony of oneself and *everything within one's sphere of influence* [emphasis added]), and peace (to avoid destruction). All of these obligations involve a responsibility to avoid doing harm to others and to promote the common good of the larger society.

Recognition of the link between moral creativity and furthering the well-being of other human beings is not new. The Chinese Emperor, Han Wudi, who reigned until 86 BCE, was intensely interested in finding innovative thinkers and giving them high rank in the civil service, and reformed the method of selection of mandarins to achieve this. Both Francis Bacon and René Descartes, two of the founders of modern science, saw creativity as involving the harnessing of the forces of nature for the betterment of the human condition (i.e., for moral purposes).

How Do People Become Moral?

Moral creativity can bring great benefit for human beings and their environment, but immoral creativity can bring great harm, as was discussed above. It seems to lie in the public interest that creative people possess positive moral values and apply them to their own behavior. How does this occur? Evolutionary biologists and sociobiologists believe that morality develops as a result of evolutionary forces. Seeking justice, fostering the well-being of others, showing courage, co-operating with others, and similar behaviors are not the only behaviors of which people are capable. Unfairness, lack of concern about others, avoiding danger, and exaggerated individualism are also possible (and indeed, are not especially uncommon in real life). The widely accepted morality outlined above is thus not absolute, but relative, and in theory any set of values could be adopted. However, properties such as justice, concern about the well-being of others, co-operation and courage enhance the survival both of the individuals who display them and also of the collective to which the individuals belong. As a result, such moral values have come to prevail through the process of natural selection. Simple versions of what humans regard as morality are seen, according to biologists, in all species. The greater complexity of human moral systems is attributable to their greater brain size, living in larger groups, and more complex interactions among individuals and groups.

In psychological thinking, however, the acquisition of moral values is mainly regarded nowadays as the result of learning from other people. According to the psychoanalytic view, morals are imposed upon the developing child by its parents, and are resident in the super-ego, from where they may cause neurotic symptoms in the individual when they conflict with innate drives that are oriented towards the satisfaction of individual, self-centered urges, possibly at the expense of the collective. However, the most influential modern description of the psychological process of moral development is that of Lawrence Kohlberg, who further developed the work of Jean Piaget. According to Piaget, development is not merely the result of gaining more knowledge, but consists rather of a sequence of qualitative changes in the way an individual thinks. This involves moving from understanding events in terms of their immediate concrete properties and effects (as in the case of young children) to understanding them in terms of abstract, general principles (as is the case in cognitively well-developed individuals). Within any stage of development, thought is organized according to the constraints of that stage: the understanding of morals grows in parallel with cognitive growth in general.

Kohlberg proposed that children acquire understandings of concepts such as justice, equality and concern about the welfare of others as they move through a series of six developmental stages. At the lowest level, young children define right and wrong in terms of immediate concrete effects on themselves (e.g., an action is bad if you get punished for it – Stage 1, or an action is good if you get something desirable out of it – Stage 2). As children become more cognitively mature, they come to understand that other people have interests that differ from their own, that these may also vary from person to person, and that good and bad reflect an interplay among the array of interests. At the highest level, people understand that morals are higher-order abstract principles that promote smooth functioning of the society at large, and are based on reciprocal relationships marked by characteristics such as trust, loyalty, respect, or gratitude; these protect everyone, not just in the short but also in the long term. There is an understanding that morals such as, for instance, respect for life and human welfare transcend particular cultures, societies, and eras. Although Kohlberg's stages may no longer be regarded as a literal and exact description of the course of moral development, they offer substantial insights into the course of moral growth and how to foster it (see below).

How Can Moral Creativity Be Fostered?

This section focuses on the contribution of education to the growth of moral creativity. The traditional approach involved teachers explicitly advocating virtues such as honesty, kindness, patience, or strength, for instance through direct communication of their belief in such virtues, by personal example, and by giving students opportunities of practising these virtues and rewarding such expression. This process was frequently supported by separate classes on moral and ethical behavior, such as religious instruction or civics. A common teaching method for doing this was to present a moral dilemma to

students and ask them to work out an appropriate moral course of action. Class discussion would then focus on deviations from justice, fairness, or other moral principles.

The goal of the cognitive development approach to moral education, however, is to encourage individuals to develop to higher stages of moral reasoning. According to Piaget, children understand events in their environment in ways dictated by their level of cognitive development. When they encounter new information that is inconsistent with their existing world view they must adjust their current understanding of how the world operates in order to make sense of this new information (i.e., 'accommodate'), or else ignore the information or distort it so that it can be incorporated into their existing understanding of how things hang together, after all (i.e., 'assimilate'). The process of adjustment is called 'equilibration', that is, reaching a new and stable, expanded understanding of the nature of things by accommodating new and previously discrepant information. It is through equilibration that cognitive development occurs. At the heart of this model is the idea of confronting students with information contradicting their present level of cognitive development, in order to make it necessary for them to accommodate and thus reach a higher level.

In order to achieve this, writers such as Piaget argue that educators should provide students with opportunities to discover morals themselves, rather than simply being indoctrinated with norms. Kohlberg argued that moral education also requires more than individual reflection, and should include students functioning within a community. This could be done by emphasizing cooperative decision-making and problem solving, in order to make it possible for them to work out for themselves ethics based on fairness, consideration for others, altruism, loyalty, and the like. The 'infusion' approach emphasizes that, rather than simply being an add-on, education offering such experiences should permeate the entire school experience. It is not a competitor with or an ancillary to the acquisition of academic knowledge and skills, but supports this process: responsibility, respect for others, self-control and diligence foster academic learning. The point is to convey to young people an image of the kind of people the particular culture admires and wants them to emulate. Teachers should speak openly of 'good' and 'bad' and of 'right' and 'wrong.' Words such as 'responsibility,' 'honesty,' 'consideration,' and 'perseverance' should be used in discussing actions and behaviours.

Infusion with moral and ethical issues is most obviously possible in language arts, social studies, history, and similar areas, but it is also possible in science, sport, technology education, and similar areas of curriculum, where honesty, consideration for others, fairness, ethically acceptable behavior, and similar values can be discussed. Infusion also involves out-of-class activities, even behavior in the schoolyard, the toilets, the locker room or the lunchroom. Infusion involves the development of a positive moral climate in an entire school. A related approach is service learning, in which children are given classroom chores such as passing out library books or straightening the desks and chairs, at the simplest level, tutoring or mentoring younger children later, and, eventually, performing service activities such as carrying out an internship in a seniors' residence or a day-care center.

The Role of 'Wisdom' in Moral Creativity

Hilton mentioned censorship as one possible way of avoiding immoral creativity, but did not recommend it, since it is incompatible with individual freedom and is thus harmful to the common good – the cure might well be more immoral than the original disease. Hilton saw a need for 'social wisdom,' which is based on a 'multi-perspective community approach,' and essentially considered the effects of creativity in its social context. He also called for emphasis on 'the hard-won insights of the past,' thus incorporating the historical context and the accumulated wisdom of previous generations into the understanding of morality in creativity.

Sternberg, too, identified the crucial factor in moral creativity as 'wisdom.' He sees wisdom as involving awareness of the need to balance personal interests and the general good, willingness to do this, and the ability to do so – to find a compromise path that satisfies both sets of interests. Creativity without wisdom runs the risk of not being moral, but when it is tempered by wisdom it is of necessity moral. The central characteristic of wisdom – as against, for instance, 'mere' intelligence – is concern for the common good: a wise person tries to contribute to the common good, not to pursue solely his or her own advantage, and moral creativity seeks to generate effective novelty in order to promote the common good. The Great Train Robbery would thus be seen as not involving creativity, since it was directed against the common good and, indeed, left one victim so seriously injured that he never recovered his health and died a few years later. From an American point of view, the 9/11 attack did not display wisdom, since its intention was not to serve the common good, so that it was immoral and ultimately not creative. Nonetheless, it may well have seemed to the attackers – rightly or wrongly – to be advancing the common good of some other ethnic or national group(s), so that even wisdom is relative. In times of war this issue becomes particularly acute. People who generate effectively novel devices with the sole purpose of inflicting damage and death are frequently judged to be acting in a moral way by one side in the conflict, even though it is clear that they understand the 'common' good in a narrow way.

Sternberg argued that wise thinking can be developed, and outlined activities students should engage in: these include reading classic works of literature and philosophy (i.e., engaging with 'the hard-won insights of the past,' as Hilton put it), and participating in class discussions, projects, and essays that encourage discussion of the lessons to be learned from these works and how these lessons can be applied to everyday life. He also recommended particular emphasis on the development of dialogical and dialectical thinking. Dialogical thinking involves understanding significant problems from multiple points of view and understanding how others can see things differently. Dialectical thinking involves understanding that ideas pass from the past to the present and from the present to the future. Students need not only to acquire factual knowledge, but also to develop their own values through reflecting upon such knowledge. Instruction should place greater emphasis on critical, creative, and practical thinking that benefits not only the individual doing the thinking but others as well. Students would be encouraged to think about

how almost everything they study might be used for better or worse purposes, and to realize that the ends to which knowledge is put do matter. Sternberg and colleagues have constructed a program for teaching American History based on these principles.

Concluding Remarks

Despite the commonly voiced view that creativity is beyond questions of virtue and wickedness, to paraphrase Sternberg, the ends to which creativity is put *do* matter. We need concepts that make it possible to distinguish between the creativity of people who bring great benefits to humankind in both artistic/aesthetic domains (fine art, literature, music, and the like), as well as in technology, business, science, public administration, and similar areas, and the creativity of those whose creativity harms other people. Moral precepts provide guidelines on how to do this. Although morals are, in theory, arbitrary, at their core is a set of values that are shared by a wide variety of cultures over a long period of time. The heart of these is the idea of fostering the well-being of others. Thus, the application of creativity to serve narrow interests at the expense of the wider community is immoral, whereas applying it to enhance the common good is moral.

Morals are acquired, and can be taught. However, rather than being imposed by exhortation or diktat they should be worked out by each individual, and should be based on shared experiences, both of what past generations worked out and recorded in, for instance, great works, as well as on direct interactions with contemporaries, especially in activities that involve contributing to the common good. In this way, people acquire wisdom, and wisdom makes it possible for them to apply creativity in ways that balance private and common interests, and is thus moral. The purpose of placing emphasis on moral issues in creativity is not the self-righteous imposition of a rigid set of pre-specified values on the generation of effective novelty, but encouraging those who generate or use such novelty to examine their own efforts from the moral point of view.

See also: Aesthetics and Creativity; Confucianism; Crime and Creativity; The Dark Side of Creativity; Definitions of Creativity; Mental Health: Affective Disorders.

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Motivation

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Glossary

Extrinsic motivation The motivation to engage in an activity in order to obtain an incentive or reinforcer that is separate from the activity itself, such as a monetary reward or a positive evaluation. Extrinsic motivation can undermine creativity.

Inspiration A motivational state that emerges following a creative idea and energizes transforming the creative idea into a creative product.

Intrinsic motivation The motivation to engage in an activity for the enjoyment, satisfaction, or personal challenge that arises from the activity itself. Intrinsic motivation fosters creativity.

Motivation The energy underlying behavior. A person's motivation to initiate and persist in a specific action explains

why the person chose that specific action, given the circumstances.

Motivational synergy The process by which intrinsic and extrinsic motivation combine to support creative work. Synergy is most likely when intrinsic motivation is initially high and extrinsic motivators are perceived as supportive, rather than controlling.

Personality trait An enduring characteristic of a person. Traits generally refer to a person's tendencies in social and emotional responding, rather than physical characteristics or cognitive abilities.

Reinforcer Any consequence of behavior that increases the likelihood of that behavior occurring in the future.

Early studies of personality traits established that highly creative persons are indeed different in some important ways: they are enthusiastic, they produce more ideas and more unusual ideas than their peers, and they have the courage to follow through with their ideas, even when their ideas are not popular. Some theorists believe that this energy and courage are so powerful because creative work expresses strong emotion. A small body of research has shown a relationship between affective disorders and high levels of creativity, suggesting that emotional dysfunction may fuel creative expression. On the other hand, a humanistic approach suggests that creativity is an expression of healthy psychological functioning. This idea is consistent with a larger body of literature linking positive affect with creativity. A simpler explanation comes from behaviorists, who propose that some people become more and more creative because they receive powerful reinforcers for their creative efforts. However, evidence from social psychological studies of creativity shows that intrinsic motivation fosters creativity, while extrinsic reinforcers such as reward can often inhibit it. Several lines of research suggest that the creative process is self-reinforcing. Flow, a motivational state that facilitates creativity, is thought to occur during activities that are inherently rewarding or 'autotelic.' Recent research shows that the development of a creative idea provides inspiration to produce a creative product.

Despite the clear differences between these attempts to explain the energy underlying creativity, taken together, an important message emerges. The motivation to create will sustain itself when the right conditions are present. When our personality, mental health and the social environment all contribute to the intensity of our work, we are likely to become immersed in the highly engaging process of producing creative products.

Personality Traits of Highly Creative Individuals

Attempts to define the personality traits of highly creative persons must be interpreted with caution. Clearly, all kinds of people, from all backgrounds, with a variety of personality characteristics, have made creative contributions to all domains of endeavor. Nonetheless, systematic attempts to study the personalities of highly creative individuals have uncovered two categories of traits that highly creative persons seem to share. One category includes descriptors such as spontaneous, playful, curious, open to experience and flexible. The second category includes traits like determined, independent, confident, and persistent. Clearly, creative persons are quite complex. At once, they are childlike in their ability to be open and interested in all possibilities, and exceptionally mature in the intense focus they maintain on their work.

Donald MacKinnon and Frank Barron were the first to attempt to capture this complexity in their landmark studies of creative lives at the Institute of Personality Assessment and Research in the 1960s. They conducted in-depth investigations of highly creative individuals from many disciplines; their participants included well-known mathematicians, architects, and writers. By administering a wide range of personality inventories, interviewing and observing these people over several days, and using appropriate controls, researchers were able to describe these highly creative people with an impressive degree of clarity and depth. They found the highly creative to be more complicated, imaginative, flexible, and original in their thinking than matched groups of less creative professionals in the same fields. They were also more individualistic, courageous, independent, and confident. These qualities seem to propel their work in two directions. They are excited about new possibilities, and so generate a range of new ideas.

They also have faith in the value of their ideas and are thus able to pursue them assuredly.

The continuous stream of novel ideas that is characteristic of creative people may emerge from a chronically low level of latent inhibition. Latent inhibition is a process by which individuals filter out much incoming sensory information as a way of focusing attention on new or salient information. Those with low latent inhibition have less of a tendency to do such filtering. Jordan Peterson and colleagues have conducted research linking low latent inhibition with openness to experience and the production of creative ideas. Not all individuals with low latent inhibition are highly creative, however, suggesting that personality characteristics that support following through with creative efforts are also important.

Most current theories of creativity include personality traits related to openness as well as traits related to persistence. For example, both categories of traits appear in Teresa Amabile's componential theory of creativity, within the 'creativity-relevant processes' component. The first category includes spontaneity and tolerance for ambiguity, leading a person to take in and produce a wide variety of perceptions and ideas. The second category includes a high degree of self discipline in matters concerning work; an ability to delay gratification; perseverance in the face of frustration; independence of judgment; a high degree of autonomy; an internal locus of control; a willingness to take risks; and a high degree of self-initiated striving for excellence. Taken together, these two types of traits allow a person to both generate and follow through with creative ideas. Robert Sternberg's investment theory also names personality as an important component necessary for creativity. The personality traits proposed in that theory also would facilitate unusual responses, such as tolerance for ambiguity and moderate risk taking, and support follow-through, such as willingness to surmount obstacles, perseverance, and self-esteem.

Research provides support for the notion that highly creative persons are highly energetic persons – both in generating ideas and in pursuing them. Although there can be strong differences in personalities, especially across fields, this feature emerges consistently. One study found highly creative persons to have a passion for autonomy, a high degree of self sufficiency, and a heightened sense of identity. Another showed that the most creative individuals tend to be highly ambitious and confident in their views. This self-assurance may allow creative people to focus on personal motives and goals, rather than being overly influenced by the opinions of others. In order to study this possibility, Teresa Amabile and colleagues developed the Work Preference Inventory, which assesses motivational orientation as a personality characteristic. They identified two primary directions for work motivation: intrinsic motivation, which is marked by a focus on the challenge and the enjoyment of the work, and extrinsic motivation, which is marked by a focus on external reward for one's work. This research found that an intrinsic motivational orientation is positively correlated with creativity on a variety of tasks, in several different subject populations. Also, people involved in creative professions, such as artists, poets, and research scientists, were higher in intrinsic motivation and lower in extrinsic motivation than the general population. Recent work by Vikram Prabhu and colleagues confirmed

that intrinsic motivation is an enduring personality trait with a positive relation to creativity.

This kind of research is important in that it extends beyond the basic personality traits of creative persons and begins to explore the motives that underlie these traits. Research on personality traits describes creative individuals, but does not explain them. How does the motivation that characterizes creative persons arise?

Emotion as Energizing Creative Passion

Creativity has been thought to emerge from the strong and vacillating emotions that characterize mental illness, although it paradoxically has also been associated with positive emotion and psychological health. A greater incidence of affective disorders is observed in highly creative individuals; creative expression may be a positive means of coping with strong and conflicting emotions. Low levels of latent inhibition have been found to be associated with psychosis (particularly affective disorders) in some individuals, and with high levels of creativity in others. People confronted with a lowered ability to filter sensory information may find creative work an effective strategy for using all of the information they perceive.

Highly creative individuals may be those who are able to use self-expression in their work as a way to endure their mental illness. For example, when individuals write about emotional experiences, their physical and mental health improves as a result. A crucial component of therapy is self-disclosure. While feedback of some kind is inherent in the therapy process, simply expressing painful emotions can have a substantial beneficial impact on psychological functioning. The creative process, because it often involves self-expression, may be a useful means of working through psychological problems. In fact, various kinds of creative activities have been incorporated into some therapeutic efforts. Clinicians have used artwork, music, and drama to encourage creative expression and thus improve mental health.

Creativity might also support mental health by promoting feelings of self-worth and competence. A great deal of self-esteem can come from creative accomplishment. Those suffering from affective disorders, or any form of mental illness, may have a fragile sense of worth. A deep involvement in creative work may allow them to channel their anxieties into a valuable pursuit. The work itself may represent a part of the self that is valued and under the individual's control. The recognition that comes when the work is complete can be self-affirming. Of course, the criticism and failure that are also an inevitable part of efforts toward creativity may have the opposite effect. When creative work is progressing well, it may be wonderfully supportive. In times of difficulty, individuals may seek therapy as a way of coping with their symptoms.

In addition to promoting personal growth and fulfillment in those vulnerable to mental illness, creative work has been thought of as a sign of superior mental health. Humanistic psychology places a great deal of importance on respecting the potential of individual people. It is grounded in the belief that people have a great capacity for creativity. Humanists believe that creativity arises from a natural human tendency toward growth and self-actualization. Self-actualization,

a focusing on important problems rather than oneself, represents the height of mental health. Mihaly Csikszentmihalyi has studied 'optimal experiences,' which support self-actualization. Self-actualizing individuals take great pleasure in their work. At times, they experience states of complete and utter absorption in the work. They lose all sense of time. Csikszentmihalyi has labeled this highly enjoyable state 'flow.'

Work produced during flow is often highly creative. Through extensive interviews and field studies, Csikszentmihalyi has identified the conditions that facilitate flow. The most important appears to be an optimal level of challenge in relation to a person's level of skill at a task. If challenges are too great, the person becomes anxious, and his enjoyment and concentration are disrupted. If the task is not challenging enough, it is experienced as boring. One way that highly creative people maintain their motivation is by seeking optimally challenging work. As their skills develop, they will pursue more and more difficult problems. This process likely contributes to the self-reinforcing nature of the self-actualizing tendency.

Recent research in business organizations provides support for the view that creative behavior emerges from positive affect. This evidence on creativity following mood upswings fits well with experimental research on the effect of emotion on creativity. Most experimental studies, which have used participants from nonclinical populations (such as university students), have found that induced positive mood leads to higher creativity but induced negative mood leads to lower creativity. Moreover, the research in business organizations suggests that doing creative work contributes to positive mood; this process can establish a self-reinforcing cycle of creativity and positive affect.

Uniting work suggesting that creativity emerges from psychological problems with work showing that creativity emerges from psychological strength, Celeste Rhodes proposed that both deficiency needs and growth needs can motivate creativity. From these two categories of needs, Rhodes defined two types of creativity. The first satisfies the deficiency needs in Abraham Maslow's hierarchy (such as the need for the love and respect of others). This type of creativity aids psychological functioning, can serve to work through psychic conflicts, and increases self-esteem. The work leading to this type of creativity has a driven quality. Such individuals *need* to be creative in order to be satisfied with themselves. The second type of creativity is motivated by growth needs (such as the need for self-actualization). This type of creative work is pursued for the beauty of the work itself, in order to reach a higher level of understanding, or to solve an important problem. The motive of the artist, according to Rhodes, has an important impact on the final product. The audience can appreciate the transcendent understanding expressed by the self-actualizing creator.

Robert Vallerand's recent work on harmonious and obsessive passion provides empirical support for these ideas. His concept of passion is analogous to a strong drive to create. He proposes that passion can emerge in psychologically unhealthy or healthy ways. Those who possess a harmonious passion have an enduring commitment to their work and experience positive emotions when engaged in it, yet enjoy other activities as well. Those with an obsessive passion are compulsive about doing their work and experience negative emotion if they are prevented from working.

Our analysis, thus far, has focused on the creative person. Are there factors outside the person that motivate creativity? Can creativity be encouraged or thwarted by the social environment? Behaviorists focus on efforts to encourage creativity with rewards.

Reinforcing Creative Efforts

B. F. Skinner championed the effort to develop the scientific study of observable behavior, an approach known as behaviorism. Because internal states could not be measured directly, Skinner focused on the influence that the external environment has on behavior. After years of carefully controlled experiments, Skinner became convinced that the most important principle underlying the control of behavior was operant conditioning. Operant conditioning is the process by which behavior is followed by consequences that influence the frequency of that behavior in the future. If a reinforcer follows a behavior, it will occur more frequently. If a punishment follows a behavior, it will occur less frequently. Because of the pain and fear that punishment causes, Skinner advocated the use of reinforcers to control behavior. His analysis of creativity followed this principle precisely. Creative behavior could be promoted, he argued, by following it with a reinforcer.

Reinforcers gain their motivating properties by satisfying a basic need or drive. Food is a commonly used reinforcer in animal experiments. Hungry people also find food reinforcing, but many other items have been used in experiments with children and adults, including money, praise, awards, stickers, and small toys. When a person is behaving in order to obtain a reinforcer, that person is motivated by the need that will be met by the reinforcer. So, rather than the creative activity itself satisfying the need, the need is satisfied by the consequence that follows the activity. The motivation to be creative, from a behaviorist view, is simply the tendency to seek reinforcing consequences and avoid punishing ones.

There is much support for the notion that rewards for creativity are essential for encouraging it. Even Freud once wrote that money, prestige, and sexual rewards were essential to maintaining creativity. Certainly, an environment where creative outcomes are followed by desirable consequences is likely to be an environment where creative efforts are frequent. Using the Torrance Tests of Creative Thinking, Mark Runco has shown that providing rewards for divergent thought can increase the fluency of responses. Robert Eisenberger and his colleagues have also demonstrated that reinforcing divergent thinking on word construction and picture drawing tasks can enhance future divergent thought. Teresa Amabile's work in business organizations has shown that when there are rewards for creativity in the work environment, work teams reach more creative outcomes. The reinforcement principle, applied in the most global sense, holds true.

Some behaviorist thinkers go a step further, and propose that creative responses can be shaped by contingencies of reinforcement. They conceptualize every creative behavior as a combination of simpler behaviors. If a creative behavior is broken down into the series of behaviors that compose it, a program of reinforcement could be devised to strengthen the likelihood of each component behavior. As Skinner explained

it, some people will display true creativity, but before that can happen they need something to be creative with. Previously established behavior manifests itself in new situations in orderly ways. When the environment facilitates it, this order can result in high levels of novelty. Creativity, according to these theorists, is simply connecting previously learned behavior in new ways.

The practical problem with this approach, however, is that in order to develop a reinforcement plan, it is necessary to know all of the component skills involved in a creative outcome before the outcome occurs. Naturally, for truly original work, this is impossible. A second problem is the evidence that not all component parts of creative behavior are responsive to reinforcement. Kenneth McGraw distinguished between tasks that are algorithmic (clear and straightforward) and heuristic (require exploration and discovery). His research showed that algorithmic tasks are responsive to reinforcement while heuristic tasks are not. Teresa Amabile further developed this idea by proposing that some elements within creative activities are algorithmic and will, thus, respond very well to reinforcement. Reinforcing heuristic aspects of a creative task is more difficult; reinforcers may be effective if they are not salient, if the person is highly interested in the activity, or if the reinforcer provides useful feedback. Amabile's work points to the importance of considering the subjective experience of the recipient in order to determine the impact of a reinforcer.

The behaviorist approach represents an advance over previous work that considered only the individual's characteristics and motives in understanding the source of creativity. Research from this perspective highlights the importance of the external environment for supporting creativity. Yet, it also presents an incomplete picture. By considering only rewards and punishments, behaviorist thinking omits an important source of creative energy: intrinsic motivation. This motivation, too, can be influenced by the external environment.

Intrinsic Motivation and the Social Environment

Contemporary approaches to understanding the impact of the social environment on creativity propose that external factors, including reinforcers, influence creativity by the effect that they have on the individual's motivational state. Teresa Amabile, in her componential model of creativity, was among the first to advance such a proposal. According to the model, an individual's level of creativity is determined by three primary factors. The first is the person's level of domain-relevant skills, which include knowledge, developed talent, and special skills in the target domain. The second is the person's level of creativity-relevant processes, which include personality characteristics, styles of thinking, and styles of working that facilitate creativity. The third is the person's motivation toward the task. The componential model describes the impact that the social environment has on all three components, but emphasizes the role of the social environment in determining task motivation. The intrinsic motivation principle of creativity specifies that intrinsic motivation (stemming from interest in and enjoyment of the activity itself) is conducive to creativity, but extrinsic motivation (directed at a goal separate from the task) can be detrimental.

Thus, the intrinsic motivation principle considers the impact of the social environment on creativity, as the behaviorist approach does. At the same time, because intrinsic motivation is seen as rooted in normal human curiosity, the intrinsic motivation principle is compatible with the work of humanistic psychologists. Intrinsic motivation is the inherent satisfaction that we derive from productive, engaging, personally challenging activity. The intrinsic motivation principle states that, when intrinsic motivation is supported by the social environment, people are more likely to be highly creative. If they are pressured, constrained, or driven by extrinsic motivators, they are less likely to be creative. Similarly, Mihaly Csikszentmihalyi proposes that creativity arises in autotelic activities, where rewards stem from engagement in the activity itself, rather than from an external source. A concern for extrinsic rewards, or reinforcers, could interfere with an individual's focus, and disrupt the fragile process of discovery.

There is considerable empirical support for the intrinsic motivation principle. When extrinsic motivators are offered or extrinsic constraints are imposed on individuals doing an intrinsically interesting task in the laboratory, the work they produce is, on average, less creative than when extrinsic motivators or constraints are not imposed. Teresa Amabile and her colleagues have shown this effect with several different kinds of creative activities, including making collages, writing stories, and building paper towers, and with a variety of subject populations, including preschoolers, elementary school children, college students, and creative writers. This effect has been observed when research participants expected their work to be evaluated, when they were being observed (surveillance), when they contracted to do the activity in order to obtain a reward, when they were asked to compete with other participants, when they were denied choice, and when they were simply led to focus on extrinsic motivators. Many of these same extrinsic constraints have been observed to undermine creativity in real-world settings. In one study, research scientists reported that strong extrinsic incentives interfered with the development of creative ideas in their laboratories.

Although there is substantial evidence that extrinsic motivators can undermine creativity, recent experimental and non-experimental evidence shows that in some circumstances, extrinsic motivators have no influence, or even enhance creativity. To explain the patterns of results that have been observed, Teresa Amabile has formulated a theory of motivational synergy. The central premise of the theory is that, although intrinsic motivation is necessary for high levels of creativity, extrinsic motivation is not always detrimental. Some forms of extrinsic motivation may combine positively with intrinsic motivation, and thus boost overall levels of creativity. The theory proposes that this is most likely when intrinsic motivation is initially high and when the extrinsic motivators are perceived as supporting, rather than limiting, autonomy and skill development. The motivational synergy theory acknowledges the motivational potential of extrinsic reinforcers, while emphasizing the importance of maintaining the highest levels of intrinsic motivation in order to facilitate creative accomplishment.

Other social psychological theories consider the impact of the wider social environment. For example, David Harrington's work on long-term collaborative groups, proposes that a

'creative ecosystem' must develop within the group, in order to support ongoing creativity. Because creative people tend to be curious and active, their ecosystems need to provide them with encouragement and opportunities for playful task engagement. These opportunities sustain their intrinsic motivation toward their work. Reinforcing creative effort is also important. A multifaceted reward system can capitalize on the variety of motivations that creative individuals bring to work. This work suggests that the principles of motivational synergy apply to work groups as well as individuals. Other theorists have considered the influence of the larger community in their analysis of the motivation underlying creativity. Keith Sawyer's concept of 'collaborative webs' for creativity serves as a compelling example.

Dean Keith Simonton considered the broad cultural, social, political, and historical influences on creativity. Findings from his program of archival research both support and go beyond those uncovered in experimental and traditional observational studies. In one study, he found that musicians who had a higher number of contemporary competitors were less creative than those who faced less competition. This research demonstrates that factors in the wider cultural environment can impact creativity. Many of these factors are analogous to those identified as influencing creativity in the immediate social environment. Other researchers have adopted a perspective that incorporates the wider cultural climate, the physical surroundings, and the immediate social environment. These factors influence people differently depending on their past experiences and their personality characteristics. Thus, social psychological approaches to creativity motivation range from those concentrating narrowly on the influence of particular motivators on an individual to those broadly considering the full range of influences across the lifespan.

While this work confirms that the social environment has an important influence on intrinsic motivation and creativity, it does not explain how motivation operates in the translation of ideas into reality. What makes a creative process ultimately satisfying? What is the crucial element that keeps the creator engaged in the hard work of bringing a creative idea to fruition? Recent research calls this motivational force 'inspiration.'

The Inspiration to Create

While creativity scholars have long recognized the creative process as being inherently rewarding and self-reinforcing, until recently, the role of inspiration in motivating creative work was largely ignored. Even in Csikszentmihalyi's work on flow, which highlights the intensely engaging nature of the creative experience, there is little mention of the motivational potential of the ideas that emerge from the creative process. Work by Todd Thrash and his colleagues has brought the concept of inspiration to the attention of psychological researchers, and has documented the central role that inspiration plays in motivating creativity. Specifically, this work suggests that inspiration *follows from* creative ideas, energizing creators to bring those ideas to fruition.

Todd Thrash and Andrew Elliot define inspiration as having three components: transcendence, evocation, and approach

motivation. When an idea highlights possibilities to transcend present reality, the idea evokes a motivational state in which the person is inspired to act on the idea. Inspiration is approach oriented in that it is directed toward acting on the idea and bringing it to life in some sense. This definition reflects a common conception of inspiration as defined across disciplines, particularly in the humanities. In a recent paper by Thrash and several colleagues, empirical indicators of these three components converged to predict a single inspiration factor. In the same series of studies, inspiration was also related to but conceptually distinct from effort, creative ideation, and awe.

A central role for inspiration in the creative process has been questioned on several fronts. There is evidence from studies of the creative process that most creative products result only after many revisions. Thus, we can dismiss the romantic notion that a burst of inspiration fuels creative production in its final form. The possibility remains, however, that the most creative works are produced by the most inspired creators. Further, a given creator may be most creative when most inspired. Research on the personality traits of highly creative individuals suggests that these individuals work hard consistently, that they have the persistence to work through challenges. Recent evidence shows that inspiration is more frequent in those who are high in work-mastery motivation, suggesting that these individuals are often inspired rather than slavishly devoted to their work.

Personality traits have been linked to the likelihood of experiencing inspiration, as well. Those high in openness to experience, specifically openness to aesthetics, are more likely to experience the cognitive insights linked to inspiration. The intensity of the inspiration experienced is linked to extraversion. This relationship makes sense, in that extraverted individuals are approach-oriented and inspiration is a form of approach motivation. Another correlate of both inspiration and creativity is positive affect. Positive affect is thought to fuel creative efforts. Experiences of inspiration may generate positive affect to support the creative process.

Thrash and collaborators have documented that inspiration comes with a unique set of motivational experiences. They found that the evocation of inspiration involves a sense that the idea is of unconscious origin, that it enters awareness without the individual's control, and that it exerts a compelling press on the individual. Following this experience, research participants were more efficient and productive – hence working in a way that optimized the chances that a creative idea would be effectively translated into a creative product. Inspiration was specifically related to a product's creativity, not simply overall quality. Indeed, writers' ratings of inspiration while writing were strongly related to judges' ratings of the creativity, but not the technical merit, of the written product. These findings generalized across scientific writing, fiction, and poetry, and were observed in both naturalistic and laboratory contexts using both between- and within-subjects designs. Interestingly, effort predicted technical merit but not creativity in these same studies.

Recent work on inspiration fills an important gap in the creativity literature. This work brings together the two elements of the creative personality, by linking creative ideas with effective motivation to work. The role of inspiration in producing

positive affect fits nicely with work on creative passion. Finally, the construct of inspiration helps us to understand the intrinsically motivated process that supports creativity.

Conclusion

Highly creative individuals are also highly motivated individuals. They stand out as curious and playful, yet persistent and committed. They appear to be driven, and in some cases, unstable or even mentally ill. Their energy seems self-perpetuating: an inspired, growth-promoting force. Their efforts can pay off, when those around them appreciate their work and generously compensate them for it. At the same time, they are devoted to what they do. Rather than being slaves to fame, status, or wealth, highly creative persons often seem most excited about the pleasure of engaging in the work that they love.

The five approaches reviewed here start in very different places in their attempts to explain the motivation to create. The essence of each approach has merit, leading to a picture more complete and more complex than any single explanation could provide. The social psychological approach comes the closest to recognizing the diversity of energy sources that support creativity. An understanding of how a person can become completely absorbed in creative activity emerges by focusing

both on the individual's motives and on the enormous influence of the social environment. This combination illuminates both the everyday creativity of noneminent people, as well as the widely-recognized work of creative geniuses.

See also: Climate for Creativity; Self-Actualization.

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Multiple Discovery

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Glossary

Camera lucida A *camera lucida* is a small hand-held, four-sided prism used to facilitate accurate sketching of objects in broad daylight.

Camera obscura A *camera obscura* is a darkened space with a small opening admitting light through a mirror and lens arrangement. This set-up projects an image of the outside world onto a viewing table or plate.

Eponymy The practice of affixing personal names to all or a part of what someone has invented, discovered, or supported (e.g., Euclidean geometry, daguerreotype, Planck's constant, Boyle's Law).

Matthew effect A complex pattern of giving greater increments of recognition to scientists of considerable repute while withholding such recognition from those who

have not yet made their mark. Derived from a verse in the biblical Gospel of Matthew (25:29) that reads: "Unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath."

Parallel discoveries Independent and similar discoveries. A synonym for multiple discoveries or 'multiples.'

Pluralism Grants a kind of equivalence to many possibilities, making them seem more or less equal.

Problem-finding The recognition, identification, and definition of an anomaly, obstacle, or problem that must be resolved in order for problem-solving to begin.

Singleton Something only invented or discovered once.

Zeitgeist Spirit of the times. The actual spirit of a Zeitgeist can only be understood in a long retrospect.

Overview

Multiple discovery is the technical concept used to explain the difficulty in assigning independent priority when two or more scientists or inventors give expression to a similar theory, form, model, or invention. An incomplete list would include:

1. the independent invention of the differential and integral calculus by Isaac Newton and Gottfried Wilhelm Leibniz;
2. the discovery of the light bulb by both Sir Joseph Wilson Swann and Thomas Edison;
3. the independent discovery of the fundamental principle of analytic geometry by Pierre de Fermat and René Descartes;
4. the discovery of Neptune, generally credited to the British mathematician John Couch Adams as well as Urbain-Jean-Joseph Le Verrier of France;
5. the non-Euclidean geometries independently discovered by Nikolai Ivanovich Lobachevsky, Janos Bolyai, Karl Friedrich Gauss, and George Friedrich Bernhard Riemann;
6. the discovery of anaesthesia in the nineteenth century attributed to Crawford Long, Horace Wells, William Thomas Green Morton, Charles Jackson, and others; and
7. the controversial discovery of single-wall carbon nanotubes and methods to produce them using transition-metal catalysts generally attributed to groups led by Donald S. Bethune at IBM and Sumio Iijima at NEC in the 1990s despite evidence showing that Russian researchers had independently reported this discovery in the 1950s.

This article introduces case studies that demonstrate multiple discovery in action and analyzes the difficulty in attributing discovery to a particular individual or group. The text also examines cases that show not all discoveries are easily fit into the multiple discovery framework. This first section provides

an overview of multiple discovery as a concept. Contextual issues related to scientific institutional practices, values, and unexpected discoveries are presented in the next section. The penultimate section explores the relationship between the individual and the community, focusing primarily on examples combining science and the visual arts. The final section integrates multiple discovery with cultural, philosophical and educational issues.

Overall, multiple discovery entered the science studies lexicon as a term to convey that scientists work within a community and that this community, by definition, is a domain where several people are using similar methods and technologies in exploring problems of scientific interest. Arguments favoring multiple discovery are based on the evidence that shared ideas and shared instruments are an integral part of each individual scientist's biography and that many discoveries share patterns of similarity. Moreover, it is argued, the extensive number of parallel discoveries that have been documented support the idea that something critical is lost when discovery is simply reduced to psychological thoughts and subjective processes within the heads of creative individuals. As a contextual idea, multiple discovery is also broadly defined so as to include the auxiliary products that are often needed for a discovery to be practical. For example, the invention of the telephone – be it attributed to Elisha Gray, Alexander Graham Bell, or both – necessitated the invention of switching devices, amplifiers, transformers, and transmission mechanisms.

Critics of the multiple discovery characterization say that conceiving of scientific innovation simply in terms of community exchange pushes aside many unresolved issues in regard to what creativity actually is and the actual body of knowledge we bring to our work. Moreover, when we look closely at particular discoveries we find that some fit into the multiple

framework more easily than others. These unresolved areas, the critics add, include the 'art' of science, the evidence that chance only favors the prepared mind, and the particular kinds of education, focus, and passion creative individuals bring to their work. In addition, the multiples characterization does not account for those inventions or discoveries that are only discovered once (termed singletons). Similarly, the multiple discovery designation does not address why one individual makes exceptional multiple contributions. For example, recognized as one of the most creative people ever to have lived, Albert Einstein revolutionized scientific and philosophic inquiry in the twentieth century. His reputation was largely a result of work done during his *annus mirabilis* (1905), when he published five papers that laid the groundwork for shattering cherished scientific beliefs.

An unusual individual like Albert Einstein, who opened more than one door in his field, offers a good touchstone for conceptualizing the amorphous quality of multiple discovery discussions. First, this kind of exceptional work raises the question of whether the high points of one individual's achievement and the comprehensive nature of an individual's contributions can be fully addressed using a model highlighting communal influences. In Einstein's case, multiple discovery theorists argue that all of Einstein's discoveries would have happened even without an Einstein. From this perspective, the discoveries may have taken more time, and required more minds, but the climate was ripe for these problems to be solved and thus they would have been solved. Critics of this position say the multiple discovery argument does not actually explain why Einstein was able to conceptualize so many ideas that were not yet directly a part of his culture and transform the theoretical physics in a way that extended beyond physics and into the culture-at-large as well.

Scientific Issues and Historical Examples

Institutional Practices and Values

Twenty-first century discussions of multiple discovery continue to rely heavily on the ideas of sociologists, anthropologists, and historians of science of the twentieth century (e.g., William F. Ogburn and Dorothy S. Thomas, Robert K. Merton and Elinor G. Barber, Alfred L. Kroeber, and George Sarton). These earlier researchers catalogued a vast number of discoveries that emphasized the role of context (rather than a particular person/genius), institutional practices, and values. These have been characterized as multiples since Merton. Merton's idea of the 'Matthew effect,' presented in the 1960s, has also had a significant impact on the debates. According to *Matthew* (25:29) "Unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath." Merton's point here was that whether the discovery is recognized through the commemorative use of eponymy or simply results in better funding, those who are credited with priority are elevated to influential positions and thus have the leverage to disproportionately increase their stature on an ongoing basis. This view contrasts with Donald Campbell's argument that credit for multiples often goes to more obscure scientists because the latter have more eponymic value. Scientists who make lots of discoveries dilute the value of their name for this purpose.

The ideal of science has always included a picture of dedicated individuals working toward human good and the presupposition that humility is a part of a cooperative effort to reveal (and apply) universals. Yet, and despite the value placed on humility in scientific practice, proof of personal accomplishment is a critical component in gaining professional employment, prestige, promotion, and funding. Thus, the ideal is often contrasted with a reality that points to scientists working for the rewards associated with professional recognition within the institutional system, a view that suggests that humility and ideals do not fully explain scientific practices and values. More recently, researchers have probed cultural factors more systematically in an effort to ferret out how we develop expertise and how different family backgrounds influence performance and creativity. One particularly fertile idea is Malcolm Gladwell's outlier. An outlier is situated away from or classed differently from a main or related body. Using the outlier concept to expand on Merton's idea of 'accumulative advantage,' Gladwell suggests that family background, access to tools and training, and the time in which one is born plays a role in the development of (multiple and individual) creative contributions.

All in all, the evidence supporting background, training, and position does not resolve many of the anomalies associated with multiple discoveries. With multiple discoveries in a particular geographic area (e.g., the West), priority is often disputed, many of the disputes involve values, and many of the disputes are acrimonious, long-standing, and aggressively pursued. For example, the controversy between Newton and Leibniz over the invention of the calculus is one of the best known examples of a priority dispute involving parallel discoveries. It did not involve an esteemed individual and one on the margins of science. Rather, the dispute involved two individuals of high repute. This example shows how hard-fought some priority battles are. Although Leibniz published first, Newton developed his version of the calculus several years earlier. While it is now generally agreed that the two systems use different approaches and were developed independently, at the time each man accused the other of plagiarism. It was an emotional disagreement, to put it mildly. When Newton became the President of the Royal Society he decided to appoint a committee to adjudicate the rival claims of Leibniz and himself on the matter of priority. Historical records reveal Newton packed the committee, directed its activities, and wrote many of the published reports issued by the group. The second report (a draft of which was written in Newton's handwriting) is especially noteworthy because the anonymous author (Newton!) states that: "no one is a proper witness in his own cause." Given the way the investigation was conducted (by Newton), it is not surprising that the committee voted in favor of Newton.

Other cases reveal efforts to resolve a priority controversy are often totally unsuccessful. This was the case with the discovery of anesthesia. Eventually the US Congress was called upon to settle the heated debate that had resulted in an intense bitterness among the four American claimants (Long, Wells, Jackson, and Morton). Even Congress could not decide. The upshot was that the US House of Representatives passed a bill granting Morton credit and money for the invention of anesthesia, but the Senate failed to adopt it. As in many of the cases, the anesthesia controversy had a tremendous impact on the personal lives of those involved. One claimant, Wells,

committed suicide in 1848. Another, Jackson, died in an insane asylum in 1880.

This is not to say that multiples are synonymous with animosity and rancor. Moreover, given the 'Matthew effect,' it is also important to note that in some cases the wrangling appears to be oversimplified when characterized as the esteemed as opposed to the marginal. When Charles Darwin received a copy of Alfred Wallace's theory of evolution he spoke of the striking coincidence to his own theory, actually developed several years before Wallace's publication. In this case, even Darwin's chapter headings used Wallace's terms. This striking coincidence illustrates that regardless of whether one wants to credit Darwin for the theory of natural selection or characterize the insight purely as a multiple discovery and then attribute it to Darwin and Wallace – their work was presented together in a joint paper at the Linnaean Society on 1, July 1858) – does not change the fact that the theories took form at a particular point in time. This 'coincidence' has encouraged many to apply the idea of *Zeitgeist* to parallel discoveries and to emphasize that parallels appear to reflect the spirit of a time.

All do not accept *Zeitgeist* correlations as sufficient explanations, however. In terms of the Darwin/Wallace comparison, for instance, we find that there are significant differences in how they conducted their investigations. Darwin studied marine invertebrates while at Edinburgh University and then traveled to the Galapagos Islands, where he began to systematically formulate his theories of natural selection and evolution. Wallace, by contrast, did extensive fieldwork, in the Amazon River basin and in the Malay Archipelago. In weighing the different backgrounds the two men brought to their work one additional factor stands out: some say that it was unlikely that Wallace's views would have been taken seriously without Darwin's support given that Darwin's social and scientific status was far greater than Wallace's.

Zeitgeist, which implies inevitability, also brings additional issues into play. First, if we define discovery in terms of a 'spirit of a time' how do we accommodate developmental aspects of discovery? Second, *Zeitgeist* fails to contend with factors that are not a part of a culture per se, such as natural catastrophes and serendipity. Although these kinds of events significantly impact individual ideas as well as the broader community, they do not germinate from within a culture or even from within an individual. Specific concepts proposed to explain (or explain away) *Zeitgeist* in light of the existence of inexplicable events include God, free will, fate, causality, chance, and determinism. Third, there are also concrete, contextual debating points that are often a part of *Zeitgeist* discussion. These turn on the evidence that some individuals within a specific cultural environment will see theoretical and actual possibilities their colleagues miss. In addition, *Zeitgeist* does not adequately address unexpected discoveries; these are the discoveries that happen despite the evidence that no one was working toward solving the problem involved.

Unexpected Discoveries

The crux of the debate surrounding unexpected discoveries in science centers on the question of what drives individual creativity. Why do some *choose to investigate* anomalies in nature

and theory that others noticed and did not pursue? In other words, often a scientist chooses to focus on more solvable or socially esteemed problems that reflect the interests of his or her scientific community. Later, with the evidence that an important and unexpected discovery touched upon material he or she had seen and ignored the scientist is likely to acknowledge having seen a facsimile and put it aside. As such, the multiples issue is not just that history books, perhaps in error, tend to refer to discoveries in terms of individuals (e.g., we speak of Halley's comet, the Copernican revolution, and Linnaean system). Rather, there is also evidence that a contextually defined focus for discovery can overlook that neither products nor minds are generic – and the minds of particular individuals have made a difference.

Sir Alexander Fleming's discovery of penicillin and Wilhelm Conrad Röntgen's discovery of X-rays are examples that show that context alone does not account for how an individual's attentive focus on an anomaly can lead to an extraordinary discovery. In Fleming's case, for instance, in 1928 he noticed a bacteria-free circle in a Petri dish had been spoiled by a mold that killed the bacteria. Investigating, he found a substance in the mold that prevented growth of the bacteria and he termed it penicillin. Historical records indicate that similar observations had been made 50 years earlier; the primary difference between the earlier work and Fleming's is that only Fleming's work led to the discovery of antibiotics.

Röntgen, on the other hand, discovered X-rays in 1895 when he found that invisible radiation could not only penetrate solid, opaque substances but was also capable of producing images of the interiors. His investigation began only after Röntgen observed his bones were visible on a photographic plate during one of his experiments. At this time, Röntgen was working with cathode rays and a variation of a Crookes tube designed by a younger colleague, Philipp Lenard (who later demanded credit for the discovery). After Röntgen investigated the anomaly, he deduced that the rays created the image of his bones, which were easily discernible through his skin due to the different qualities of bones and flesh. The critical point here is that many scientists were working with Crookes tube and cathode rays at this time. For example, A. W. Godspeed of the University of Pennsylvania and a friend W. J. Jennings had made similar pictures six years earlier and filed them away. In addition, Crookes, the inventor of the tube, had observed that photographic plates fogged when placed near a Crookes tube. The evidence of these earlier observations has encouraged some to argue that the discovery of X-rays was inevitable and thus a multiple. Critics of adopting this hard line view note that the distinguishing element Röntgen brings to the picture is his willingness to investigate when he saw something that logically should not have appeared before his eyes (the image of his bones through his opaque skin). In Crookes's case, for instance, he did not ask what could be gleaned from the fogged plates. Instead, he returned the tubes to the manufacturer with the claim that they were defective.

Neither the Fleming nor Röntgen discoveries fit cleanly into a multiples category. Still, both are often, correctly, classified as products of their time. These examples demonstrate that some discoveries are more complete than others. In addition, both examples raise the question of whether unexpected discoveries should be considered as equal to similar discoveries that were

made earlier when the earlier 'discoverers' decided not to pursue what they noticed. Finally, these examples raise the question of whether there is a contradiction regarding discovery embedded in the multiples definition. In other words, the multiples definition does not convincingly account for anomalies that were 'seen' and ignored a number of times before the individual credited with the discovery recognized that he was seeing an event worthy of investigation.

These brief examples illuminate why some state that characterizing unexpected discoveries as multiples omits the importance of identifying a problem to solve, attention, background, training, and interest. Attention, background, training, and interest also speak more to the importance of the individual in discovery than social construction or a particular methodology. Examples that focus on the individual in turn raise the question of how each individual is related to the broader community environment. This is explored in the next section by turning to examples that combine science and the visual arts.

Science and the Visual Arts

The literature regarding visual art has always characterized multiple discovery somewhat differently from what is found in science and social science publications. For this reason, many social scientists argue that multiple discoveries are not applicable to the visual arts. Yet, the diversity of art and art as a practice show that the art within any particular culture is compatible with ideas about multiple discovery in a general (contextual) sense. This is because art has been a part of all cultures and has also developed along with cultural traditions. Moreover, throughout most of history artistic styles have changed gradually, reflecting that practitioners made subtle refinements as the cultural wisdom passed from generation to generation. One result of this gradual evolution is that it has often been difficult to look at the art of a culture and identify the hand of any one particular artist. In part this can be explained by the fact that a good artist was not striving to achieve something new. Rather, the belief was that good art was art made according to time-honored formulae. Toward this end, artists generally used traditional tools and techniques to produce a product that conformed to the community's standards.

Within this matrix, some cultural periods stand out as exceptions to this statement. These periods thus offer benchmarks useful in bracketing the practice of art in relation to multiple discovery. Well known benchmarks include (but are not limited to) classical Greece, Renaissance Florence, Elizabethan London, and the nineteenth-century *fin-de-siècle*. The styles associated with these periods are distinct and thus capable of demonstrating how particular artists have invented new technologies, redefined long-standing formulas, and altered time-honored practices.

Two points are critical here. First, in the visual arts, as in science, we can identify both multiple and singleton contributions. Second, because artists produce a different kind of product than scientists, and have different intentions when engaged with the practical problems that govern artmaking, it is harder to integrate art into the type of contextual presentation identified with multiple discovery in science. This section cannot comprehensively address the difficulties and will present three

case studies (the invention of oil painting, Galileo's illustrations of the Moon, and the impact of photography on nineteenth-century painting) to offer an overview that combines science and art. Before proceeding to the specific examples, it should be noted that while art and science are often represented in terms of dichotomies (e.g., imagination and logic, objective and subjective, inner and outer), scholarly work in the history of art has increasingly acknowledged that these kinds of dichotomies distort the many interactive elements that are a part of discovery in art. The use of dichotomies thus tends to obscure that visual artists and scientists alike grapple with concrete materials and subtle relationships. As they do so, their work combines theory with experiment and the individual, probing mind with the products that result.

Individual Contributions and Multiple Discoveries

The invention of oil painting

Two early sources on the lives of artists, Giorgio Vasari's *Lives of the Artists* (1550) and Karel van Mander *The Lives of the Illustrious Netherlandish and German Painters*, from the first edition of the *Schilder-boeck*, (1603–1604), described oil painting as a sudden technical innovation that was discovered by Jan van Eyck (c. 1395–1441) after much experimentation. In recent years extensive documentation has established that many painters were experimenting with oil, even as far back as the eighth century. What van Eyck (and other Netherlandish painters) did was see the optical possibility of using systematic glazing to make a painted surface look more realistic. Still, and despite the evidence that clearly documents the invention of oil paintings was a cultural (and thus a multiple) discovery, research has yet to explain why people continue to be drawn to agree with the attribution of priority to van Eyck. His paintings are often introduced in books with the statement that in viewing them one can see why van Eyck had long been credited with the invention. This tendency to attribute the discovery to van Eyck is then explained by looking closely at his work and at descriptions of van Eyck's virtuosity. For example, to demonstrate that van Eyck knew ways to make oil paint behave that no one had displayed before him, the eminent art historian Erwin Panofsky wrote that van Eyck's eye operated as both a microscope and a telescope. As a result, according to Panofsky, the beholder's eye is compelled to oscillate between a position reasonably far from the picture and many positions very close to it.

In sum, it is because the art establishes these complex relationships with the viewer that people are inclined to agree that Van Eyck was not a technician. He had a style of application most of his contemporaries could not duplicate, even when using the same materials and a comparable approach. This evaluation highlights that something particular to van Eyck is evident in his paintings. His 'eye,' his attention to detail and color relationships, his patience in application, and the rich quality of his descriptive product cannot simply be reduced to his knowledge of painting techniques and the evidence that the invention of oil paint was actually a multiple discovery.

Galileo and the Moon

Galileo Galilei's illustrations of the Moon expand on the van Eyck example. Galileo also offers an example that explains why many claim that what an individual contributes by virtue of his

or her unique background needs to be factored into multiple discovery discussions, for individual contributions often show that discoveries can reflect a community larger than the particular field in which the multiple is generally explored. Briefly, the activity of looking at the Moon and other planetary objects through telescopes excited many scientists early in the seventeenth century. What set Galileo apart from his contemporaries was that he had some training in drawing and watercolor. He also had a relationship and ongoing correspondence with the artist Lodovico Cigoli. Thus, while research has convincingly shown that the telescope was a multiple discovery, a multiples explanation per se deletes that Galileo brought a cognitive advantage to the activity of deciphering what he saw when he looked at the Moon through the telescope due to his background. This need not be defined as innate genius. Rather the advantage was environmental. His training in artistic perspective made him aware of how to translate a three-dimension surface onto a flat plane. Because he understood how to create a naturalistic rendering of the rough texture he was able to convincingly convey the nature of the Moon's terrain, and to do so in a way that allowed his peers to fully interpret what they saw.

Galileo's now well known astronomical observations/illustrations were published in *Sidereus Nuncius* (*The Starry Messenger*, 1610). In the text Galileo both includes paintings of what he saw when looking at the Moon and explanations of how he observed the geography of mountains, valleys, and craters through his telescope. By making reference to how the light and shadows change their disposition as the Moon moves from one phase to another, Galileo forthrightly asserts the difference between the terrain he saw and the long-standing Aristotelian belief that the Moon must be a smooth surface. The unique body of knowledge he brought to the project and his contacts helped him overturn a longstanding cultural meme and the prevailing Aristotelian idea that the moon was a smooth surface.

Ironically, the information about the Moon's texture information was readily available even to the inquiring and thoughtful naked eye, despite the tendency to explain it away. In fact, William Gilbert, best known for his research with magnetism, had earlier produced naked-eye maps of the Moon's geography. The outstanding element here is that Gilbert's maps did not draw upon the perspective techniques Galileo knew and used to render a naturalistic picture. In Gilbert's studies it was hard to decipher that the Moon had a geography similar to that of the Earth. Thomas Harriot offers another counterpoint. He is now generally credited with making the first rendering of the Moon as seen through a telescope and thus has the somewhat dubious distinction of being one of the first to fail to 'see' the rocky surface until viewing Galileo's images. Having no previous cognitive understanding of how a rough three-dimensional image would appear on a lens, Harriot, it seems, did not conceptualize he was viewing ridges and shadows – until he had Galileo's work to reference. Harriot, too, was among those more constrained by Aristotle's view that the Moon was smooth despite the evidence we see with the naked eye.

The differences among these images and the conclusions drawn from them explain why critics of multiple discovery say the multiples concept is overly generic. By reducing discovery to loosely defined products (like oil paint and the discovery of

the telescope), the concept under-emphasizes how attention, experience, and training inform discovery. In light of this, it should be mentioned that historians of science have long been interested in the community of science and multiple discovery complements this area of community by showing scientists comprise a community in which all scientists participate. Galileo's illustrations likewise affirm the scientific valuation of community and add that the more communities connected to a particular scientist, the more potential there is to bring information outside of one's domain into one's creative ventures. Galileo's work also demonstrates that scientific discovery has often been fostered by cross-disciplinary exchange and that cross-disciplinary examples inform the shared problems/parallel product style of inquiry. History, however, also offers examples of multiple discovery that underline a community tends to explore several lines of inquiry simultaneously, even when addressing one product or discovery. This accounts for the tendency to see products in *Zeitgeist* terms. Yet, for example, the painter Jan van Eyck produced three paintings in the fifteenth century that included naturalistic depictions of the Moon's rocky terrain. His paintings, unlike Galileo's, were not included in the philosophical and scientific discourse, where it was unquestioned that the Moon was smooth.

Zeitgeist

The history of photography speaks directly to the *Zeitgeist* issue, offering a classic case of how artists and scientists often work on problems in tandem. In this case, practitioners in both domains were interested in developing better methods for representing the world we see. This is not surprising given that representation has been an ongoing practical problem for both artists and scientists, and a practical problem easily separated from the philosophical arguments centered on 'appearance' and 'reality.' Many of the prephotography solutions (the *camera obscura*, the *camera lucida*, studies of optics, and perspective) aided the hand and the eye tremendously. But what was wanted was something that would allow an individual to fix an image and forego the need for long calculations and/or systematic tracing. Eventually determining a combination of light and chemicals capable of copying and fixing images solved this problem. The exciting solution, photography, made it possible to record visual images permanently and offered a level of detail that led some to exclaim that it was like looking at nature with a telescope.

Many helped develop this exciting technology. As early as 1727 a German professor of anatomy Johan Heinrich Schulze had shown it was possible to render images using sunlight and silver salts. In England, as early as 1802, Thomas Wedgewood, the son of the famous potter Josiah Wedgewood, successfully recorded images on paper. In 1819 the chemist John Herschel, the son of William Herschel, the discoverer of the planet Uranus, likewise discovered how to fix images and by 1839 could print them on paper as well. Independently, William Henry Fox Talbot, an English scientist who became interested in the problem because he was unable to draw easily using a *camera lucida*, determined how to create a single negative from which multiple copies of positive prints could be made. The Frenchmen Joseph Nicéphore Niépce and Louis-Jacques Mandé Daguerre conducted other independent investigations early in

the nineteenth century. Their experiments grew out of lithographic techniques and eventually, after Niépce's death, Daguerre fixed a single positive photographic image (a daguerreotype) on a metal plate coated with chemicals and exposed to light.

Assuming these examples represent multiple discoveries, and many think this is an incorrect assumption, does not explain why the mechanical representations of nature changed the cultural environment of art in ways quite unlike their influence on science. This aspect of multiples is of great importance to how one defines creativity and to how one applies the *Zeitgeist* characterization to multiples. Some elements of disparity thus need to be briefly explored. This inquiry will clarify that multiples take form in a context and form a context as well.

In a general sense, the photographic image provided a means for both scientists and artists to quickly record information about nature. Many found the efficiency attractive and astronomers and others quickly adopted the camera as a professional tool in the natural sciences. They immediately saw the technology eliminated the bothersome tasks of drawing and were pleased to no longer have to bear the burden of tracing moving images (although early prints often included after-images). In addition, the images satisfied several cultural demands. These included the desire for relatively inexpensive images for books (or as separate items) and the desire for cheap portraiture. The way in which the camera could record faces was a source of so much delight that some enthusiasts marvelled at how the camera was able to make the fugitive images of the mirror permanent.

The excitement, however, was not all-embracing. Generally, there was some concern that a photograph could be staged to give the impression it was a snapshot and thus be used to deceive people about events. Moreover, especially in the arts, many still preferred something included in the cognitive exercise of rendering by hand and eye. Even those artists (e.g., Manet) who did choose to incorporate the possibilities the camera offered had reservations about the mechanical nature of photographic reproductions. This is not to say that artists were against reproduction per se. Art has always been reproducible in principle, and multiples had always been printed using various technologies (e.g., woodcuts, etchings, etc.). It was the mindless mechanical reproduction of the camera that was disdained. Critics felt the camera was only capable of rendering surfaces. This argument was not a 'multiples' (Talbot's technique) versus 'singletons' (the daguerreotype) argument in regard to the multiple discovery of the photographic process per se, although the differences between the two processes were a part of the argument. Rather, the concern centered on the mindless nature of the mechanical images and whether mechanical images of surfaces could capture all that art and reality include. In other words, people believed, rightly, that mechanically produced copies did not contain the history, the pulse, and the depth of understanding embodied in an original.

In terms of *Zeitgeist*, the photographic images and the multiple reactions beg two questions. First, why did disciples of art and science have contrary reactions to the multiple discovery of photography. Second, how do we define a product of a time. The key point in evaluating these questions is that scientists were more likely to see photography as a tool. Painters, however, felt compelled to compare the nature of their images with

those the camera produced. The overall conclusion of the painters was that the mechanical images were not a replacement for painting or a reason to deny that the so-called objective reality of nature was of painterly interest. It would be more accurate to say that nineteenth-century painters continued to see an objective reality and to believe in the importance of rendering it. But the process of evaluating what images include also changed the nature of painterly problems. In sum, photography was one of many discoveries that reframed numerous nineteenth-century ideas regarding invention, mechanism, discovery, the mind, appearance, reality, the artist, the scientist, nature, seeing, and knowing. Some other factors include the nineteenth-century political situation and the turn toward Romanticism at the end of the eighteenth and through the mid-nineteenth centuries.

The details surrounding the entry of photography in the nineteenth century have been introduced to highlight a recurring question in discussions about creativity and multiple discovery: where do painters like Vincent Van Gogh (1853–1890) and Paul Cézanne (1839–1906) fit? Both nineteenth-century painters are hard to reconcile with multiple discovery in a generic sense, especially when a *Zeitgeist* model is implied. Now deemed as superior artists, their work was considered virtually worthless when they lived. What must be stressed in considering how these men 'fit' into models of creativity and discovery are, first, that the paintings done by van Gogh and Cézanne depicted the 'objective' natural world and were thus deeply rooted in the nineteenth-century tradition. This tradition, as noted, included the development of photography. Second, while both men were marginal in their time, each tried to integrate his work while he lived and failed to receive community acceptance. Finally, it is now said that the authenticity of their paintings and they way the forms conjure up a sense of presence that seems to go beyond the surface turned art in a new direction.

Putting these elements together raises the question of how do we evaluate the contextual incongruence the discoveries of van Gogh and Cézanne present? Many have pointed out they were people of their time. Yet, it is hard to align their productive lives and the intrinsic motivation that guided them with the idea that community acknowledgement of one's efforts is an integral part of being a successfully creative individual. It is equally difficult to align their lives with multiple discovery as generally defined. The problem is best summed up by asking why and to what degree are the individual and the culture connected in the discovery process, be it multiple or singleton? While it is true that most highly creative people do achieve success in their fields and are well-respected by their peers, in the visual arts we do find significant exceptions to this. As van Gogh and Cézanne attest, if we assume a discovery is contextually created, that the quality of a creator's work is evaluated by experts and institutions, and that only one who is 'accepted' by the community can be justly deemed creative in a complete sense, we are left with examples where a person, who is not defined as creative during his or her life, has, nonetheless, left behind products that are deemed creative long after the person has died. This time lag is especially problematic if we want to define artistic and scientific creativity using similar terms and in relationship to one another.

Cultural Issues and Conclusions

Reviewing the historical examples and the literature surrounding scientific breakthrough we find that even in earlier eras there was a tension between the individual genius model of creativity and the idea of a group working together to develop new ideas. For example, the philosopher Francis Bacon's (1561–1626) *Novum Organum* (1620) argues for multiple discovery when he states that discoveries are the products of 'joynt labours,' of people working together on common problems. The genius model, by contrast, is built on the image of God, the Creator, and glorifies individual accomplishments. Compatible with both theories of genetic determination and chance theories, the genius model suggests creative insight comes from out of nowhere, as if one is touched by something akin to the divine.

The long-standing debate about multiple discovery, as this article has shown, has raised many questions about creativity that remain unresolved. The issues and debates include:

1. the fact that the contribution of one individual may be significantly more complete than that of another in parallel discoveries;
2. the question of whether multiples theories adequately address individual creativity, especially given the differences between artistic and scientific creativity;
3. the length of time that separates what are termed 'multiple' discoveries;
4. the length of time that separates an individual's creative process of discovery and the community's acceptance of the work produced;
5. whether it is useful to define all discoveries as inevitable products of a time, an idea that *Zeitgeist* implies;
6. the individual priority disputes that have resulted from parallel discoveries throughout history;
7. the greater emphasis on team work in scientific research today; and
8. how the growth of team work makes it harder to recognize the contribution of any one individual.

The complexity of these unresolved questions tends to give rise to philosophical explanations. Given this, and although philosophical theory has not been the primary concern of this article, some precedents related to multiples need to be mentioned.

Briefly, both Plato and Aristotle grappled with the 'one' and the 'many' and did so because each saw human development and education as key concerns. Moreover, despite their differences, both Plato and Aristotle were deeply committed to an inquiry premised on logic and reason. Both were also in agreement that scientific knowledge is universal knowledge and that it is the same for all people, for all times, and for all places. These points of agreement were to become the backbone of natural philosophy and science in the West. As such, Platonic and Aristotelian ideas gradually set the stage for some of the ambiguities that have come to define the concept of multiple discovery today, as well as western views of creativity.

Since Plato and Aristotle have come to be defined more in terms of how they disagree, with Aristotle being seen to

emphasize studies of the natural world to a greater degree, it is often overlooked that both men did adopt a language/logic prototype for inquiry. The western allegiance to this prototype is no doubt why the concept of multiple discovery per se works better in a scientific (or verbal) context than in the visual arts. This language/logic preference, moreover, has generally been adopted by cognitive science in their search for universals.

Presently this long-standing preference for logic-based explanations is being counterbalanced by contextual case studies, systemic studies, research into the psychology of history, cognitive-historical analysis, and multiple intelligences research. Within this broad range many possibilities coexist. One that might foster viable information connecting individual and community approaches is the evidence of brain plasticity now being generated in cognitive neuroscience, for it appears that new tools might offer ways to align the focus on universals with individual case studies. Even if bridging studies are pursued, however, social and cultural interpretations will still have to be judged on their own terms.

Plato, himself, is not only a foundational reference for these ideas. He also offers a powerful example of the limitations within critical interpretation, albeit indirectly. Plato, who had a creative mind and was in awe of artistic inspiration in the sense that he saw it as divinely inspired, solved the problem of the one and the many with a philosophy premised on the idea that individuals could all discover the one Truth. In order to ensure it is the 'right' Truth, Plato banned artists from his ideal Republic, arguing their facility for imitation could too easily turn people toward appearances and thus turn them away from a genuine engagement with moral purpose. As philosophers, sociologists, and others have often noted, societies that mold people in 'one' way cannot be reduced to simple philosophical conundrums. Rather, manipulative social foundations pose numerous questions regarding education, individual growth, and governance. How people answer these kinds of questions, in turn, has a tremendous impact on what we discover in general – as well as conclusions pertaining to multiple discovery. The heart of the issue is multidimensional: How does a society differentiate between a discovery that is a 'correct' product in the sense that it is in line with a culture's norms and the discovery of something that is actually new and unique? How does the dynamic challenge of intergenerational education influence creativity? Each generation needs to be educated, and each educational process must align technological advances with ever-emerging cultural issues. Within this, one over-riding problem is fostering excellence in discovery, be it multiple or singleton. How does a culture balance individual potential and honor models that include structure, cooperation, teamwork, pluralism, and the exceptional?

The exceptional is of exceptional importance within this – especially because exceptional people defy neatly packaged conclusions about multiple discovery, as the example of Albert Einstein's *annus mirabilis* (1905), discussed earlier, shows. In sum, multiple discoveries can be defined as products that emerge from scientific exchange. Within this, definitional challenges exist due to the difficulty in precisely balancing the many variables that contribute to individual and communal change.

See also: Attribution and Creativity; Creativity in Science; Creativity Through History; Discovery; Expertise; Genius and Greatness; Innovation; Invention; Problem Finding; Theories of Creativity; Zeitgeist.

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Multiple Intelligences

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Glossary

Creativity A purpose or outcome of the interaction of individuals' intelligences and a domain of symbolic knowledge. The resulting solution or product is initially considered novel and unusual by the field but is ultimately accepted as appropriate and valuable. The creative breakthrough becomes part of the domain's knowledge base that is passed on to future generations of practitioners.

Domain A discipline, craft, area of work, or system of symbols used in a cultural activity; a set of practices associated with an area of knowledge.

Field The collection of practitioners, leaders, and institutions that judge work in a domain in a given historical period.

Intelligence A cognitive ability to solve problems or fashion products.

Intelligence profile A depiction of a person's intelligences in terms of relative strengths and weaknesses.

Purpose An intention to accomplish some outcome that is meaningful to the self and of consequence to others.

For much of the twentieth century, leaders, educators, and employers have been interested in predicting which individuals are more likely to succeed and, perhaps, even to change the world. 'Intelligence' has been a key psychological construct used to assess individuals for future performance. However, accurate prediction – especially of transformative or creative outcomes – has proved elusive.

IQ and general intelligence measurements have failed to account for why some people, and not others, change the course of history. Psychometric tests of intelligence and creativity do not correlate strongly above IQs of 120. In addition, Lewis Terman's landmark longitudinal study of high-IQ children produced few, if any, creative groundbreakers. Furthermore, the high-IQ criterion eliminated historically important creators, such as physicist William Shockley, inventor of the transistor.

Multiple Intelligences (MI) theory was devised, in part, to better explain the variety of performance outcomes individuals can produce. Psychologist Howard Gardner suggested that real-world achievement beyond academic tasks could be accounted for better by examining the interactions of an ensemble of relatively autonomous intelligences rather than the measurement of one 'general' intelligence. An analogy to building block toys may be helpful. IQ or 'g' is like having only one giant block. People can 'bang' that block in a variety of situations, but there are a limited number of items they can build with it. Multiple intelligences is like having several smaller blocks with different shapes. The scope of possibilities for individuals to build solutions or products is much wider, and the possibilities for researchers to understand how intellectual abilities interact in performances are more nuanced.

A Brief History of Intelligence

Intelligence is a capacity to learn, to gain knowledge and meanings, to understand relationships, and to reason. It has been a key construct in psychology throughout the twentieth century, especially in discerning individual differences and predicting

future performance on academic-type tasks. The measurement of intelligence has focused on IQ and the g-factor.

IQ, or intelligence quotient, is a quantitative measure based on scores on a battery of standardized tests of verbal comprehension, quantitative reasoning, perceptual reasoning, processing speed, and working memory. Tests such as the Stanford-Binet Scale and the Wechsler Adult Intelligence Scale compare an individual's score normatively to a bell curve centered at 100 such that 68% of people fall between 85 and 115.

The g-factor, or 'general' intelligence, relates to the positive correlation among various cognitive abilities measures. Derived using statistical factor analysis, 'g' is the dominant first factor on which many intelligence tests strongly load. Thus, 'g' is interpreted as a summary measure of intelligence of the person, although it primarily reflects a consistency across various intelligence tests.

In contrast to reducing cognitive ability to a single number, a few psychologists, in addition to Howard Gardner, have proposed more complex models. In the first half of the twentieth century, several theories, such as J. P. Guilford's Structure of Intellect Model or Louis Thurstone's Primary Mental Abilities, comprised hierarchical models of cognitive abilities subsidiary or in addition to 'g'. More recently, Robert Sternberg's Triarchic Theory of Intelligence posits three capacities: analytical, practical, and creative. His approach emphasizes the purposes toward which intellectual capacities are used. Raymond Cattell factored 'g' into fluid and crystallized intelligence. Fluid intelligence finds meaning, makes inferences, and solves new problems, whereas crystallized intelligence applies acquired knowledge. His approach emphasizes the situations toward which intelligence is applied. Stephen Ceci's Bio-Ecological Theory of Intelligence emphasizes that intelligence, rather than being an independent property of individuals, is fashioned by and in relation to the surrounding context. His approach depicts how intelligence is an interaction not only among a person's cognitive capacities but also among the person, the immediate environment, and historical circumstances.

Multiple Intelligences Defined

In the 1970s and 1980s, with revisions continuing today, Gardner devised Multiple Intelligences theory by synthesizing findings from research in psychometrics, neuroscience, anthropology, developmental psychology, evolutionary psychology, experimental psychology, and cognitive psychology. Not all cognitive capacities qualify as intelligences. MI takes a 'middle road': the senses, and fundamental perceptual or motor abilities, are too fine a grain to be useful for the ends to which intelligences are put, whereas one general intelligence or broad personality traits are too diffuse. To be named an intelligence, a cognitive capacity must satisfy eight criteria:

1. Potential isolation of brain damage that shows neurological separation of functions.
2. Existence of savants and prodigies that shows individuals can be strong in specific abilities without necessarily having high general ability.
3. Experimental psychological tasks that show performance on two simultaneous tasks do not interfere with each other.
4. Psychometric findings that show certain abilities factor separately.
5. Developmental trajectories and end-states that show capacities have different speeds, building blocks, critical periods, and pathways.
6. Evolutionary history that suggests different capacities can be found separately in earlier or less complex species.
7. Identifiable core set of operations for processing information that shows a relatively modular organization of capabilities.
8. A cultural symbol system providing information for which the intelligence is needed. Such a system may catalyze educational institutions that foster the development of an intelligence within a community.

At first, Gardner named seven intelligences, then later added '1-1/2' more. Although several other scholars and educators have suggested various other intelligences, such as spiritual intelligence or emotional intelligence, Gardner limits the intelligences satisfying the above criteria to the following list:

1. Linguistic intelligence: ability to process words, language, and verbal meanings.
2. Logical-mathematical intelligence: ability to process numbers, mathematical and logical patterns and operations.
3. Musical intelligence: ability to process sound and rhythm as well as meanings derived from them.
4. Spatial intelligence: ability to process shapes, arrays, and directions as well as meanings derived from them.
5. Bodily-kinesthetic intelligence: ability to process sensations, movement and coordination and to manipulate objects with one's body.
6. Interpersonal intelligence: ability to process information related to other people and social interaction, such as discerning feelings, needs, and intentions.
7. Intrapersonal intelligence: ability to process self-related concepts and sensations, such as differentiating one's own feelings, mental models, and self-knowledge.
8. Naturalistic intelligence: ability to process lists and categories and to classify and build models based on phenomena's features.

9. Existential intelligence (provisional '1/2' intelligence): ability to process profound, hard-to-grasp abstractions.

Gardner concluded that individuals possess differing degrees of these intelligences. Barring brain damage, all humans possess some of each intelligence, yet individuals can differ in their profiles. Some people may have smooth profiles with relatively equal degrees of the intelligences. These individuals are described as having 'equipotentiality,' although a smooth profile could depict low levels across the intelligences as well as high levels. Other people may have jagged profiles with one or two intelligences 'spiking' to a higher level than the others. Among these individuals are often found the savants and prodigies who may have difficulty in common tasks but can calculate complex equations in their heads or play sophisticated musical compositions by ear on first try.

Furthermore, profiles can be influenced by historical and social circumstances: some types of information are more prevalent or important in one time period or culture than another, and thus intelligences that process those types of information, for a time, will be more valued and supported. In the historical past, bodily-kinesthetic and naturalistic intelligences, as well as linguistic intelligence for storytelling, may have been preeminent for survival and growth. For most of the twentieth century in developed countries, linguistic and logical-mathematical intelligences have been the most highly valued. In the twenty-first century, interpersonal intelligence may become more valued as individuals must interact with a diverse array of people, and spatial intelligence will gain importance with the rise of computer graphical user interfaces and the Internet. Perhaps existential intelligence may rise in the ranks, as much of the knowledge that cutting-edge scientists produce is beyond the scope of our direct perception.

In summary, according to MI theory, an intelligence is a capacity to process certain forms of information that are available in the environment or produced by other cognitive faculties. Cultures value and support intelligences through schooling, symbolic *domains* of knowledge that utilize particular intelligences, and *fields* of practitioners in which individuals can apply their intelligences.

Multiple Intelligences in Interaction

Although researchers and practitioners continue to debate what constitutes an intelligence and to suggest further intelligences, theoretical work on MI has turned to how the intelligences interact. Although defined, in part, by their independent functioning, brain locations, psychometric factors, and developmental pathways, the intelligences do not work in isolation to create performances. The power of an MI approach is that individuals' diverse profiles of intelligences can be used in concert to engage tasks, achieve goals, solve problems, and create products. For example, dancing combines musical intelligence's processing of rhythm and bodily-kinesthetic intelligence's movement control.

Furthermore, different people can demonstrate similar performances using different combinations of intelligences. For example, compare three equally good dancers: one dancer may

draw on spatial intelligence to navigate the dance floor and spin his partner around, whereas another dancer may call on logical-mathematical intelligence to count steps and keep in time, whereas a third dancer may emphasize the connection with his partner using interpersonal intelligence.

Also note that most performances are not completed by one person. People work and play in teams and groups; outcomes are based on complementarity of resources, including intelligences. One person's intelligences interact with other people's intelligences. Ballroom dancers must adjust to each other, which may mean calling on intrapersonal, interpersonal, bodily-kinesthetic, spatial, and linguistic intelligences in a way they might not have needed if they were dancing alone.

Moran and Gardner discuss how intelligences can interact in three broad ways: bottlenecking, compensation, and catalysis. Intelligences bottleneck when one interferes with the expression or development of a different intelligence. For example, a language-based paper-and-pencil test may bottleneck the expression of other intelligences, such as when the subject matter examined is musical or logical-mathematical. Intelligences compensate when a stronger intelligence offsets the impact of a weaker one. For example, in *Creating Minds*, Gardner discussed how Albert Einstein was relatively weak in math, for a Nobel Prize winning physicist, but he more than made up for it with his strong spatial intelligence. Intelligences catalyze when one stimulates the use or growth of another. For example, while attempting to sway an audience, a public speaker's spatial and bodily-kinesthetic intelligences can multiply the effectiveness of their interpersonal intelligence.

Interactions may help explain why there is much diversity in expression of intelligences. A public speaker and a poet both may have strong linguistic intelligences. However, public speaking also draws on bodily-kinesthetic and interpersonal intelligences, and poetry draws on musical and perhaps logical-mathematical intelligence for structuring, and existential intelligence for addressing big issues. Thus, with multiple intelligences, there can be multiplicative as well as additive effects of intelligences. The moderate correlations among multiple intelligences scales may reflect these interactions. Furthermore, neuroscientific studies continue to show that higher 'intelligence' seems associated with higher interconnectivity among brain regions.

Finally, these interactions caution researchers and teachers not to confuse an *intelligence* with a *domain* – even when they have the same name. Intelligences interact to produce performances valuable to a domain. Domains are subsets of culture that focus on the use and perpetuation of a particular symbol system or body of knowledge. Examples of domains are history, music, visual art, physics, and business. Musical intelligence is not the only intelligence used in the music domain. Linguistic intelligence for lyrics, bodily-kinesthetic intelligence for playing an instrument, and interpersonal intelligence for coordinating with others in a symphony also may be called for. Similarly, someone with strong musical intelligence may employ it in a variety of domains, including poetry, acoustic engineering, or medicine to understand the sounds and rhythms a body makes in health or disease.

Assessment of Multiple Intelligences

In part, MI theory arose from Gardner's frustration over the failure of standardized intelligence tests to explain the diversity of human performances. Yet, assessment of 8-1/2 intelligences, plus their interactions, is much more complex than a test score or first factor. Adding to that complexity is the need to find assessment techniques that people can efficiently and reliably use in schools or workplaces. Assessment is the aspect of MI that the majority of intelligence researchers and school practitioners most criticize. Assessment also seems to be on the rise, especially in other countries such as Portugal or in Asia, and is, thus, increasingly emphasized in empirical studies of MI.

Branton Shearer has written extensively on MI assessments. In his chapter in *Multiple Intelligences Around the World*, he reviews the variety of MI assessments that have arisen. Several paper-and-pencil tests of each intelligence have been proposed and used. Gardner believes these tests suffer from a bottleneck of linguistic intelligence. Questionnaires, checklists, and interviews, such as the Multiple Intelligences Profiling Questionnaire (MIPQ) or the Multiple Intelligences Developmental Assessment Scales (MIDAS), ask students, and sometimes teachers or parents, to evaluate students' intellectual abilities. Gardner suggests that these self-report measures may suffer from a bottleneck of intrapersonal and/or interpersonal intelligence.

The Key Learning Community, a school widely known for adopting a schoolwide MI perspective, as well as other public and private schools, uses rubrics to evaluate portfolios of student work as the work develops. Project Spectrum assessments developed at Harvard Project Zero have trained adults to observe young children as they engage with carefully designed problem-solving materials. The portfolio and observation approaches pose less of a bottleneck and are more ecologically valid and 'intelligence fair,' but they have been criticized as time-consuming and too subjective.

Importantly, intelligence-fair assessments evaluate each intelligence directly, rather than through a linguistic-oriented paper-and-pencil test. Object manipulation tasks evaluate spatial intelligence; group collaborations evaluate interpersonal intelligence; self-reflections evaluate intrapersonal intelligence. Danfoss Universe's Explorama, a children's science museum in Denmark built on MI theory principles, is an example of intelligence-fair assessments. As with Project Spectrum, Explorama exhibits feature activities in which individuals can interact with materials to employ various intelligences. For example, one exhibit provides biological specimens for students to touch and move (tapping bodily-kinesthetic intelligence), arrange (naturalistic), create relationships among (logical-mathematical), tell stories about (linguistic), or even compare themselves to (intrapersonal). Yet, unlike Project Spectrum, which is designed for young children, the Explorama is used by people of all ages and backgrounds, from school children to business executives.

These assessments differ from testing in that they are more contextual and conducted in the course of performance rather than via decontextualized questions. MI assessment is considered to be part of the natural process of learning and engaging with the environment, rather than a task set apart. Yet, the difficulties of MI assessment are three-fold. First, MI assessment

does not have a 'norm' or 'standard' for comparison because children's different intelligence profiles can follow various developmental paths. Assessment results are qualitative as well as quantitative. This type of assessment may help people find their 'niche' in their societies and cultures, but it leads to two further issues. MI assessment is not as quick, efficient, or cheap to administer as paper-and-pencil tests. Hence, many schools find MI assessment cumbersome when teachers or counselors are under time and resource pressures. And MI assessment does not produce a single number that can be used to label and compare students. If the purpose is to categorize or place students in 'higher' or 'lower' bins, such as gifted or remedial programs, then practitioners find more traditional intelligence testing easier.

However, policymakers, educators, and business leaders increasingly realize that one norm, standard, or pathway applied to everyone does not produce the variety of talents and skills needed in a complex society or economy. 'Meets standard' may not equate with 'maximize potential' or 'able to make a contribution to society.' Individuals have different sets of intellectual resources and potentials that lead to different ways those people can contribute to their communities. An expert mother, entrepreneur, architect, bus driver, or computer programmer each requires different skills that draw on different intelligences. Yet, most cultures need *all* of these skills spread among their members.

Purposes of Multiple Intelligences

As more emphasis has been placed on how multiple intelligences are assessed, educators and scholars have turned to the question of purpose. This exploration of the practical dimension of MI theory has come to the attention of educators worldwide. An assessment is meaningful in light of a reason for the capacity. *Why* do individuals' MI profiles matter?

Intelligences are often considered an individual property, a capacity a person 'has.' However, intelligences are not important so much for their own sake as for what they accomplish. One of the reasons to understand intelligences is that they contribute to the achievement of personal and cultural goals. Intelligences operate within cultural contexts. As cultures develop different domains and develop domains differently, some intelligences may be more valued, and thus developed and supported, in one culture than in others, or within one culture at different times.

In *Five Minds for the Future* published in 2007, Gardner elaborated five ways that intelligences could be focused toward particular purposes: to master a particular discipline, which converges intelligences on one cultural domain; to synthesize information from a variety of sources, which uses intelligences to cross the boundaries within and between cultural domains; to create new ideas or products, which expands or transforms cultural domains; to be respectful of differences among individuals, which may synthesize or expand notions of belonging and acceptance; and reaching for ethical ideals, which emphasizes the impact of one's efforts on others now and in the future.

Although many cultures have these purposes operating concurrently, sometimes they may clash. For example, the emphasis of a disciplined mind to maintain expertise within

a domain may conflict with the emphasis of a synthesizing mind to expand the boundaries of the domain. Similarly, the creating mind that develops something new, unknown and untested may conflict with the ethical mind that evaluates what has traditionally been considered right or helpful in a domain. These conflicts can occur contemporaneously within a democratic culture, or across historical time within a culture as the culture changes. For example, some educators in Asian countries realize that MI theory returns their educational systems to traditional purposes, such as Confucian education principles. Or these conflicts can occur across cultures as different cultures express different values. And conflicts can occur across subcultures within a nation, such as has been promoted in debates on race/ethnicity and IQ.

In *Multiple Intelligences Around the World* published in 2009, educators in countries on five continents discussed the impact of MI in their school systems. The main purposes of intelligences *assessment* they provide remain the traditional reasons of placement and educational tracking/planning. However, several other purposes are presented for the *development and education* of intelligences, including harmony among people and their skills, inclusion of a wider variety of talents into the realm of cultural acceptance, self-understanding and personal fulfillment, and contribution to society. These purposes point to two increasingly important values: flexibility and cooperation. Within an MI framework, education aims to enhance a culture's collective information-processing potential to use the culture's collective knowledge base effectively to complete more varied tasks. As societies become more complex and interactive globally, a similarly complex and interactive view of intelligences strengthens individuals' and cultures' abilities to adapt and thrive.

Multiple Intelligences and Creativity

One purpose to which intelligences is increasingly summoned is creativity. MI theory provides a way of thinking about education and performance that allows and supports a wider variety of talents and skills to be expressed and to contribute to the community. An MI approach invites more diverse array of intelligence profiles to become producers rather than just consumers of culture. That is, by taking a broader and more inclusive view of intelligences, MI supports an increased probability of creativity in two ways. First, more people can access domains in which they can make creative contributions because MI is more inclusive of different groups of people exhibiting distinctive profiles. Second, more contributions may be judged as creative because of a wider array of acceptable ways to use one's talents.

MI addresses the 'novelty' aspect of creativity by recognizing how different profiles can result in different performances and also by realizing that intrapersonal intelligence can help the self-direction and self-regulation of creative work. By its very nature, creative work aims to transform a domain and, thus, may encounter resistance from domain practitioners already in power who like the domain as it is. Under such circumstances, intrapersonal strength may be particularly important for orchestrating not only the creator's other intelligences but also his or her motivation during challenging times.

MI addresses the ‘appropriateness’ aspect of creativity by recognizing how difficult and potentially conflicting it is for people to process different types of information in reaching a judgment of value. Each intelligence, by processing a different type of information, contributes differently to how a creative work is perceived. Individuals have different intelligences, thus process the whole of the creative work differently. Such differences may contribute to controversies over value. Furthermore, intrapersonal and interpersonal intelligences may be particularly important for the ‘appropriateness’ aspect as these intelligences may be most directly involved in creativity’s main aim to ‘change minds.’ Through reflection and communication, a creative work influences the way others think.

Creativity is an *extraordinary* contribution to culture in that it eventually changes the culture. Thus, creativity, over time, can change the value of different intelligences within a culture by altering types of information available, importance of these types, and the purposes toward which such information is used. Thus, the interaction of multiple intelligences and creativity is bidirectional.

See also: Intelligence (as Related to Creativity); Paradigm Shifts.

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Relevant Websites

- <http://www.616.ips.k12.in.us> – The Key Learning Community.
- <http://www.danfossuniverse.dk> – Danfoss Universe Explorama, Denmark.

Music

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Glossary

Composition Music that is created and then written down using notation to produce a score, or recorded by some other means that permits copying, so that it can be read and played by others. However, performers and conductors may still have freedom to interpret the piece according to their own preferences.

Emotions Feelings of which we are consciously aware, which can result in behavioral and bodily changes such as tears, sensations in the stomach, a lump in the throat, heart palpitations, skin tingles, and increased perspiration. The physiological mechanisms involved are complex, involving different parts of the brain, and both the sympathetic and parasympathetic nervous systems. Playing and listening to music can be emotional experiences.

Music An auditory, nonverbal medium of communication: the language of feelings, compared with speech which communicates information and ideas.

Musical creativity Composing and interpreting music makes use of skills that are not just logical and convergent, but are emotional, divergent, artistic, and original. There is evidence that musical training, especially for school

children, can enhance other aspects of intellectual development.

Music therapy The use of music by a trained therapist to help communicate with, and help, people with specific behavioral or emotional needs, where the use of words alone may fail.

Musical sound Noise that is structured rather than random, and which comprises melody, rhythm and, if more than one note is played at once, harmony. Different instruments, or combinations of these, produce their characteristic tone color (*timbre*), and dynamic variations in loudness and tempo also influence the overall musical effect. The vibrations of sound can be felt by the body as well as being heard, and some successful musicians are in fact totally deaf.

Song Musical pieces that are composed to be sung, with or without instrumental accompaniment. The words need to be processed by the speech areas of the brain, and singing adds the element of aural communication by one (or more) human beings to another. Researchers who are interested in music per se invariably restrict their stimulus material to nonvocal pieces, in order to limit the influence of confounding variables.

What is Music?

Sound

Music is a type of sound. When a suitable object vibrates, it alternately compresses and decompresses the air around it forming waves. These waves travel through the air at a speed of about 740 miles an hour, and are intercepted by the ear, within which the ear drum (tympanic membrane) moves back and forth in synchrony with the pulsations of the air pressure. Then, via a series of structures within the ear, the signals are conveyed by the auditory nerve to the brain and are perceived as sound. The particular noise that is heard is determined by characteristics of the vibrations, such as frequency (number of wave cycles per second) and amplitude (the height of a single wave). Where several sounds are generated at the same time the wave forms can interact and become very complex.

The Sound of Music

Almost anything struck will yield a sound but, in the case of random or nonmusical sound, the waves formed will tend to be irregular and unstructured, and will likely be perceived simply as noise. For sounds to be musical, the waves must be structured into time and space, that is, be regular rather than random. The structuring then needs to yield a sequence of notes that is recognizable as a *melody*, and arranged in a

pattern that generates some form of *rhythm*. If more than one note is sounded concurrently, these need to blend into an acceptable *harmony*. Finally, to be perceived as pleasing, the resulting sound needs to have a characteristic *timbre* (tone color), and this will vary according to the instrument that generates it. However, the final decision on whether or not the sound can be regarded as music lies within the perception of the beholder. What qualifies as music (and particularly harmony) has changed over the years, and is subject to the whims of taste, fashion, culture, and social context (see 'Historical Development of Music').

Sounds of Nature

Can sounds of nature be regarded as genuine music? Birdsong, for example, can have a melodic structure and tone color, and also a rhythm. Ralph Vaughan Williams (1872–1958) is but one composer who was inspired to create a composition based on bird song, with his evocative *The Lark Ascending* (1914), in which a violin replicates the sound of the bird. The decision on the authenticity of music not of human origin remains a matter for debate, but a possible criterion could be that the sound is intentionally composed or created by human beings for human beings, as an artistic expression that is conveyed through performance by the self or others (see 'Sounds of Nature').

Origins of Music

Prehistory

Music has probably been present since the dawn of civilization, and is found in every culture and historical period, so far as can be ascertained. Its precise origins remain uncertain, but some (including Charles Darwin) believe that it arose from an increasing tonal range of emotional speech, including verbal exchanges between mothers and their babies which itself indicates emotional bonding. Another possible origin, or at least influence on the development of music, is that our early ancestors mimicked and adapted the 'musical' sounds of nature – the wind blowing through reeds, the sonorous tone of an object hitting a hollow log, and the vocalizations of animals including birds (see 'Sounds of Nature').

Early Musical Instruments

What is believed to be a fragment from a flute made from the thigh bone of a bear has been dated to between 43 000 and 67 000 years ago, an era when Neanderthals still existed. Also, part of a 40 000-year-old flute fashioned from a vulture's wing bone, probably *Homo sapiens* in origin, was discovered in a German cave. Later, more certain flute specimens have been dated to about 27 000 BC. Evidence suggests that drums have existed from the earliest of times, that stringed instruments such as early forms of the harp and lyre (Figure 1), plus bells, date from about 3000 BC, and that the lur, an ancient form of trumpet, originated around 1000 BC. Around the time of the medieval period, early versions of many of the more modern



Figure 1 The ubiquitous ancient lyre design is reflected in this lyre guitar C1815. Image courtesy of Pamela Wilson Collection, UK.

instruments in use today were being evolved, such as the fiddle, trombone (sackbut), and harpsichord (Figure 2).

Notation

The oldest known attempts at musical notation – written music that allows many pieces to be shared and copied without the need for rote learning, were in Babylon circa 1250–1200 BC, although the symbols are very obscure. A more systematic attempt to write music was made in the seventh century in the context of sacred monastic chants. This became more effective only by the eleventh century, although it comprised little more than dots above the words of a song, indicating when the voice should be raised or lowered in pitch. As notation became more sophisticated, so did the opportunities for composers to embellish their written scores with more complex timings, harmonies, and expression (Figure 3).

The Harmonic Series

Leonard Bernstein, twentieth century American composer and conductor, referred to music as sound that is produced by beating, blowing, plucking, striking, or frictionalizing with a bow. In about 500 BC, the Greek philosopher and mathematician Pythagoras discovered that the note from a plucked string becomes progressively higher as the string is shortened, according to simple arithmetical ratios. It is now known that, with only slight discrepancies, these ratios agree with changes of frequency as measured in megahertz, and thus they comply with natural physical laws. If a string is shortened by half, the note plucked will be an octave higher than that produced when at full length, the ratio between the two notes being 2:1. When the string is shortened to a third of its original length, the sound it generates will be five tones higher than when it was at half length (known as a 'fifth'), with a ratio of 3:2. Likewise, when shortened to a quarter of its original length, the note will be a further fourth higher (ratio 4:3) and, when a fifth of its original length, it will sound another third higher (ratio 5:4). These examples can be deemed simple ratios, but the process can continue almost indefinitely and the ratios become very



Figure 2 This archaic serpent C1835 is an early brass instrument. Image courtesy of Pamela Wilson Collection, UK.

music. Research by Sandra Trehub and colleagues found that infants as young as 4 months were superior to adults in being able to detect melodic changes within the same key signature. Trehub has concluded that there is present at birth a biological predisposition for understanding musical structure, as well as an innate preference for what can be termed 'good' (consonant) melodies.

If there is an inherent universal ability to understand and respond to music, why do only some individuals become talented musicians? Many factors are involved, including encouragement, interest, musical environment, opportunity, and sheer hard work. Hayley Goldman and Michael Lewis investigated the respective influences of genetic and environmental factors on the development of musical ability in children. They used Edward Gordon's *Advanced Measures of Music Audiation*, which assesses both rhythmic and tonal aptitude, to test a sample of young people drawn from the United States and the United Kingdom, along with their parents. The children also completed a self-report questionnaire on environmental influences such as musical training, music listening, and concert attendance.

Whilst the results supported the role of environmental (nurture) factors in the development of musical skills, an additional intriguing finding was of a significant link between fathers and children specifically for rhythmic ability. Could there be an evolutionary advantage in inheriting rhythmic skills, passed only through the male line? Not only is rhythm an essential component of music, but it is also evident in marching, chanting, drumming, and other warlike behaviors such as hunting and fighting. In most cultures these would have originally been male pursuits. Such spatial skills are predominantly controlled by the right cerebral hemisphere, held to be more dominant in men than in women, and this region is also responsible for much of the musical processing. Additionally, some research has implicated the cerebellum in the processing of rhythm, this being the area of the brain responsible for the coordination of voluntary motor movement that would include the behaviors mentioned above (see 'Cerebral Processing').

The nature or nurture issue on the development of musical talent has yet fully resolved, and this is particularly relevant to the question of musical geniuses, of which Mozart (1756–1791) is cited as a prime example. Mozart came from a family of musicians which could imply that he had some innate ability, but it also means that he was surrounded by music from birth, and even *in utero*. His father, Leopold, was a music teacher and a hard, even ruthless, taskmaster forcing his young son to practice for many hours a day. Anders Ericsson and colleagues have searched for strong scientific evidence for innate talent and giftedness, but as yet have not found rigorous reproducible outcomes that support this. Perhaps the debate should continue, with the provisional conclusion that nature and nurture might both have a part to play in musical development.

Emotional Experiences

Music is a medium for communicating emotions, in some cases very extreme emotions. How and why it does this is still

not fully understood, despite research that includes measuring brain activity during music listening trials (see 'Cerebral Processing'). Most, although not all, research into the effects of music has been carried out using selections from instrumental (that is nonvocal), classical repertoires, which are sufficiently complex to require a degree of cognitive processing. When melodies are sung, the human voice introduces the confounding element of verbal meaning plus the expression of emotion.

In the 1960s Abraham Maslow described *peak* (emotional) *experiences* that can occur in practically everyone, and could manifest as moments of great awe, a feeling of oneness in the world, seeing the ultimate truth, satisfaction of vague, unsatisfied yearnings, stepping into heaven, or being detached from time and place. Others think of them as altered states of consciousness, but the emotional impact needs to be much more profound than just great pleasure or enjoyment for it to qualify as a *peak*. Maslow said that aesthetic events, particularly music, could act as triggers for peaks, and that some individuals could rely on certain pieces of music to help them bring them about.

Is it possible to identify what it is about music that can lead to such heightened emotion? Music in major modes tends to sound happy, whereas minor modes can evoke sadness. Likewise slow tempi sound dignified and calm, fast tempi happy and exciting, high pitches sprightly and humorous, and low pitches solemn, sad, and dignified. Research on hymn tunes, carried out by Adrian Hughes and Michael Lewis, found that higher scores for emotional and spiritual impact were awarded for hymns in triple time, when compared with those in quadruple time, and that there was a similar effect with hymns in minor modes compared with those in the major.

Lewis and professional musician Colin Touchin exposed participants to 30-min selections of classical music, and asked them to press a button each time they experienced a peak emotional reaction conforming to a predefined description. The music scores were then scrutinized for specific events that coincided with the main clusters of peaks. Only a few were identified with any certainty, for example at the start of a solo passage, where one instrument takes over from another, at a fortissimo, at percussive impacts, crescendos, and a full-blooded climax. Others such as John Sloboda of Keele University, United Kingdom, have cited appoggiaturas, descending fifths, earlier than expected changes in harmony, and unexpected changes or tensions, as being responsible for producing what have been variously called 'chills' or 'thrills' or 'shivers.' Although increased arousal could be responsible for such responses, especially with upbeat music, it is likely that other factors are also involved, especially in the case of gentle music that can generate a dreamy or even hypnotic state in the listener.

Does the knowledge of such triggers mean that composers simply make use of a 'cook book' technique to build emotional expression into their music? Opinion is divided on this question. Philosopher Susanne Langer did not believe that a work of art expresses the feelings of the artist, adding that music is (just) a form of logical expression of emotions that can enable listeners to experience them. The composer Stravinsky stated that music is powerless to express emotions, and that any indications to the contrary are simply illusions. However, he did not deny that music can have *apparently* expressive qualities that can be perceived as such by the listener. Hindemith,

another composer and performer, opined that melodies can be constructed rationally, making use of experience that indicates which musical patterns correspond with particular emotional reactions. Others, such as Sloboda and Deryck Cooke, maintain that music does indeed have inherent characteristics that promote affective responses, and that it can convey the subjective experiences of the composer.

Vladimir Konečni looked for evidence from previous studies, and was able to make a distinction between $M - E$, the notion that music can represent or *express* emotion that is perceived as such by the listener, and $M \rightarrow E$, in which music is believed to *induce* emotion in the listener. Konečni concludes that, whereas music can certainly depict and represent emotion, the evidence for the direct induction of emotion by music is weak.

In any discussion on music and emotion, it is necessary to consider the roles of the performer and listener respectively. Whilst most composers include expression marks on their musical scores, to help performers recreate what was intended, often some freedom remains for the artist to add his or her own expressive interpretation. This can be done through manipulation of tempi, dynamics, or sheer virtuosity to reinforce the structural features that the performer (or the conductor) believes are intrinsically important. Performers may not be able to clearly explain why they interpret the way that they do, but rather simply follow their intuitive feelings.

The listeners will be influenced by the degree of musical training they have received, and the musically sophisticated will probably hear what is being played in a more cognitively involved way than do their more naïve colleagues, as well as liking the more complex musical styles. Finally, another important quality of music is its ability to evoke memories of association, especially if the piece was being played at the time of an earlier, emotional, event such as a wedding, funeral, or the first meeting with a future marriage partner ("darling, they are playing our tune"). Rehearing the music could either generate an emotional response that was not specifically intended by the composer, or enhance an emotion that was so intended, perhaps sufficiently strongly to stimulate mental imagery of the earlier occasion. Daniel Levitin has delved deeply into the biological processes underlying how we experience music, and why it plays such a unique role in our lives. He concludes that our brains are hardwired for music and that our musical preferences begin to form even before we are born. Rather than music being just an addition to our lives, Levitin is convinced that it is an obsession at the heart of human nature.

Cerebral Processing

Music, being a nonverbal (if purely instrumental and not sung) medium of auditory communication, is processed predominantly (but not exclusively) in the right cerebral hemisphere, at least for right-handed individuals.

Lauren Stewart and colleagues reviewed findings from imaging studies on the normal musical brain, obtained from procedures such as functional magnetic resonance imaging (fMRI) or magnetoencephalography (MEG). They also examined similar data from patients who had brain lesions caused by surgery, accident, or stroke. From this information, the

authors were able to identify the areas of the brain where different types of musical processing mostly took place. With normal brains, Stewart and colleagues report bilateral hemisphere activation during analysis of pitch sequences, but with a degree of right-lateralization, and additional activity in the right frontal operculum when participants were required to follow a melody. For rhythm, some studies revealed activity in the cerebellum, suggesting that motor mechanisms may be required for its production. Evidence from patients with brain lesions in areas involved in processing music indicated that the regions concerned are widely distributed, but with a preponderance of locations in the right hemisphere. For example, the areas involved in pitch interval, pitch pattern, and tonal structure ranged across several areas in the right brain, although there were some indications that the two hemispheres work in cooperation. For rhythm, again several right hemisphere areas were involved, although a minority of studies also implicated the left parietal lobe but, unlike the studies with normal brains, not the cerebellum. The work with damaged brains also showed that the right hemisphere was involved in emotional responses to music.

There is evidence from a number of studies that differences exist between the brain lateralization of musicians and nonmusicians. For example, trained musicians also utilize the left brain more than do casual listeners, because they tend to cognitively analyze the structure and complexity of the music they hear. Christian Hoppe and Jelena Stojanovic used MEG scans to compare the neural responses of musicians and nonmusicians to changes in melodic contour, and found that the responses were 25% higher in the former. The musicians also showed higher gray matter density in the left inferior frontal lobe (Broca's area) which is a region used for language processing; the authors explain that this part of the brain is also used for sight reading of musical notes. Hoppe and Stojanovic also found that children who started to learn the violin before they were seven years old had enlarged primary motor areas that controlled the fingers of the left hand used for forming the notes. Other studies have shown that this use of the left hand also leads to some restructuring of the right, visual side of the brain.

The final stage of Lewis' investigation into the nature of peak emotional experiences (see 'Emotional Experiences') involved a small study using electroencephalogram (EEG) brain mapping whilst participants were either relaxed or listening to the music selections (Figure 4). Circumstantial evidence suggested a dual hemisphere involvement when such peaks were felt, as both cognitive and emotional processing were suspected to occur before the experience could be identified for what it was. The hypothesized outcome of right hemisphere (temporal lobe) activity only when relaxed, but dual hemisphere activity during peaks, was confirmed with only 25% of the participants, partly due to strong extraneous 'noise' on the EEG tracings that could have masked significant data. Thus the evidence for dual-hemisphere processing of peaks remains speculative, and justifies further investigation.

Leonard Bernstein believed that there was a musical grammar that parallels speech grammar, and he devoted much of his 1973 Harvard lectures to descriptions of the former from the musician's point of view (see 'Whither Music?'). Ani Patel, John Iverson, and Jason Rosenberg used a somewhat different

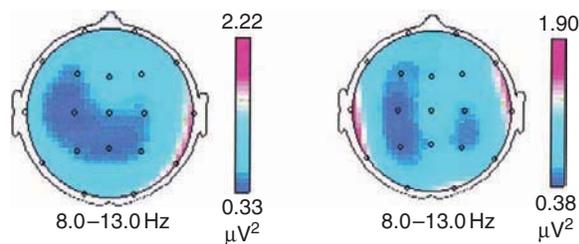


Figure 4 Head viewed from above with nose at the top. A narrow, light strip between the ear region and dark inner banding indicates an area of high activity in these monochrome images. *Image by the author.* A similar illustration appeared in *Journal of Applied Arts and Health* (2010), vol. 1, number 1, p. 89. Reproduced here by permission of the editor.

approach, starting with the premise that humans produce organized rhythmic and melodic patterns in two forms: prosody (versification) and music. They explored the notion that the prosody of a culture's native language is reflected in the rhythms and melodies of its indigenous music. From an analysis of the speech spectrograms of sentences, and the duration of musical themes of both British and French speech and music, the authors concluded that the joint (not individual) properties of melody and rhythm are involved in defining national characteristics of music.

Patel also noted that language and music show a degree of overlap in the brain for specific aspects of processing. He cited previous research using MEG that showed harmonic processing to originate in a left frontal language region (Broca's area) and its right hemisphere homologue. Patel then specifically examined syntactic processing in both language and music, that is, the set of principles governing the combination of discrete structural elements such as words or musical tones. He concluded that linguistic and musical syntax share certain processes in the frontal brain areas that apply over different domain-specific representations in posterior brain regions.

Uses of Music

Music Therapy

Music therapy is an established health profession that aims to help people who have difficulties with social, physical, mental and emotional functions such as communication, cognitive functioning, learning difficulties, autism, dementia, and depression. Because music is such a powerful communication medium, it can sometimes be used to interact with a client when attempts to do so through words alone have failed. Following an assessment of the client's needs the music therapist, who is a skilled and experienced musician, will use a range of musical styles including improvisation, to try and establish interaction with the client. The music that is successful may provide an indication of the client's prevailing mood. The practitioner can then manipulate the music to facilitate positive outcomes such as mood improvement and confidence, and encourage transfer of these to other aspects of the client's life. Song writing, singing, or other musical performances may also be introduced as part of the procedure.

The Mozart Effect

In 1993 great interest was generated by the publication of research by Frances Rauscher and her colleagues, which claimed that listening to ten minutes of Mozart's *Sonata for two pianos in D major* resulted in a short-term (10–15 minutes) improvement in scores on a spatial-temporal problem-solving test. In attempting to explain this phenomenon, the authors built on an earlier notion that similar neurons fired when either listening to music or performing spatial tasks, and they proposed that hearing the right type of music might 'warm-up' neurons prior to completing this type of test. Another suggestion is that appropriate music stabilizes arousal level by either raising one that is too sedentary for efficient operation, or reducing excessive arousal that might be caused by anxiety or hyperactivity, so that the level of concentration for addressing the task is optimal for good performance. William Thompson, Glenn Schellenberg, and Gabriela Husain conducted a controlled experiment with a Mozart composition and another piece, measuring enjoyment, arousal and mood, in addition to performance on a test of spatial abilities. Statistical analyses of the outcomes suggested that the Mozart effect is an artefact of arousal and mood.

In an attempt to identify just one aspect of classical music that could enhance performance, this time on verbal as well as spatial tasks, Catherine Sutton and Lewis digitally manipulated a piece of music composed by Handel, to create two identical versions, except that one was now in the key of F-major and the other in F-minor. The major mode version was rated by participants as emotionally more positive than was the minor, and performance on verbal tasks by females was enhanced by listening to this version. However, no other significant results were obtained for either sex on spatial or verbal task performance.

Such inconsistent research findings on the ability of music to enhance task performance, including the so-called Mozart Effect, rather than suggesting that all such claims are spurious and not to be taken seriously, instead merit further controlled studies. A particularly interesting theory on why specifically Mozart's music might have beneficial effects, but one difficult to prove, is that Mozart himself suffered from what is now known as Tourette's syndrome, and he instinctively created compositions that were therapeutic for his own condition. If this is so, and the calming effects of his music can be passed on to the listener, then Mozart did not suffer in vain.

Other Health Benefits

Further uses of music include social aspects such as the promotion of group solidarity, cultural identity, and trust and cooperation brought about by playing or singing in groups. These are of particular benefit to the physical and mental health of the elderly, including those with various stages of dementia, and the neurologically impaired. Because music is a medium of communication, as well of having the power to evoke memories, appropriate musical selections enable people to maintain links with the real world, even when verbal communication and facial recognition become difficult (see 'Music Therapy').

Laura Mitchell and colleagues investigated what they called 'audioanalgesia,' the use of music for pain control, either by

distracting attention from the discomfort through emotional engagement with the music, or by creating a feeling of control over the pain by having a technique to decrease its severity. Such applications can have far-reaching clinical applications, for example in recovery from, or tolerance of, pain of surgery, childbirth, accidents, or other medically related conditions. Paul Robertson describes studies that were carried out in a German hospital by Dr Ralph Spintage; it was found that just 15 minutes of soothing music allowed the dosage of sedatives and anaesthetic drugs used to control the pain of operations to be reduced by 50%.

Creativity

A dictionary definition of creativity would refer to aspects such as originality or imagination, novel solutions or reinterpretation without being bound by conventional rules or procedures. Psychologist Carl Rogers defined creative process as the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his (*sic*) life on the other. Rogers emphasized that there must be some observable end product such as a work of art, or an invention. At a basic level creative thinking is often referred to as divergent, compared with the more rational, convergent thinking. However, if Rogers' requirement is to be achieved, the former is of little practical use without the latter in order to convert the novel idea to a practical reality.

Robert Sternberg stated that creative individuals work long and hard studying their chosen field, in order to build on what has gone before and become experts. They then draw on this knowledge for insight – to see new relationships or make breakthroughs in understanding. Creative people prefer novelty to tradition or convention, and are open to new ways of seeing. They are also intrinsically motivated by the desire to solve problems, and obtain much enjoyment from doing so. An examination of the lives of those whom we regard as creative will invariably reveal many of these qualities, and Mozart is but one example (see 'Musical Aptitude: Nature or Nurture?').

Can musical skills help the creative processes in other disciplines? Based on correlational evidence, Robert Root-Bernstein noted that skills associated with music, such as pattern forming and recognition, analogizing, and imagining are equally evident in creative scientists. Many leading scientists are, in fact, also musicians. Albert Einstein, for example, is quoted as saying that his theory of relativity occurred to him by intuition, and that music was the driving force behind that intuition (he studied the violin from the time he was six years old). Other scientists have reported that they work best when listening to music, and this can be especially useful in mathematicians as some music, for example, baroque, is very mathematical in form, and thus there is an overlap or priming of neurons common to both skills. Root-Bernstein states that the creative ideas of scientists often manifest as sensory images or kinaesthetic feelings, which must then be converted to words or mathematics in order to be communicated.

Can training in music enhance abilities in other spheres? Norman Weinberger reviews some research evidence, including a study where high school music students were compared with nonmusic students on a measure of creativity involving

devising unusual uses for common objects. A significant correlation was found between music and creativity; whilst this does not prove causality, it does confirm a relationship between these two variables. In another study, with school children in the first grade, one group received 30 minutes of music instruction per day for a full year, whilst a control group did not. The music group scored significantly higher on creativity tests and in perceptual-motor skills, than did the controls. A similar trial was carried out in Hungary with preschool children, and the results also demonstrated an increase in creative ability. Interestingly, however, there was no parallel increase in intelligence quotient, showing that the effect of the music education on creativity was quite specific.

Naomi Ziv and Efrat Keydar in Israel were interested in the degree of complexity of musical selections that creative individuals prefer (see 'Emotional Experiences'). They subjected participants to a range of music of differing complexity, and then measured their preferences, liking and perceived complexity of the selections, in addition to administering a test of creative potential. As hypothesized, a positive and significant relationship was found between creative potential and preference for (but not necessarily enjoyment of) the more complex musical pieces, although musical tastes and familiarity with specific musical styles were also relevant factors.

The evidence that creative benefits arise from (preferably active) music involvement, and that there is a positive relationship between the amount of time and intensity of such involvement, the preference for complex musical stimuli, and the accompanying increase in scores on tests for creativity, cannot be ignored. Thus, if we want to improve and develop the creative ability of humankind, inclusion of musical training in the school curriculum would seem to be indicated.

Whither Music?

This was 'the unanswered question' discussed by Leonard Bernstein in his six lectures at Harvard in 1973, published in book form in 1976 (see 'The Harmonic Series'). Bernstein's thesis was that people are born with an innate musical grammar, which is universal regardless of culture, in the same way that theorists such as Noam Chomsky claim that there is a universal grammar underlying human speech. How the language or music skills develop is influenced by aspects such as culture, history and individual creativity. Bernstein developed his ideas by pointing out that music comprises mathematically measurable elements such as frequencies, durations, decibels and intervals, as does language. He presented many examples of musical structures, phonology, syntax, semantics, and ambiguities. Does this mean that the science of music has now been fully explained, and that the original question 'whither music?' has been addressed? Surely not, as even a full understanding of the technicalities of an art form does not explain the aesthetics, and Bernstein himself is happy to admit that music is 'a mysterious and metaphorical art.'

This article has included some scientific ideas, for example, on the physical basis of the harmonic series, and the brain areas involved in the processing of music. Mostly, however, it has accepted that music is a medium that can generate and communicate emotions, sometimes extremely profoundly,

probably has some benefits to cognitive ability and health, and gives pleasure to most people both through performing and listening. There still remain many unanswered questions, and it would be surprising if they were ever all resolved (and perhaps disappointing if no mystery remained). One particular question still lingers: why did music evolve and why has it survived the process of evolution, when there seems to be so little practical use for it apart from enjoyment and pleasure? (see 'Emotional Experiences').

Music has a very long history and universal presence and, from its association in earliest times first with nature and later with religious practices, it is not surprising that it became associated with the supernatural. It has also been held to have a divine origin, perhaps being the only particle of the divine essence that humankind has been able to capture, and that it is the language of higher entities. Are such ideas just flights of fancy, the products of naïve minds that have little understanding of scientific principles? Perhaps, but the fact that so much about music remains a mystery despite the discoveries of modern science, leaves us with a point on which to ponder: is the propensity to create and enjoy music simply a gift and, if so, from whom?

See also: Emotion/Affect; Flow and Optimal Experience; Improvisation.

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Nature/Nurture and Creativity

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Glossary

Behavior genetics Behavior genetics is the field concerned with investigating the role of genetics in human behavior, particularly through twin studies to study the inheritance pattern of traits.

Emergenesis A process whereby novel or emergent properties arise from the interaction of more elementary (and partly genetic) properties.

Genotype The genetic constitution of an individual (or cell).

Lamarckianism A principle according to which the mechanism for evolutionary change is environmental: organs which assist an organism in altered conditions are strengthened, else they atrophy through disuse.

Furthermore, such acquired characteristics are inherited.

Log-normal distribution The distribution of a variable can be modeled as log-normal if it can be considered as the multiplicative product of many independent random variables. Log-normal distributions are skewed to the right, although the logarithm of the random variable is normally distributed.

Molecular genetics Molecular genetics is the field concerned with investigating the structure and function of genes at a molecular level. Its methods can be employed to study how variation in molecular features is related to the expression of behavioral traits.

Phenotype The appearance of an organism, determined by the interaction during development between its genetic constitution (i.e., genotype) and the environment.

Introduction

The idea that creativity and genius are influenced by nature and nurture is not new. Joy P. Guilford reemphasized this notion in his classic presidential address at the meeting of the American Psychological Association in 1950. However, *scientific* interest in the question of genetic and environmental contributions to creativity must be traced back to Sir Francis Galton's seminal book *Hereditary Genius*, published in 1869. Galton believed that genius was a biologically transmitted trait, and that it would run in families in a Lamarckian fashion. Galton's own lineage may have prompted him to ponder this hypothesis, given that his blood relations included his grandfather Erasmus Darwin, his cousin Charles Darwin, Charles's scientifically eminent sons Francis the botanist, Leonard the eugenicist, Sir George the physicist, as well as the latter's son Sir Charles Galton Darwin the physicist.

A critical issue for Galton concerned how to define his key dependent variable of Interest – genius. Galton defined genius in terms of achieved distinction or *reputation*, in turn defined as “the opinion of contemporaries, revised by posterity . . . the reputation of a leader of opinion, of an originator, of a man to whom the world deliberately acknowledges itself largely indebted.” Galton devised novel statistical and methodological techniques to support his hypothesis that eminent scientists tended to have eminent relatives at a much higher rate than would be expected by base rates in the population. Nevertheless, Galton's work was plagued by its own shortcomings. For

example, there were uncertainties regarding the actual relatedness of some individuals, as well as the questionable inclusion of some others as *bona fide* geniuses. This meant that on the whole the evidence was not very convincing. However, had Galton not focused on eminence (which has a log-normal distribution) but instead shifted his attention to any of its normally distributed component factors (e.g., talent, IQ), he would have succeeded in showing that creativity is influenced by genetics. I shall present evidence from behavior and molecular genetics to demonstrate that genetic factors exert a strong influence on the expression of creativity. In fact, despite considerable reluctance by some scholars to embrace the role of genetics in creativity, there is reason to believe that our current estimates for its role may in fact be too low. The implications of this evidence for educational interventions to boost creativity are discussed.

Genetics of Creativity

Behavior Genetics

Personality, cognitive ability, and behavior are heritable to varying degrees. Heritability is a statistic that tells us the proportion of phenotypic variance that can be attributed to genetic factors. When genetic contributions are additive, the heritability quotient is calculated by doubling the difference in the intraclass correlation between identical (monozygotic) and fraternal (dizygotic) twins. On average, cognitive abilities and

personality traits tend to have higher heritability than many medical disorders such as autism, schizophrenia, and alcoholism. In fact, 30–60% of the variance in most personality traits and cognitive abilities can be accounted for genetically.

Many researchers view creativity as an emergent trait. A term initially coined by David T. Lykken, *emergence*, refers to a process whereby a trait is expressed if and only if a number of independent subtraits or abilities are simultaneously present. Because the relationship among the subtraits is not additive but multiplicative in nature, the absence of any one component is sufficient to block the occurrence of the emergent trait altogether. Thus, even though many of the subtraits may themselves be normally distributed throughout the population, the emergent trait itself shows a log-normal distribution. This makes it extremely uncommon for any individual to possess simultaneously all the necessary subtraits for the expression of an emergent trait such as high-level creativity or genius. Among the traits that seem necessary for real-life creativity are IQ of at least 120, capacity for analogical reasoning, and high motivation, to name but a few. In fact, emergence explains why, contrary to Galton's assertion, creative achievement does not run in families: even though members of a given family possess genetic similarities, it is unlikely that they will possess all the necessary characteristics for the expression of creative behavior.

In an early study to compute the heritability of creativity, Robert C. Nichols conducted a large-scale review of twin studies and compared the heritability coefficients of twelve types of cognitive abilities. The heritability coefficient of divergent thinking, widely recognized as an aspect of creativity, was only 0.22. This was lower than the coefficient of all other cognitive abilities, which had an average heritability of 0.42.

However, the studies Nichols reviewed have been criticized because the sample sizes were very small, and the measures of divergent thinking were not very reliable or valid. This shortcoming was rectified by Niels Waller and colleagues who conducted a much more systematic investigation using data from identical and fraternal twins. For identical twins, they found an intraclass correlation of 0.60 for the Creativity Personality Scale, whereas for fraternal twins the intraclass correlation for the scale was essentially zero (–0.02). Note also that the Creativity Personality Scale has been shown to predict scientific creativity. These results indicate the presence of a substantial multiplicative genetic component in even potential creativity.

Recently Dean K. Simonton made a significant contribution to our understanding of the heritability of creativity. His approach employed a unique combination of features. He focused on scientific talent rather than eminence, and defined *scientific talent* as any feature of natural endowment that has one or both of the following two effects. First, talent must enhance training. For example, although it is generally known that it takes a person about ten years to become an expert in any given field, those with higher natural endowment (i.e., talent) will require less time to gain expertise in the field. Second, talent must enhance performance. For example, given that two scientists have the same level of accumulated experience, the scientist with higher talent will be more productive than the one with lower talent. Simonton further clarified his definition of talent by noting three refinements. First, talent is not a 'diffuse' gift. Rather, it consists of a composite of highly specific abilities and

characteristics. Second, the natural endowments for training and performance need not be the same. For example, although general intelligence probably contributes to training and performance, the personality trait Openness to Experience probably contributes more to the latter. Finally, natural endowment may be genetic or nongenetic. Genetic endowment involves the direct transmission of genes from the parents to the offspring, whereas nongenetic endowment involves any personality or intellectual variable present at birth that can be ascribed to other developmental factors, such as the intrauterine environment during pregnancy.

Although for the purpose of his analysis Simonton focused on genetic endowment, it is important to note that endowment is not synonymous with *genetic* endowment. Simonton generated formulae for three quantitative estimators of *criterion heritability* that can be applied to meta-analytic and behavior genetic research to predict the intellectual and personality components of scientific training and performance.

Criterion heritability was defined as follows. Let us suppose that a given criterion of scientific training or performance can be predicted using a set of intellectual and personality variables. Furthermore, assume that each of these predictor variables has a heritability that corresponds to the proportion of variance in that variable that can be attributed to genetics. Using these two bits of information one can calculate the criterion heritability, which is the proportion of the variance in the criterion variable that can be explained using genetic variation. Here we will focus on one of the criterion variability estimators developed by Simonton (i.e., *hc32*).

After specifying the ideal data requirements for the application of the estimator, Simonton applied his analytic procedures to previously published results. He focused on personality and intellectual traits. The personality factors were derived from the California Psychological Inventory and the Eysenck Personality Questionnaire. For criteria that distinguished scientists from nonscientists and creative scientists from less creative scientists, he was able to show that between 37 and 48% of the explained variance was explained by genetic variation, the rest attributable to environmental factors and error variance. He then applied the same analytic procedures to analyzing intellectual traits in a different data set using the Miller Analogies Test with respect to seven criteria (first-year graduate grade-point average, graduate grade-point average, faculty ratings, comprehensive examination scores, degree attainment, time to finish degree, and research productivity). Here the heritability estimates ranged from 3% for research productivity to 27% for comprehensive examination scores. Simonton's results demonstrated that by applying the proper analytic procedures to datasets that adhere to the proper statistical specifications, the substantial contribution of genetic endowment for personality and intellectual criteria becomes clearly apparent. He also presented considerable evidence to show that if certain analytic improvements were made – such as if the profiles of the predictive traits were coupled more closely with the specific criteria and the phenotypic predictors made more exhaustive – the criterion heritability estimates could reasonably double in size. In combination, the behavior genetic work of Simonton and Waller and colleagues strongly suggests that a substantial portion of the variance in creative potential and talent can be attributed to genetic factors.

Molecular Genetics

Recently, the study of gene–behavior relationships has become much more sophisticated by the introduction of quantitative genetic technology into molecular genetics. It is now possible to link a genetic polymorphism at a particular neurotransmitter site on a chromosome to behavioral, personality, and cognitive variables. Theoretically, the most important departure point has been to move away from a one gene–one disorder model (OGOD) toward a view of complex traits as being caused by or mediated through the effects of a composite of potentially distinguishable genetic constituents. The majority of traditional genetic studies investigating the association between genes and behavior have relied on linkage analyses. Linkage analysis involves testing a model that is proposed to explain a particular inheritance pattern. Specifically, one posits a specific location for a trait-causing gene and tests that hypothesis against the null hypothesis, which by definition posits the lack of a trait-causing gene in that location. The systematic nature of linkage studies allows for a high degree of confidence if an association between a genetic locus and a phenotype were to be discovered.

On the other hand, because linkage studies follow the OGOD model, they are only appropriate for investigating the genetic bases of dichotomous traits. The major shortcoming of such an approach for studying creativity is obvious: Because complex traits are caused through minor effects originating from multiple genetic loci, they are likely to be distributed as quantitative dimensions rather than qualitative syndromes. Therefore, linkage approaches will not be successful in identifying such multiple-gene influences in complex systems.

In contrast to linkage approaches, *allelic association* has provided geneticists with a powerful tool to solve this problem. Geneticists define complex traits as those that are caused by the influence of multiple genetic loci, or as “phenotypes that do not exhibit classic Mendelian recessive or dominant inheritance attributable to a single gene locus.”

The definition of a complex trait is analogous to that of an emergent trait, such as creativity. In other words, because creativity is a complex trait with a strong heritable component, it is highly probable that it is under the influence of several gene loci that influence its various components. This characterization brings us to the forefront of genetic research involving allelic association. Alleles are different forms of DNA found at a particular locus on a chromosome. Allelic association refers to the relationship between allelic variants (i.e., polymorphisms) and quantitative variables, such as cognitive variables or personality traits. Because complex traits are hypothesized to be influenced by several genetic loci, they are also referred to as polygenic traits. The multiple genetic sites that contribute to the observed variance in complex traits are referred to as Quantitative Trait Loci (QTL).

Unlike linkage analysis which is systematic but not powerful, QTL mapping is less systematic but much more powerful, especially when using large sample sizes and comparing individuals from the extremes of a phenotypic distribution. Most importantly, allelic association is ideally suited for locating multiple gene loci, each of which contributes to a part of the overall phenotypic variance in complex traits. This characteristic makes allelic association ideal for genetic investigations of creativity.

Next, I shall review allelic association work on novelty seeking, a trait long associated with creativity.

Novelty Seeking

Claude R. Cloninger has defined the trait Novelty Seeking as the “tendency toward intense exhilaration or excitement in response to novel stimuli or cues for potential rewards or potential relief of punishment, which leads to frequent exploratory activity in pursuit of potential rewards as well as active avoidance of monotony and potential punishment.” Not only is novelty a core feature of products considered to be creative, but the description of this trait accurately characterizes the personality profile of many creative people. Previous studies using large twin samples have demonstrated that approximately 50% of the additive variance in Novelty Seeking is accounted for by genetic factors. Because Cloninger had hypothesized that Novelty Seeking is mediated by cortical dopaminergic activity, investigating the links between the dopamine pathway and Novelty Seeking became a primary concern for this research program.

The year 1996 marked a breakthrough year in genetic mapping: Two independent teams reported an association between the dopamine D4 receptor gene and Novelty Seeking in Israeli and American samples. The D4 receptor is the product of the D4 receptor gene (DRD4). The DRD4 gene is highly polymorphic, in that its alleles vary along several dimensions. Given the particular region on the gene where the polymorphism was detected, the researchers were able to conclude that the allelic variation at that locus plays a ‘functional’ role in the regulation and expression of Novelty Seeking. These studies were a demonstration of the ability to find association between specific alleles and higher-order traits. Since 1996 the aggregate findings from numerous replication studies have shown that the DRD4 polymorphism accounts for no more than 10% of the variance in overall Novelty Seeking scores. This is to be expected because Novelty Seeking is by definition a complex trait and influenced by the expression of numerous genes, each of which accounts for a small portion of the variance in the observed trait. This is consistent with a componential and emergent view of creativity.

Developmental Trajectories

Much can be surmised about the influence of nature and nurture on creativity by investigating the developmental trajectories of individuals varying in creativity. This can be done in two ways: Prospectively or retrospectively. Lewis Terman’s *Genetic Studies of Genius* (1925–1959) represents a towering achievement of the former variety. Terman was interested in determining whether children who score high on tests of IQ will turn into successful adults by registering extraordinary accomplishments. He carried this out by following children who had scored high on psychometric tests of IQ over their lifetime, and was able to show that there is a positive correlation between high scores on tests of IQ in childhood and genius in adulthood. In other words, achieving eminence is at least partly a positive function of high intelligence in childhood.

The second volume of Terman’s series was written by Catherine M. Cox and published in 1926. Cox argued that to

understand the development of genius, it is critical to understand three factors: heredity, native gifts (i.e., endowment and/or talent), and education. Whereas Galton's work had focused on the role of heredity in the expression of genius, hers would focus on the role of native endowment, which follows logically from considerations of heredity. Furthermore, an understanding of the role of native endowment must precede studies on the effect of education on the gifted person. She also adopted a retrospective, historiometric approach to her investigation. Specifically, she started out by selecting eminent individuals, and then calculated their childhood IQ based on recorded biographical data about early intellectual development. Eminence was computed using the amount of space devoted to each individual in standard reference works. If Terman were correct in hypothesizing that high IQ leads to genius, then the reverse analytic path should lead to the same conclusion by showing higher IQ estimates for individuals who have been recognized as eminent. Indeed, Cox was able to show a positive correlation between the two variables. In other words, prospective (psychometric) and retrospective (historiometric) approaches converged on the same conclusion that early endowment in childhood begets genius in adulthood.

Unbeknownst to many, Cox had also collected mental and physical health data from her 282 geniuses which were never presented in raw form in any publication. Following a lengthy archival search Simonton and Anna V. Song were able to locate Cox's raw physical and mental health data. This made it possible to test some brand new hypotheses using this invaluable dataset. First, how do early physical and mental health relate to intelligence? Specifically, should all three variables be positively correlated? Second, should early physical and mental health predict later eminence the way IQ predicts later eminence? Third, how will the domain under investigation affect the relationship between early physical and mental health and later eminence? The results were intriguing. First, early physical and mental health were related to intelligence, but in opposite ways: IQ was a positive function of mental health but a negative function of physical health. Second, early physical and mental health did not predict later eminence, although, as expected, eminence was a positive function of IQ. Finally, commanders exhibited superior physical health and informative writers inferior physical health compared to the average, whereas politicians and composers displayed superior mental health and imaginative writers inferior mental health compared to the average.

What do these results mean? First, let us focus on the finding that among geniuses IQ was not correlated positively with physical health. This may strike some readers as odd because IQ and physical health are correlated positively in the general population.

Simonton and Song suggest that one reason for this discrepancy may be that genius may be the product of abnormal social and intellectual development. For example, there is evidence to suggest that the early development of geniuses is marred with disrupting events such as economic instability and stigmatization. If so, then poor physical health may contribute to the emergence of genius as a causal factor. Second, neither physical nor mental health predicted eminence, although IQ was a function of physical and mental health. This suggests that the effects of physical and mental health on eminence were mediated indirectly through their effects on IQ. Finally, even among a group as distinct as eminent persons, the influence of physical and mental health varied widely as a

function of domain. This indicates that to understand the effects of physical and mental health on high-level creativity one requires an appreciation for variability among domains.

Summary

I have presented results from behavior genetics and molecular genetics to support the argument that creativity – especially high-level creativity in the form of genius – is influenced by genetic factors. However, eminence does *not* run in families. Because creativity is an emergent trait, it is extremely unlikely that two members of the same family will possess all the necessary components for the expression of this trait.

Furthermore, as argued by Cox, understanding the developmental trajectory of genius requires an understanding of the roles of heredity, native gifts (i.e., talent), and education in the process. Educational interventions to boost creativity will have limited success unless two requirements are met. First, we must develop a better understanding of the ways in which talent facilitates training and performance in order to pinpoint critical intervention opportunities. This lies at the heart of Colin Martindale's observation that creativity appears easy to teach but hard to learn. Knowing the differential effects of factors that affect training and performance can also aid in our choice of training methods. Second, we must develop a better understanding of the ways in which genetic and environmental contributions to creativity differ as a function of domain. Given that different domains (e.g., mathematics, literature, etc.) rely differentially on certain abilities (e.g., spatial navigation, verbal reasoning, etc.), educational interventions to boost creativity must be tailored to the specific domains under consideration. An appreciation of the respective roles of heredity, native gifts, and education in fostering creativity will also diminish the reluctance in perceiving the rightful role of genetics in expressing creativity.

See also: Brain and Neuropsychology; Genetics; Historiometry.

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Networking

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Glossary

Actors Name given to nodes that represent individuals.

Alters Individuals to whom an actor is connected.

Network Pattern of connections among a set of nodes.

Node Entities that are connected or not connected in a network.

Tie Relationship between individuals represented as a line between nodes in a social network graph.

Networking

Networks and Networking

When first thinking of networking, one may envision the savvy job seeker who puts him- or herself in the position to meet as many people as possible – people who may lead to a job. This savvy sort introduces him- or herself to strangers, collects the names and numbers of his or her new contacts, and reaches out to his or her contacts at the appropriate intervals – all with the understanding that these ‘networking’ activities may one day lead to something advantageous, such as a job.

However, social scientists who study networks have focused less on the process of collecting names or amassing relationships at social gatherings or job fairs and more on understanding the network. In this sense, we can think of a network as a map, which displays patterns of connections among individuals. These maps are intended to capture the various social realities that individuals experience. Although not always the case, the emphasis tends to be more on general patterns of interactions rather than snap shot interactions that are not reflective of general tendencies. While instrumental outcomes such as finding a job and career advancement have received attention, networks also can affect cognition and ultimately creativity.

Social Networks Versus Other Types of Networks

If we think of networks as maps, which display patterns of connections, we can envision a variety of networks. For example, cognitive networks are networks which display ideas or concepts and the connections represent how an individual thinks about the association between ideas. We also can visualize connections between organizations. Researchers in business strategy and sociology are often interested in networks among organizations. Such interorganizational networks may represent alliances or formal partnerships between firms. These types of networks, cognitive or interorganizational networks, will not be discussed in this article.

Social networks are networks involving relationships between people. In this case, the connections are relationships or affiliations. It is these types of networks, social networks, which are the focus of this article. This is because more research evidence exists about how social networks rather than other networks influence the creativity of individuals. The focus of this article is also on organizationally based creativity, so the

emphasis is on understanding approaches to social networks that have implications for organizational contexts, although the general principles can be applied to many other contexts as well.

Various Approaches to Understanding Social Networks

Social networks are made up of nodes, ties, and the pattern between ties and can be defined as the pattern of ties among nodes. Looking at [Figure 1](#), the nodes are represented by numbers. Although nodes can be any entity, like individuals, groups, or organizations, individual nodes are widely studied and are often referred to as actors. In network terminology, ties are the connections between nodes, which are displayed in [Figure 1](#) by the straight solid lines. In discussing actors, one may refer to actors in general or distinguish alters from actors. An alter is the individual to whom an actor is connected. For example, if discussing actor 186 (circled with a dashed line), 194 and 192 are 186’s alters. From an actor’s vantage point, ties are either direct or indirect. Direct ties connect two actors, like actor 186 and 194. Indirect ties provide one actor access to another rather than directly through another actor. Focusing again on actor 186, this actor has an indirect tie to actor 109 through actor 93.

The Network Tie

One prominent approach to studying networks is to focus on the characteristics of the relationship or affiliation between actors. One way of thinking about relationships or ties is to characterize them as either weak or strong. Although the strength of ties exists along a continuum from weak to strong, for ease of understanding, we can consider ties as either weak or strong.

Mark Granovetter, in his seminal strength of weak tie theory, defined stronger ties as a combination of frequency of interaction, emotional intensity, and reciprocity. In other words, strong ties are those between actors who interact relatively frequently, have a close relationship – for example, the two consider themselves to be close friends, and have a similar view of the importance of their relationship. Weaker ties in contrast may involve one of these components or low levels of all. For example, perhaps two individuals interact on a regular basis at work, but they do not interact socially outside of work

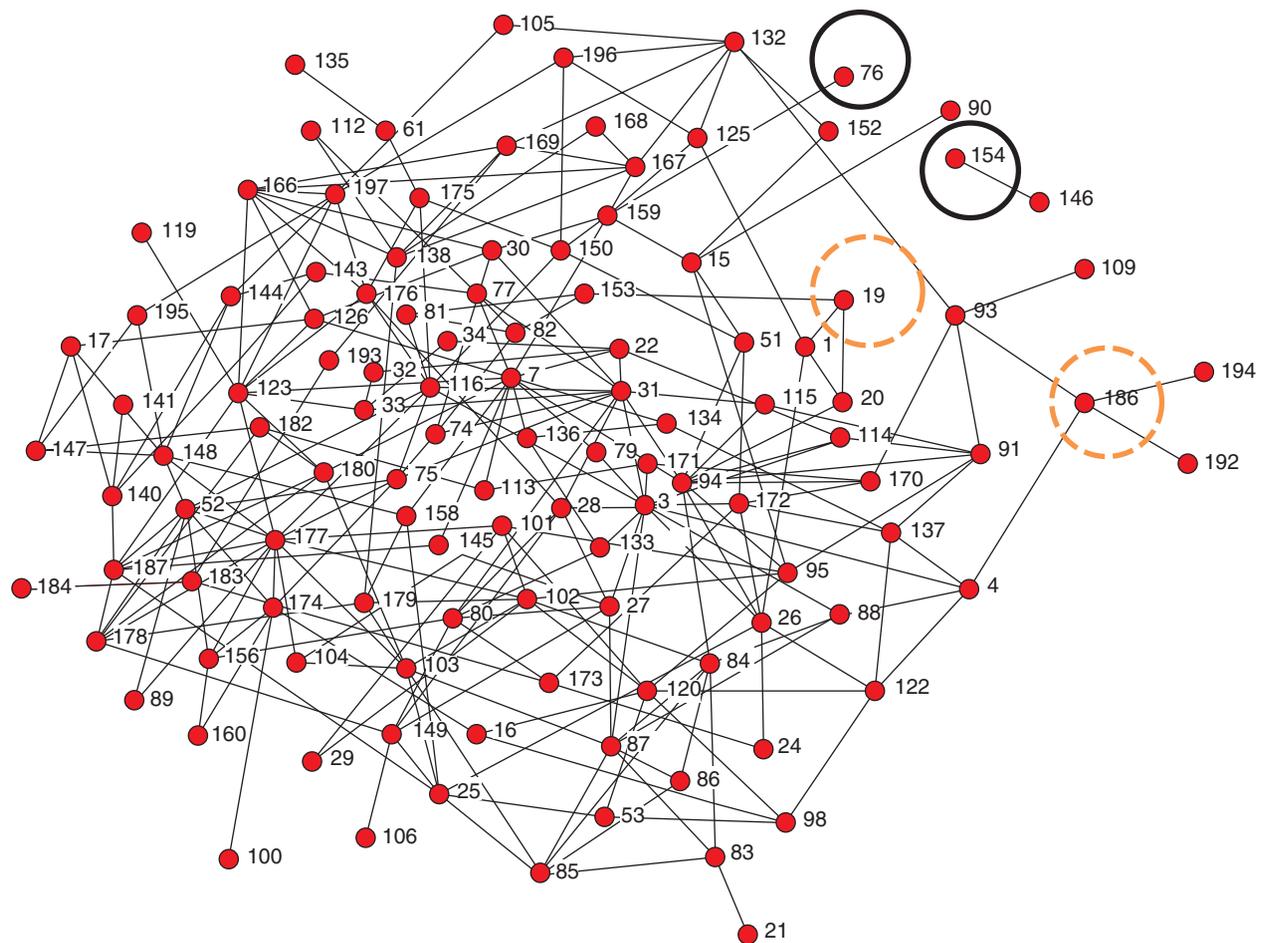


Figure 1 Sample social network.

nor do they provide emotional support to one another. At the extreme end of weakness, individuals may interact only occasionally and also may not exchange any nonwork intangibles like trust or emotional support. These are sometimes referred to as acquaintance ties.

According to the strength of weak tie theory, weak ties are beneficial despite the intuitive benefits of stronger ties. Stronger ties tend to represent close friendships and close friends tend to be similar in some way. Perhaps these friends have similar personalities, similar life styles, or personal beliefs. This is because we are often attracted to people who are similar and form close bonds with them more quickly. As a result, our friends also are likely to be similar to one another. Given that we spend a lot of time with our friends, they will come to know one another over time. The implication of this is that our friends (i.e., stronger ties) are friends of one another. This results in dense pockets of ties where everyone knows one another. Through repeat interaction – both with the actor and each other – and due to similarity, our friends tend to provide the same information and perspectives. In some cases, strongly tied contacts may not initially share the same view, but as friends discuss problems and issues together, their opinions converge over time.

In contrast, weaker ties are more likely to provide access to distinct, rather than overlapping, social circles. These ties are

less dependent on similarity and do not require a lot of time to maintain. So, our acquaintances do not necessarily know one another, so dense overlapping pockets of ties are less likely to form. As a result, these ties are expected to provide greater reach throughout the network. For example, the best way to spread a rumor is through weaker ties whereas a rumor spread through stronger ties is expected to cycle back to the originator.

A widely discussed outcome of weak ties is access to job opportunities. Weak ties are more strongly associated with finding a job than stronger ties, although not in all cases. For example, for some lower status individuals, fewer strong connections to a high status actor may be more helpful.

The emphasis on weak ties is not meant to suggest that strong ties are not beneficial. Strong ties are associated with positive feelings that go along with friendship and a greater sense of obligation to one another. As a result, an actor has a great deal of influence over his or her strong ties in comparison to his or her weak ties. Strongly tied contacts provide social support and encouragement, which are often valuable social resources.

The Node

Another approach to studying and understanding social networks is to focus on the characteristics of the nodes in

the network. Nan Lin and his colleagues emphasize the resources that an actor can access through his or her alters. More specifically, their social resource theory posits the advantages of a network tie to another are the resources that the alter has that the focal actor can utilize. Here, the emphasis is less on the characteristics of the tie, like is it a strong or weak tie, but rather the characteristics of the person (i.e., alter) on the other end of the tie. Nan Lin and colleagues emphasize social resources, which are the personal characteristics of an actor's contacts. They are social in the sense that they are accessed through a social connection.

Although the outcome of interest (e.g., creativity, general performance, career advancement) determines the characteristics that are the most relevant, this perspective emphasizes the status of the contact as one relevant characteristic. For example, when it comes to finding a job, the extent an actor is connected to high status alters within a firm may be instrumental. For career outcomes such as receiving promotions or raises, status of the alter in terms of level within the hierarchy or occupational prestige may be key.

The Network Type

Another way of understanding social networks is to categorize networks in terms of the content that flows through the network tie. With this approach, networks have been studied as patterns of ties that reflect the same content. For example, one may seek to understand the advice network. In this case, members of an organization, for example, are asked to indicate everyone from whom they seek advice. Given the member responses, a network map is drawn that reflects the pattern of advice ties within the organization. Researchers have studied the effects of having more or less advice ties as well as how an individual's overall position in the advice network affects behavior or experiences.

Other kinds of networks studied include various types of support. For example, individuals may be asked to name the individuals that they seek for encouragement. Alternatively, political support may be the focus, where individuals are asked to name individuals they go to with a difficult political problem. Affiliation networks are made up of ties that represent the extent individuals associate with one another, for example on project teams. Another type of network is the workflow network, where ties represent associations required to complete work tasks. For example, perhaps an employee interacts with her boss to get new assignments or to report progress; however, the employee does not seek informal advice from the boss on how to solve a problem or does not turn to the boss for support. This type of tie would comprise the workflow network versus other types of networks which are made up of discretionary ties that are not required to complete work tasks.

It is important to note that for conceptual and methodological clarity, these different types of networks are often considered as distinct networks. However, it makes sense that an individual may have multiple types of ties with the same alter. Multiplex networks or ties exist when an individual has ties with another that simultaneously reflect multiple types of networks. For example, a tie may connect to an individual who is a source of work related advice but also is a close friend.

Network Structure

Given a particular type of network or tie, a structural approach can be considered. A structural approach highlights that while two individuals may have the same number of a particular type of tie, they may experience the social context differently depending on the structure of their ties and their place in the overall network. Consider [Figure 1](#) again. Person 154 and person 76 (both circled with a solid line) have the same number of relationships; however, person 154's alter is an isolate, with no ties other than the tie to 146. In contrast, person 76's alter appears to be well connected to others within the network. As another example, consider person 19 (circled with a dashed line) in the same figure. Person 19 has two alters who also are connected to one another. In contrast, person 186 (circled with a dashed line) also has two alters (1 and 20), but they are not connected. These examples illustrate that it is not only the number of ties a person has, but the structure of ties can lead to very different social realities.

Structural holes

According to Ronald Burt in his seminal theory of structural holes, structural holes exist when an actor's connections to two other actors are not redundant, or more specifically, exist when an individual's contacts are not connected to one another. Consider [Figure 2\(a\)](#) as a simplified example of a social network. Actor A is connected to actor B and C; actor B and C also are connected to each other. In [Figure 2\(b\)](#), actor A is connected to actor B and C, but in this case, actor B and C are not connected to each other. Thus, there is a structural hole between actor B and C. Actor A's connection to B and C are not redundant. In other words, the only way for actor B to reach actor C is through actor A. Thus, actor A's ties, in the case of [Figure 2\(b\)](#) are said to bridge a structural hole and provide unique access to B and C. In contrast, in [Figure 2\(a\)](#) actor A's ties to B or C are considered redundant, because actor A could access actor C either directly or indirectly through actor B.

Structural hole theory suggests a variety of career advancement benefits for individuals who have direct ties that span structural holes. Such individuals (Actor A in [Figure 2b](#)), also referred to as brokers, can control the flow of resources amongst their contacts or may play their disconnected contacts off one another. For example, the only way that a broker's contacts can get information from another one of the broker's contacts is through the broker. As a result, the broker can decide to share or not share information according to his or her needs. This also means that the broker is uniquely positioned to freely take advantage of information from one of her contacts without another contact acting on the information, since they can only hear about the information or opportunity

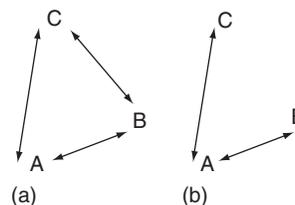


Figure 2 Example of a structural hole.

through the broker who may choose to withhold the information about the opportunity. Alternatively, the broker may selectively share knowledge from one contact with another by highlighting parts of the information that advantage the broker or framing it in a way that advantages the broker.

As a result of control, visibility, and access to information, bridging structural holes are associated with higher salaries, increased rate of promotion, and higher professional mobility. Although research on structural holes has primarily highlighted their advantages, some disadvantages also have been raised, such as stress and conflict.

Network closure

A second and contrasting structural approach highlights the advantages of redundancy or closure among contacts. James Coleman takes more of a systems view and describes the advantages to the network or community of closure. Figure 2(a) represents closure. In particular, closure ensures strong social norms, which may help enforce appropriate versus inappropriate behavior. As an example, in a team of three, we would expect social norms to be stronger and more consistently modeled if closure exists among the ties. If actor C in Figure 2(a) deviates from norms or expectations, actor C will hear about his or her transgression from two sources, actor A and B. A and B may discuss the incident with each other, which makes it more likely that they will approach C with a consistent message. Further, trust and reciprocity flow more freely when closure exists. Thus, if individuals need to work collaboratively with one another, closure may be particularly helpful.

Note that notions of structural holes and closure can be combined. For example, we may envision brokers connecting pockets of closure within an overall network.

Network centrality

A third structural approach is to focus on the position of a node in terms of how central she is in the network. Centrality captures an individual's position in the network relative to others and considers the distance (in terms of direct and indirect network ties) between an individual and all other actors. Central actors can reach the greatest number of actors with the fewest links (or ties). While there are a variety of mathematical formulas used to calculate centrality, conceptually we can understand centrality by looking at Figure 3. Actor C occupies

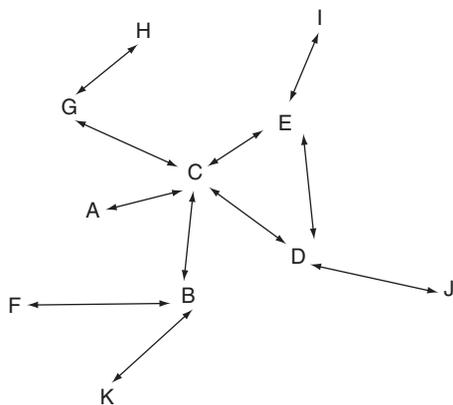


Figure 3 Example of centrality.

a highly central network position relative to actor J who is on the periphery. This approach to centrality, also known as closeness centrality, is a global network measure, because it relies on the entire network rather than only direct ties.

One of the key research findings related to centrality is that central actors have a greater degree of power and influence relative to their less central counterparts. They also experience a greater degree of control over resources due to their central vantage point. When actors with similar levels of centrality are compared, there is some suggestion that actors in similar positions share the same attitudes and perspectives. For example, central actors may have a more favorable evaluation of their work environment than less central actors. Overall, the central actor appears to perform better at work.

The Focus or Target (Three Levels of Analysis)

Given a social network among individuals, there are three different levels of interest: the individual embedded in the network; a group of individuals with a focus on the network among team members or the group embedded in a broader network; and the overall network of individuals itself compared to other overall networks.

The Individual

An individual focus highlights how individual network positions, types of ties, or characteristics of contacts influence behavior. One approach is to understand the network from the individual actor's vantage point, also known as an ego network. Only the actor's direct ties are considered. This may include a count of certain kinds of ties. Focusing on the number of weak ties or the number of advice ties are a few examples. An ego network approach also can include network structure. This may include the structural holes (see earlier section) an actor experiences among her direct ties or the level of redundancy among direct ties.

An alternative approach is to view the individual as being embedded in a broader social network. With this approach, the type of network becomes very important. In other words, the effect of network position on individual emotions, attitudes, or behavior may vary depending on the type of network being considered. For example, centrality within the friendship network versus the workflow network may differentially affect individuals. This approach is a more global approach to networks in contrast to the ego network approach, because the entire network is being considered (see the previous section on 'Network centrality').

The Group

For a small workgroup, either the structure of ties among group members or the strength of ties among group members may be considered. Early research by Marvin Shaw highlighted different patterns of communication among group members. Figure 4 provides two examples from this line of work which emphasizes the importance of understanding patterns of communication flows within groups.

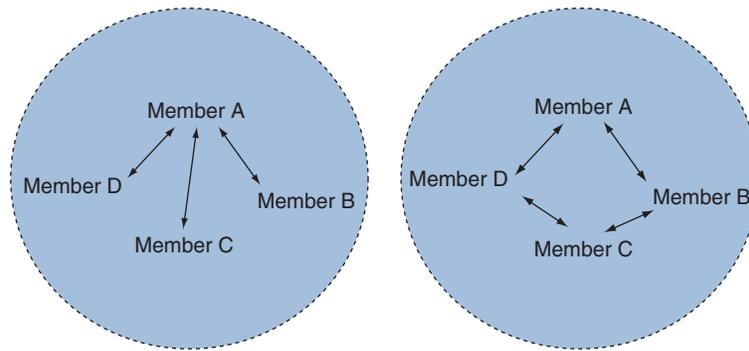


Figure 4 Social network within a team.

Density is often of interest when understanding relationship patterns within the group. Density is the total ties divided by the total possible ties. In some cases, friendship ties may be of interest. In this case, density reflects the level of closeness among group members. Researchers continue to investigate the effects of density on various group outcomes. Generally, Coleman's notion of closure (see earlier section) suggests that redundant trust laden ties help groups perform better; however, the conditions under which this is true continue to be investigated.

An alternative approach to understanding workgroups and networks is to consider groups as nodes. In this case, one may explore how relationships between groups affect either the performance of groups or the performance of a collection of groups. Research confirms the importance of ties between groups for various dimensions of group performance. As discussed previously, the effects depend on the type of tie and the type of network.

The Overall Network

An alternative is to define a network by its boundary and then assess how global structural characteristics of the network affect the performance of the overall network or the performance of individuals within it. This is much more of a cross level approach in comparison to the individual approach discussed previously. In this case, the boundary of the network becomes important. The boundary may be drawn so that the network reflects the pattern of relationships among individual in an organization, industry or even a particular geographical region.

Several structural approaches are relevant to the entire network. At the network level, centralization refers to the extent centrality is clustered among a few individuals versus the extent centrality is evenly distributed among actors. Alternatively, one may explore the level of dense sub groupings within a network, also known as cliques. Some networks have a number of fairly isolated groups of densely connected actors (i.e., clusters of actors where every actor is connected to every other actor). In some cases, these social pockets may have one or two connections to other social pockets.

A limited amount of research exists comparing overall network structures. Gathering data that allows for these comparisons and the effects on individuals is complex. For example, one may be able to collect data from a few professions but

gathering enough professions to make statistically sound inferences would be more difficult. Nevertheless, the concepts are available to allow for comparisons across bounded networks and the theoretical principles can be applied to the network level as well.

How Networks Affect Creativity

When we think about highly creative people, we may think about intriguing or even quirky aspects of their personality, and a rich body of work explores these traits. In contrast to a personality or intraindividual approach, a social network view of creativity is more about understanding how social experiences affect cognition and knowledge in ways that facilitate or constrain creativity. This approach is consistent with contextual views of creativity, which focus on factors external to the individual. With a social network perspective, the spotlight is less on creative types and more on creativity enhancing social situations.

Creativity has been defined as the generation of novel and useful ideas and solutions. Thus, the focus is on how various social network parameters influence the generation of ideas. The emphasis is less on simply transferring ideas from a friend or associate but more about how social experiences influence the way one thinks about problems and forms solutions to those problems. In this section, the node is assumed to be the individual and the target of interest also is the individual. The focus is on the network tie and network centrality perspectives within a communication network.

Weak Ties

Recall that strong ties are more likely to connect individuals who are similar on some dimension, and since we spend more time with our friends than acquaintances, it is likely that our friends interact with one another while interacting with us. Friends also can influence one another, and given that our friends are often friends, social influence pressures can be strong. In contrast, the weaker tie is more likely to connect individuals who differ and represent diverse social circles. As a result, weak ties provide exposure to nonredundant information, perspectives, and ideas.

There are a variety of implications for creativity. If we consider a network of individuals within a profession, such as computer scientists, lawyers, or behavioral research scientists

for example, individuals with weak ties will receive nonredundant information from their contacts which should enhance their knowledge base. Creativity theorists have long described how knowledge provides individuals greater capacity to make unusual connections. Domain relevant knowledge provides an important foundation that individuals can draw from when thinking of creative ideas. Interestingly, however, there is some debate about whether or not detailed complex knowledge or broad exposure is best for enhancing creativity. One perspective is that breadth in terms of general information or broad exposure to different perspectives enhances the type of knowledge that facilitates creative contributions at work. This is the type of information most likely to be gleaned from weaker ties, because complex knowledge or sensitive information is more likely to require the trust of stronger ties.

In addition, weaker ties are expected to enhance creative cognition in comparison to strong ties. As individuals are exposed to a variety of perspectives through a number of weak ties, they have more opportunities to make associations between different viewpoints and become more practiced at thinking broadly. Having a number of weaker ties puts more requirements on the focal actor to reconcile these perspectives and think autonomously in comparison to actors with stronger ties. With stronger ties, because of redundancies and social influence processes, individuals become less required to synthesize due to the greater similarity of perspectives associated with stronger ties. Furthermore, conformity tendencies are greater, which can limit creativity.

Strong ties are not universally bad for creativity. In particular, the social support and positive affect associated with friendships may be helpful for creativity. It makes sense that one may be more comfortable sharing creative, and potentially odd or unusual ideas, with a trusted friend. As a result, one line of argumentation is that these ties may help with the implementation of new ideas and may help an actor gain support for his or her idea. However, when it comes to the generation of creative ideas, rather than their implementation, strong ties may not be helpful and actually may undermine creativity.

Centrality

Central individuals have direct or indirect access to most others in the network. They are aware of what is going on in the network or can be made aware of what is going on if they choose. They also are assumed to be highly powerful and able to influence others to adopt their views. As a result, they have a generally favorable view of organizational life and may be more comfortable taking calculated risks than their less central counterparts. This should enhance creativity in some cases as these individuals are more comfortable exploring creative ideas.

Although research in this area is relatively new, there are several suggested conditions under which centrality is most likely to enhance creative contributions at work. One such condition is the extent a person has connections outside of the network. Central individuals in the network are expected to be highly creative but whether or not they are creative depends on the network ties that they have outside of the network. Typically, in order to study networks, the network must be bound in some meaningful way. The boundary may be drawn to denote those within the network as members of an

organization, employees of a firm, or members of a profession. This type of demarcation can help us understand a variety of features of networks beyond direct ties and the characteristics of these ties. However, if we consider the boundary as a loose circle around a social entity, the reality is that members of that organization, firm or profession have network ties to individuals outside of the network. If we consider ties outside of the network, the expected effect of centrality within the network on creativity may differ.

Let us reconsider the arguments about centrality and creativity. If central individuals are expected to be creative, the converse of this expectation is that peripheral individuals will not be creative. However, if the person is on the periphery of the organization's network but has lots of ties outside of the network, she actually may be highly creative. Here is why. She also is exposed to perspectives outside of her reference group, which is comprised of others within the organization. Relative to her peers with fewer outside ties, this person is influenced by approaches that may not be standard within her organization. In addition, when this person is simultaneously on the periphery of the network, she may not as strongly identify with the organization or the organization's widely accepted practices. Thus, it is easier for this person to question practices and explore new ideas from other domains. As a result, an individual on the periphery of a network but with many ties outside of the network will be highly creative.

Interestingly, we can understand a person's creative life cycle in terms of her movement from the periphery of a network to the center. For example, a newcomer to an organization may occupy a peripheral position at first, but she brings with her a variety of connections and associations outside of the network. For the new graduate, this may include fellow graduates or professors. For the more senior hire, this may include professional peers from other organizations in similar or different industries. This person has the potential to be highly creative. If creativity is valued, as it is in many organizations, others within the organization will be drawn to this creative person. As he or she offers new ideas to solve problems or receives recognition for creative insights, he or she is sought out for advice and guidance. As a result of prior creativity, he or she becomes more central in the network. His or her centrality and increasing comfort with taking risks suggests that he or she becomes incrementally more creative.

The cycle continues where centrality enhances creativity and creativity leads to more centrality until a point of diminishing returns. As he or she becomes too central, the network begins to constrain her creativity. It becomes increasingly difficult to see beyond the *status quo*, as he or she is so immersed in the web of relationships that seeing beyond existing ways and standard solutions becomes increasingly difficult. Ultimately, centrality begins to constrain creativity as the relationship between centrality and creativity has been defined as an inverted U relationships. Centrality is helpful to a point, but then undermines creativity.

How Networks Affect the Implementation of Creative Ideas

When it comes to generating ideas, it is expected that weaker ties and centrality under certain conditions will help people be

more creative. The next step in the process of realizing creativity is to get others to accept the idea and to get others to help implement the idea, particularly within organizations. The understanding of how this works continues to grow and evolve, but there are some generalizations that are becoming clearer and others that are less clear.

Central actors are in a better position to get their ideas accepted. Interestingly, it is the peripheral actor with ties outside of the network that is expected to come up with groundbreaking new ideas, but it is the central actor who is more likely to convince others that her idea is worthwhile. In one study of the Hollywood film industry, Gino Cattani and Simone Ferriani found that key members of film crews with intermediate central positions were more often nominated for creativity based awards by peers and other experts. These individuals had the requisite level of centrality that allowed them to be creative, without stifling their new ideas, but also gave them a degree of influence and connectedness to get others to accept their ideas. In addition, peripheral individuals who associate with a few key central actors may maximize the benefits of both high and low centrality. They may come up with highly creative insights and gain support from their central associates, who can more effectively champion the idea.

While weak ties facilitate generating creative ideas and structural holes are associated with good ideas, closure may help with implementation. Studies by David Obstfeld suggest that redundant ties are helpful because in order to implement a creative idea, it is necessary to bring people together to work cooperatively to advance an idea. In addition, the generator of a creative idea must influence others that the idea is worthwhile. This can be very difficult with creative ideas given that the idea represents something that has never been implemented or at least has been implemented very rarely. However, in a study of an electronics company, Ron Burt found that brokerage rather than closure was associated with organizational members rating the actor's ideas as valuable. One explanation is that individuals with ties that span structural holes are better able to communicate ideas so that various groups will understand the idea's merits.

Conclusions

The social context provides an important means of understanding creativity. Understanding social networks is more complicated than understanding the extent a person gathers names or charms others at a social gathering. A social network lens is way of understanding a person's ongoing social context.

These social contexts vary greatly. As an example, one person may have many friends but may not be very central in the network. Another may not have many friends but may be connected to a highly central person. In contrast, two people may have the same number of contacts, but one person's contacts are also friends whereas the other person's contacts do not interact at all. By considering various social network configurations, we gain knowledge about the extent a person's social context facilitates or constrains creative thinking. Two important ways that networks matter are by providing access to non-redundant knowledge and enhancing creative cognition. Ultimately, creative ideas can be either inspired and nurtured or thwarted and stifled depending on a person's social network context.

See also: Business/Management; Friendship and Creativity; Organizational Development; Social Psychology.

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Novelty

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Glossary

Constraints Tools for increasing novelty. Constraints come in pairs. One of the pair precludes a reliable, predictable response while the other promotes an atypical, unexpected one.

Domain An area of knowledge or expertise.

Ill-structured problem A problem in which all the parts are not specified. Novelty is only possible in ill-structured problems.

Novelty A kind of variability involving responses that are new and useful (innovative), unusual (original), or domain-changing (creative).

Problem space How a problem is represented by a solver. The space has three parts: an initial state, a goal state, and a search space in which a solution path is constructed. Constraints increment novelty by re-structuring problem spaces.

Variability A measure of how differently something is done. Moderately high variability is associated with novelty; higher variability, with domain-changing creativity.

Well-structured problem A problem in which all the parts are specified. Novelty is not possible in well-structured problems.

Novelty is necessary but not sufficient for a response to be considered creative. Nonetheless, given that the criteria for sufficiency (usefulness, influence, etc.) are many and shifting, novelty may be the optimal object for manipulation and measurement. This article considers how paired constraints preclude low variability, high probability responses, and promote novel ones.

Novelty, Variability Levels, and Learning

Variability can be conceived as a scale, a continuum with minimal and maximal degrees of difference in how something is done. **Figure 1** presents one version of such a scale.

Responses closer to the minimal end of the continuum are predictable because they tend to be performed in remarkably similar ways. They increase in variability from stereotyped (invariant) to reliable (habitual) to expert (variation within a domain-determined range). Responses closer to the maximal end are less predictable because they are, by definition, quite different. Novelty is in this range because new responses appear after more likely ones have been exhausted. The remaining categories include responding that is novel and also useful (innovative), unusual (original), or, at the highest level, influential (creative).

Influential or domain-changing novelty is rare because it substitutes a novel set of criteria and procedures for satisfying the criteria for another, already accepted set. Once the new criteria/procedures are incorporated into the domain and adopted by others (i.e., what influence means), they drop back to a lower variability category.

Learned Variability Levels

Importantly, learned or habitual variability levels (how differently one usually performs or applies a skill) are domain-specific and learned/acquired early in skill acquisition. High levels ensue when training tasks require and reward doing something in

multiple ways. This kind of regime can be thought of as difficult-but-doable; accelerated training is another, in which rapid acquisition of different skill components precludes repetition and promotes variation.

Novelty, Problem-Solving, and Constraints

A counter-intuitive (i.e., counter to common usage) strategy for increasing novelty involves imposing constraints, plural and paired. Since the pairing is a convention from problem-solving, our discussion starts with problem spaces.

Problem Spaces

A problem space is how an objective problem is represented (subjectively) by a potential solver. Experts and novices differ considerably in this: the expert's representation is both more elaborate and more efficient. In both cases, however, the parts of the space are the same. These are an initial state, a goal state, and between the two, a search space in which to construct a solution path. Paired constraints guide this search. In a well-structured or well-defined problem, all parts of the space are given. Think about a paint-by-number canvas, cartooned and numbered to indicate the color of the appropriate paint. This kind of problem precludes novelty. Novelty requires an ill-structured or ill-defined problem, in which not all the parts are specified. Given a blank canvas, novelty is possible.

Constraints

In problem-solving, constraints come in pairs. One precludes/limits search in some parts of the search space; the other promotes/directs search in other parts. Solution involves substitution: the more specific the pairings, the more efficient the solution process. As shown in **Table 1**, there are four constraint categories: goal, source, subject, and task.

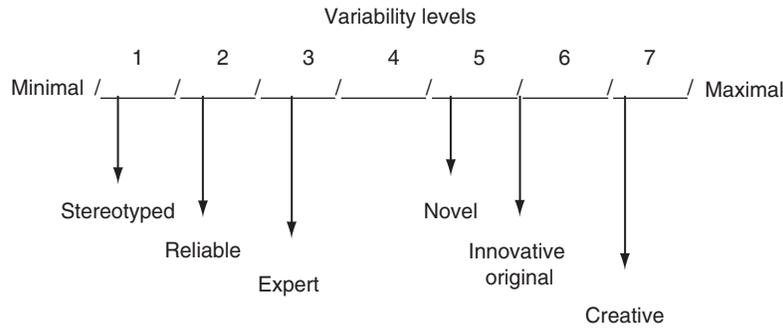


Figure 1 Variability continuum.

Table 1 Constraint categories

Category	Pairings
Goal	Preclude an existing style/solution → Promote a novel style/solution
Source	Preclude (work against) specific elements → Promote (work with) others
Subject	Preclude particular themes/motifs → Promote others (often opposites)
Task	Preclude traditional materials and manipulations → Promote alternative materials and applications

Goal constraints preclude an existing solution (the initial state) and promote an alternative (the goal state). Source constraints are elements available for selection and rejection, recombination, and restructuring. Larry Rivers, who was both a painter and a jazz musician called these constraints ‘first choruses,’ material on which the artist/performer improvises. I see them as providing both what you work with (promote) and what you work against (preclude). In some ways, choosing what to work against is the more critical. Subject constraints involve content or motif; task constraints, materials and how they are used. The goal constraint influences every other constraint. Source and subject constraints influence task constraints. Task constraints cascade, one influencing/generating another.

Novelty Problems

There are two kinds of novelty problems. One, the Domain-Specific Novelty Problem, is (in the case of experts) initiated by its solver. The other, the Generic Novelty Problem, is initiated by an outsider, typically a researcher investigating the conditions that facilitate novelty.

In a Domain-Specific Novelty Problem, the goal is a new style (or a variation on an existing style); the solution path is a set of procedures that define and realize the new style. In a Generic Novelty Problem, the goal is more general: variability of a particular degree and kind. Both problem types are solved incrementally via a series of substitutions. The substitutions are strategic (i.e., guided by the goal) and involve the selection of paired constraints. These constraints restructure the problem space by precluding repetitive, reliable responses and promoting surprising, often opposite substitutes.

Generic Novelty Problems

This section considers general, cross-domain constraints on a number of variability measures, including novelty *per se*.

There are several reasons for this focus. First (as shown in Figure 1), novelty and its progeny (originality, innovation, and creativity) increase when variability increases. Second, highly creative people tend to be highly variable in their areas of expertise (these are the habitual variability levels acquired along with skills). Third, although strict novelty criteria only reward responses that differ from earlier ones, most creativity testing and training measures use variability rather than novelty criteria. For example, the Torrance Tests of Creative Thinking (TTCT) assess aspects of divergent thinking. Fluency measures how many different responses are made; originality, how many unusual responses; elaboration, how much detail accompanies a response. We begin with constraints on novelty *per se*, then on specific kinds of novelty and finally, on variability *per se*.

Novelty per se

Novelty can be required either within or between training sessions. Within means that a response must differ from all responses in a single session; across, that the response differ from responses in all prior sessions as well.

In a famous study, porpoises were rewarded for swimming and leaping in ways that were outside the species’ normal repertoire Novelty was defined across sessions: to earn a fish, a response had to differ from all responses in all sessions. Did the porpoises notice what the fish were for? Yes. As training proceeded, new topographies appeared closer to, and even at, the start of a session. In a study with children, novelty was defined within sessions. Even if a response was seen in a prior session, its initial appearance in a subsequent session was rewarded. The children, like the porpoises, had to notice what kinds of painting or block-building responses were followed by a reward. Did children learn what praise or tokens (convertable into toys) were for? Yes. Reward increased both form diversity (first instance in a session) and novelty *per se* (first instance across sessions).

While both children and porpoises were successful at meeting implicit novelty criteria, this is not always, and not often, the case. The reason is that without explicitly stated criteria, performance reflects an individual's learning history. Since most of us are rewarded for reliable, conventional responding, it is not surprising that reliable, conventional responses occur early and often. (This is the reason why novelty involves high variability. Those reliable responses must be run through first.)

Particular Kinds of Novelty

The studies in this section targeted particular kinds of novelty: originality (unusual responses), innovation (useful responses) and flexibility (number of different response categories). The relevant response criteria were specified (made explicit) for some, but not all, participants.

One study showed that promised reward for completing a drawing task only increased originality when children were given clear instructions that the drawing be unusual, or when they had just been rewarded for coming up with unusual rather than ordinary uses for objects. In the latter case, the context seems to have cued the responding. That is, unusual responses very recently rewarded in, and thus associated with, the current context, included a new (and therefore noticeable) teacher, the experimenter. Another reported interesting mirror-image results. Instructions targeting flexibility increased flexibility but decreased originality. Instructions specifying originality had the opposite effect: originality scores went up, flexibility scores went down. A third series of experiments manipulated choice of inventive categories (subject constraints) and parts (task constraints). The explicit goal was to produce novel, useful objects, by combining the parts. The researchers reasoned that greater choice would promote conventional thinking; thus they predicted that limiting choice would preclude the conventional and promote the novel. This was the case. Compared to conditions where students chose either category (e.g., furniture or toys) or parts for combination (e.g. wheels, handles), the highest originality ratings were given when both category and parts were randomly specified rather than selected.

Variability *per se*

Variability can be measured in several ways. Two are reminiscent of divergent thinking measures: count the number of different responses, calculate the likelihood of a given response (the less likely, the more unusual the response). The second measure is called an uncertainty: the higher the uncertainty, the more unexpected or unusual the response. Several procedures reliably increase variability. Some involve explicit variability criteria; others, implicit criteria.

Explicit criteria

One procedure specifies what are called lags. A lag refers to the number of prior responses from which a current response must differ. For example, a lag of three means that reward only follows a response (or series of responses) that differs from three prior ones. Imagine three-response sequences made on right or left pointing arrow keys: the sequence RRR would be rewarded if it occurred after the sequences RRL, LLL, and LRL,

but not if any triad was repeated (e.g., RRL, RRL, LRL). Lags clearly preclude repetition and promote variation. They have been shown to increase response variability in pigeons, grade school, and college students. Pigeons have met lags up to 50; college students to 25; fifth graders to 10. Another procedure is known as frequency dependent selection. Here, less probable or less frequent responses are momentarily selected for reward. For example, with the same left-right key press pair, as R increases in frequency, reward decreases for R and increases for L. Depending on the relative probabilities specified by the reinforcement schedule, some stable (and more or less variable) alternation pattern will earn maximal reward.

Implicit criteria

Implicit criteria are embedded in all tasks; they differ depending on whether the task is easy or difficult, simple or complicated. An easy or simple task requires little variability: few things need be tried to master it, few to maintain it. Difficult or complicated tasks require higher variability: many things are necessary for mastery and maintenance. Ill-defined problems are, by definition, more difficult than well-defined ones, thus implicitly targeting and selecting higher levels of variability.

Whether variability levels are temporary or habitual depends on when a particular type problem is introduced. As discussed earlier, habitual variability levels – preferred performance ranges – are acquired early in skill acquisition. If easy/simple tasks are encountered then, the levels will be lower than if training involves difficult/complicated tasks. Computer maze games have been used to implicitly select and maintain high or low variability levels. For example, two groups of college students played two versions of a game with easier/simpler or more difficult/complicated sets of constraints. The easy set required exiting the maze at specific locations; the difficult one, exiting at the same locations by paths that differed from some number of prior paths (in other words, lags). As the number of locations decreased (from 3 to 1), the lags increased (from 0 to 5). The more difficult training task (combined locations and lags) generated higher variability both when the training conditions were in effect, and – importantly for this discussion – sustained it long after they were relaxed (i.e., when all paths to all locations earned points).

Domain-Specific Novelty Problems

In Domain-Specific Novelty Problems, the initial state is usually an existing, accepted style or solution type. The more radical goal state is replacement; the less radical, variants of the initial state. The initial and goal states together are the preclude-promote pairs of the goal constraint. This section summarizes two constraints (goal and task) in two domains – architecture and theatre; subject constraints are also included for the latter.

Architecture

Here we focus on one type of architecture (domestic) and one architect (Frank Lloyd Wright). The open, interconnected spaces of Wright's Prairie (palatial) and Usonian (practical) houses were highly influential, prototypes for single-level

ranch house, satellite spaces, and great rooms. As indicated in Table 2, his goal precluded the straight-sided box with its small, separate rooms (initial state), and promoted in its place, a radically new architectural style that he labeled 'organic' (goal state). For Wright, 'organic' was synonymous with 'continuity'. Continuity involved three relationships: between interior and exterior spaces; between interior spaces; between surface and decoration. To accomplish this, he borrowed horizontal elements (overhanging roofs, transoms, open spaces separated by sliding screens) from the traditional Japanese dwelling; balconies and verandas from the South; hearths and porches from the Midwest; simplified, stylized, and importantly – unbroken – surface decoration from his mentor, Louis Sullivan.

The site was critical in that the house conformed to, was an extension of, its topography. Most Wright sites were flat, which accounts for the horizontality of the Prairie and Usonian houses. The most famous exception is Falling Water, with cantilevers that overhang and mimic its waterfall. Critical to realizing a continuous, open plan was the modernness of materials at the time: reinforced concrete solved the problem of support. Multiple interior walls (which necessitated small, box-like rooms) were supplanted by fewer, lighter supports (piers, columns) beyond which Wright's organic, continuous plans could expand. Bridging the final separation (between surface and structure), decoration was derived from form: linear, geometric elements and patterns iterated the shapes of their supports. The house, in Wright's plans, was no longer divided.

Theatre

Commedia dell'Arte, itself a source for Chicago style improvisation (Saturday Night Live), cartoon characters (Donald Duck), and situation comedies (Seinfeld), is old, influential and extant in its original goal and form. As indicated in Table 3, the goal constraint promotes the formal exaggeration of reality, while precluding realism or naturalism. Among its obvious sources are physical comedy (Roman and Greek) and dexterity (street players). Its subject is (nonserious) survival in the face of cascading 'calamity.' The cascade results from comically misguided attempts at solving an initial problem, usually a romantic one.

Novelty in Commedia arises from its form (task constraints). The form is modular: the modules are 'prepared' parts. These parts are limited to a small set of types identified not only by masks, but also by idiosyncratic movements, motives, and lazzi (gags), all of which are well-practiced, that is, prepared. Novelty (spontaneity) is possible precisely because the types are so well-prepared: just as you or I respond to new situations in characteristic, recognizable ways, so do the Old Man, the Lovers, the Zanni (and Donald Duck). Improvisation emerges from the interaction of set types and changing situations.

Summary and Concluding Question

This summary has three parts: the first reiterates the relationships between novelty and variability; the second, the ways in which constraints help solve novelty problems; the third suggests ways to train for novelty. The question concludes the chapter.

Novelty and Variability

Novelty and variability are inseparable, and for a number of reasons. First, previously rewarded responses appear before novel ones, thus variability is high. Second, variability increases with difficulty: adding useful (innovative), unusual (original), or influential (creative) to a newness criterion augments variability. Third, influential creators as well as successful inventors and innovators, are highly variable in the domains of their expertise. This may be attributable to habitually high levels acquired during early, accelerated skill acquisition (a commonality for the gifted and talented). Finally, many novelty measures (fluency, originality, etc.) are actually variability measures. Variability is easily quantified, which makes it feasible to study.

Novelty Problems and Constraints

Novelty problems are ill-structured or incompletely specified. Paired constraints, strategically selected to realize a novel goal,

Table 2 Constraints for Frank Lloyd Wright

Category	Pairings
Goal	Preclude the 'box' → Promote the 'organic' (continuity)
Task	Preclude interior–exterior separation → Promote site-specific elements (cantilevers, strip windows, overhanging roofs, terraces)
	Preclude interior separation → Promote open, interconnected plans (piers, columns, screen walls)
	Preclude surface-structure separation → Promote structure-specific elements (decoration follows form)

Table 3 Constraints for Commedia

Category	Pairings
Goal	Preclude the realistic → Promote formal exaggeration of reality
Subject	Preclude the serious → Promote survival in face of 'calamity'
Task	Preclude prepared scripts → Promote prepared parts (the set types)
	Preclude predetermined outcome → Promote improvisation (interaction of set type and situation)

re-structure the problem space by precluding search among reliable, expected responses and promoting it among risky, surprising ones. The more explicit or more specific the constraints, the more efficient the solution process.

Constraints come in four kinds: goal, source, subject, and task. In Generic Novelty Problems, the goal is simply to augment variability; task constraints communicate the criteria. In Domain-Specific Novelty Problems, the goal is more complex: either to replace an existing solution/style (as in the case of Frank Lloyd Wright) or to continually produce variants of it (as seen in *Commedia*). With complexity, the initial pairing can be critical. For example, George Balanchine's re-structuring of classical ballet (the new style was called neoclassical) started when he precluded steps based on a story and promoted steps based on the score. The change necessitated others, for example, precluding elaborate costumes and promoting pared-down (albeit still elegant) ones. Balanchine was the Chanel of ballet: practice clothes became equivalents of the little black dress.

Training for Novelty

Two suggestions stem from this summary. The first is that skill acquisition should be early and accelerated so that students not only acquire repertoires replete with elements for recombination and restructuring, but also the high habitual variability levels necessary to do so. The second is that the use of constraints should be explicitly taught and practiced. There is no one more aware of constraints and their value than a professional; no one more unaware and averse to them than a novice.

In fact, in many professional schools, including the Pratt Institute (a well-known art, design, and architectural school in New York City), constraints are always in play, but implicitly. In others, like The Julliard School of Music (also well-known and in New York), they are also always in play, but explicitly. The difference stems from the discipline. Musical performance appears to be more constrained than painting or printmaking, but Monet was no less an expert at constraint selection than Stravinsky.

The Question: Is Novelty Undermining Creativity?

The kind of creativity at stake here is the influential sort, the novelty that expands a domain. This has always been rare, but the pressure to be 'new' has long been escalating, and in ways that work against the development of domain-changing creativity. The 'anxiety of influence,' to use Harold Bloom's prescient term, is omnipresent in art and in science. We open a first book of poems, Bloom wrote, expecting a 'distinctive voice,' and if disappointed, close it. We enter an art gallery, expecting a distinctive vision, and if disappointed, dismiss the artist as derivative. We peruse a professional journal, expecting a seminal finding, and if disappointed, dismiss the research as unoriginal, unimportant.

Michael Kimmelman, art critic for the New York Times, put the problem this way: "Novelty is one of the demands we make on living artists. An artist who sticks to a course for any length of time we tend to say has fallen into a rut." How long is "any length of time"? Long enough to develop a truly new point of

view? Would Braque and Picasso be allowed the eight years (1906–1914) they took to develop Cubism? Today, probably not. When the work of an artist (and less so, but only slightly, that of a researcher) has to consistently be new, both gatekeeper (critic, curator, editor) and creator suffer. The gatekeeper forgoes the exposure necessary for comprehension, much less evaluation. Our brains are made to sort information (conceptual and perceptual) into categories. The categories are not Platonic, preexisting. They are built experience by experience into sets with common properties. The truly new fits in no existing category, and requires repeated exposure to build its own. When Impressionism was new, when Abstract Expressionism was new, each was incomprehensible.

The fledgling forgoes more than the field. First to go is the ten-year plus developmental period required before or between real breakthroughs. *Broadway Boogie Woogie* followed ten years of static 'equivalents' to use Mondrian's term, and ten more of dynamic ones. It took Monet 20 years to move from easel-sized, middle-distant views to wall-sized, close-ups of water lilies. This kind of exploratory space is still allowed to well-established painters with highly priced, 'recognizable' styles. The same is true of well-established researchers. Fledglings, in contrast, are judged by how different they are from each other, and how different their current work is from the past, including their own.

Second is the willful (or worse ignorant) precluding of the past, the curbing or checking of critical 'first choruses.' In jazz, the first chorus is what the musician improvises on. In art, the first chorus is what the artist improvises on. Picasso's first choruses included the composition of Valesquez, the mannerism of El Greco, the structures of both Cezanne and anonymous Benin sculptors. In psychology, the first chorus is past research on which the researcher/practitioner improvises. I was fortunate in having Walter Mischel on my dissertation committee: Walter introduced me to the problem-solving literature, in which I 'discovered' the mostly-ignored work of Reitman on constraints. I am surprised at how often studies that were seminal, initiating whole areas of research, are unmentioned in current variants. Also, too often the wheel is reinvented. Perhaps if artists and critics, scientists and editors, were less anxious about influence, *influential novelty* would not be so hard to come by.

See also: Behavioral Approaches to Creativity; Claude Monet 1840–1926.

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Georgia O'Keeffe 1887–1986

Painter

Paintings include *Evening Star* (1917), *Radiator Building—Night New York* (1927), *Summerdays* (1936), *An Orchid* (1941), *Ladder to the Moon* (1958), *Sky Above Clouds IV* (1965), *Black Rock with Blue Sky White Clouds* (1972)

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GEORGIA O'KEEFFE was a quintessential American painter. Born in the Midwest, she moved to New York City and became a central part of the New York art scene with her husband, the art dealer and photographer Alfred Stieglitz. She then established her home in New Mexico, becoming one of the founding artists in the Southwest art world.



Georgia O'Keeffe at an exhibition of her work "Life and Death." (Copyright UPI /CORBIS/Bettmann.)

The Early Years

On November 15, 1887, Georgia O'Keeffe was the second of seven children and the oldest girl born to Ida Totto O'Keeffe and Francis Calyxus O'Keeffe, owners of a prosperous 640-acre farm in Sun Prairie, Wisconsin. The O'Keeffe family was musical and encouraged creativity; there was a strong interest in reading and her mother promoted education.

Although O'Keeffe preferred her fun-loving father to her stern mother, it was her mother, grandmothers, and unmarried aunts Lola, a school teacher, and Ollie, who worked for a newspaper, who became her role models as capable, assertive, and focused women. Intense drive, independence, and a strong will characterized O'Keeffe since childhood. As she grew older, they formed the strengths necessary to maintain an artistic career, but in childhood they made her appear domineering to her siblings. Referring to a family photograph of the children where O'Keeffe was partly blurred, her sister Catherine, as noted by Robinson, said it was "probably because Georgia was giving orders."

O'Keeffe, who began drawing at an early age, was given art lessons on Saturday afternoons from a woman in Sun Prairie along with her younger sisters. Between lessons, O'Keeffe

would practice at home and by the age of 12 had decided to become a painter. At 13, she was sent to a Dominican Boarding School and then to a public high school in Madison. At both places, O'Keeffe concentrated on art, but it was a high school art teacher who made her aware of the details of nature through examining the structure of a jack-in-the pulpit.

Later, flowers became an important aspect of her iconography. When O'Keeffe was 15, the family moved to Williamsburg, Virginia, and she attended the Chatham Episcopal Institute, whose principal, Elizabeth Willis, was also an art teacher. It was Willis who encouraged O'Keeffe to apply to the Art Institute of Chicago, where in 1905–1906 she studied anatomy with John Vanderpoel. Afterward, she attended the Art Students League from 1907 to 1908, winning a prize in William Merritt Chase's still life class. During this period she began going to the 291 Gallery owned by Alfred Stieglitz (1864–1946) and saw shows by Rodin and Matisse. To help her family with its financial difficulties, O'Keeffe worked as a commercial artist until 1910 when she began a career teaching art in high schools and colleges in Texas and Virginia. During her time as an art teacher, she continued her own education, studying at the University of Virginia with Alon Bement and then from 1914 to 1916 at Columbia Teachers College with Arthur Wesley Dow. At Columbia, O'Keeffe became friends with Anita Pollitzer, a fellow art student, and continued to visit the 291 gallery, seeing shows by Braque and Picasso. When she left New York and returned to teaching art in college, O'Keeffe reviewed her work. Realizing that she needed to break away from her academic training, she decided to eliminate influences from previous teachers and make art she could call her own. Living and teaching first in South Carolina and then in Texas, O'Keeffe abstracted her impressions of nature and began creating works, such as *Special, No. 15* (1916), *Blue Lines* (1916), and the 1917 watercolor series entitled *Evening Star*, in what would become her mature style. O'Keeffe's independence and originality extended to her way of dressing. In a time when women wore ruffles, corsets, and pointed shoes, O'Keeffe wore simple dark garments, no corsets, and men's shoes. Interested in comfort and mobility, she said women's shoes pinched her feet. Looking at photographs of the young O'Keeffe, she appears contemporary, but when her style is compared to other women of her time, the contrast is marked. O'Keeffe also avoided jewelry but later in life wore a brooch with her initials made by the sculptor Alexander Calder.

The New York Years

O'Keeffe had been corresponding with Anita Pollitzer, and sent her friend works of art to critique. In 1916, Pollitzer showed several pieces to Alfred Stieglitz, the photographer and owner of the 291 Gallery. He was extremely impressed and presented O'Keeffe's art in two group shows that year. In 1917, just before closing his gallery, Stieglitz gave her a solo show. When O'Keeffe arrived in June just after the exhibition was taken down, Stieglitz rehung it for her to see. It was at this time that O'Keeffe began to model for Stieglitz. Returning to her teaching job in Texas, O'Keeffe kept up her correspondence with Stieglitz and in June of 1918, at his urging came to New York to paint. Stieglitz moved in with her in the 59th street studio and later that year they vacationed at the Stieglitz family summer home at Lake George. O'Keeffe and Stieglitz, who were married in 1924, made annual trips to Lake George until the 1930s when the family home was sold. It was there that O'Keeffe painted her studio, *My Shanty, Lake George* (1922).

Living together on 59th street, Stieglitz continued photographing O'Keeffe, a process that over the years generated an enormous variety of images. O'Keeffe was shown in different costumes, as facial portraits, as erotic nudes, and as a series of hand portraits. O'Keeffe said her hands had been admired ever since she was a child but 60 years later looking back at the variety of images of herself, she said she wondered who that person was; it seemed to her that in one life she had lived many lives.

O'Keeffe painted intensely and Stieglitz promoted her career, speaking to critics, walking with them through her exhibitions, and explaining the work. She showed at the Anderson Gallery in New York along with other well-known artists of the period such as Arthur Dove, Marsden Hartley, Charles Demuth, John Marin, and Paul Strand. In 1925 Stieglitz opened The Intimate Gallery and in 1930 The American Place Gallery, continuing to exhibit O'Keeffe's work.

In 1925, when O'Keeffe and Stieglitz moved to rooms on the 30th floor of the Shelton Hotel, O'Keeffe was so taken with the view of New York that she began to paint images of skyscrapers and industrial docks. The male artists in the gallery thought women incapable of doing cityscapes, but O'Keeffe, used to competition with her older brother, was also competitive in the gallery. In works such as *East River from the Shelton* (1927–1928) and *Radiator Building—Night New York* (1927) she demonstrated that a woman could successfully paint the City.

It was during this period that she also began exhibiting her large flower series containing works such as *Black Iris III* (1926) and *Two Calla Lilies on Pink* (1928). Although New York was an exciting place, O'Keeffe longed for the countryside; she said "distance has always called me" (Hogrefe, 1992, p. 369). In 1920 O'Keeffe began taking yearly trips to Maine and in 1929 made her first trip to the Southwest.

The Southwest

As a child, O'Keeffe's favorite stories were about the West, and visiting New Mexico was like an experience of coming home. On her second trip there, she sent back a barrel containing bones and fabric flowers, which enabled her to produce

Western themes such as *Cow's Skull: Red, White, and Blue* (1931) and *Summerdays* (1936) when she painted in the East. Eventually O'Keeffe divided her year between living with Stieglitz in Lake George and New York and her time in the Southwest. During her early trips to New Mexico, O'Keeffe stayed at Ghost Ranch, a dude ranch in the eastern part of the Jemez Mountains where the Mesozoic rock formations derive their intense color from iron oxide. In 1940, O'Keeffe bought Rancho de los Burros and in 1945 bought a second house in Abiquiu. She spent the summer and fall at Rancho de los Burros and the winter and spring at Abiquiu, which O'Keeffe considered to be her main residence.

Although she continued to make flower paintings, such as *An Orchid* (1941), the New Mexico desert was a constant source of inspiration both in its landscape and in the objects she found there. Walking in the desert the artist took pelvic bones bleached by the sun and used them in a series of paintings, such as *Pelvis With Moon* (1943) and *Pelvis III* (1944), where their holes let in the sky. After the death of Stieglitz in 1946 O'Keeffe settled her estate, delegating his large collection of art to museums. She was also active in organizing two exhibits of his collection, first at the Museum of Modern Art in 1947 and then at the Art Institute of Chicago in 1948. Beginning in 1949 the artist lived in New Mexico throughout the year.

O'Keeffe's career continued to expand. Even in the Depression she had sold work, but during the 1940s her fame increased. She had retrospectives at the Art Institute of Chicago in 1943 and at the Museum of Modern Art in 1946, and received an honorary doctorate from the University of Wisconsin in 1942. Later, in 1973, O'Keeffe received a second honorary doctorate from Harvard.

The 1950s were a decade of travel for O'Keeffe, who had until then spent her entire life in the United States except for brief forays into Canada. In 1951, she made her first trip to Mexico and in 1953 made her first trip to Europe, to which she returned in 1954. In 1956 she traveled to Peru and in 1959 took a three and a half month excursion around the world. Although O'Keeffe continued to paint images of the Southwest, such as *Ladder to the Moon* (1958), a new imagery entered her art as the result of her travels. O'Keeffe became interested in the cloud formations she saw from airplane windows and began her series of cloud paintings, which included the largest canvas of her life, the 8 × 24-ft *Sky above Clouds IV* (1965).

The Final Years

O'Keeffe remained active and retained good health until close to the end of her long life. She made her first rafting trip down the Colorado river when she was 74, her second one at 82, and her final trip in 1970 at 83.

In addition to rafting, she also returned to Colorado to paint. Eventually O'Keeffe's failing eyesight necessitated a change of medium in order for the artist to remain creative. Juan Hamilton, a potter and her studio assistant, showed her how to construct hand-coiled pots and O'Keeffe turned to pottery. Her pots echoed the shapes found in her late paintings such as *Black Rock with Blue III* (1972) and *Black Rock with Blue Sky and White Clouds* (1972). Before her death on March 6, 1986, at the age of 98, O'Keeffe had become the most celebrated

woman artist in America. She was elected to the American Academy of Arts and Letters in 1962, given the M. Carey Thomas Award from Bryn Mawr College in 1971, and in 1979 received the Medal of Freedom from President Gerald Ford. It is the nation's highest honor awarded to a civilian.

Georgia O'Keeffe and the Creative Process

Her Quest for Originality

After she finished school, O'Keeffe had an intense desire to find her personal method of expression, saying "I decided I wasn't going to spend my life doing what had already been done." She hung all her recent work on the wall and observed that each piece reflected the influence of one or another of the teachers with whom she had studied. Wanting to find her own voice, O'Keeffe (1976) said,

I have things in my head that are not like what anyone has taught me—shapes and ideas so near to me—so natural to my way of being and thinking that it hasn't occurred to me to put them down. I decided to start anew—to strip away what I had been taught—to accept as true my own thinking. . . . I was alone and singularly free, working into my own, unknown—no one to satisfy but myself.

Painting from Nature

One of her favorite ways to work from nature was by painting in her car. For this O'Keeffe said the Model A Ford was best. Its high windows let in the light and she could take out the passenger seat, and after unbolting the driver's seat, turn it around and have the car as her studio. This ingenious solution shows O'Keeffe used her capacity for what Ruth Richards calls "everyday creativity" in the service of her creativity in art. Sitting in the swiveled driver's seat, she could prop a canvas up to a size of 30 × 40 in. on the back seat and paint until about four in the afternoon when bees would invade the car. At that point, she had to close the windows and eventually the car became too hot to continue working. A very keen observer of nature, O'Keeffe would often remember events and images so clearly that she was also capable of painting them from memory. [See EVERYDAY CREATIVITY.]

Visual Memory

Artists are known for their excellent visual memories and O'Keeffe demonstrated the capacity at a very early age. She remembered, when she was 8 or 9 months old, sitting on a patchwork quilt and seeing her Aunt Winnie, accurately describing her aunt's blond hair and the details of her dress. Years later she told her mother, who also remembered that day. Her mother was at first incredulous, but then had to admit that O'Keeffe's visual memory was accurate.

O'Keeffe, who was very physically active, always liked the outdoors. All her life, she took long walks, and her observations formed the basis for later work. Her paintings *From the Plains I* (1919) and *Orange Streak* (1919) were memories of Texas, but created months later in New York. The habit of working from memory lasted her entire life. In her sixties, O'Keeffe began her *Cloud Series*, images of the world seen from the window

of an airplane. She did small charcoal drawings on the plane but filled in all the details for the large works from memory.

Early Evidence of Creative Ability

Evidence of early creative ability, common among artists, is also found in the life of O'Keeffe. She began to draw as a young child, first making images of her dolls. Because she sewed well, O'Keeffe made them clothing and then also built them a house. When she and her sisters were given art lessons as children, they learned by copying pictures of their choice in the teacher's collection. At home, O'Keeffe practiced by copying a picture of a lighthouse from her geography book. When she was unsatisfied with her first effort, she made another variation, this time with greater success. She then made a landscape drawing of the night view from her window, again working until it was made to the best of her ability. Writing in her late eighties, O'Keeffe noted that the two paintings—the lighthouse with the cloudy sky and the night with the bare trees and snow—must have been important to her because she kept them for a long time.

Abstraction versus Realism

For O'Keeffe even if a painting was realistic, it was not successful unless it worked as an abstract arrangement of color and form. She never separated the objective from the abstract and did not believe that subject matter alone produced a good work of art. For her it was the way lines and colors came together that formed the expressive basis of a painting. She altered the forms she saw in nature to heighten the abstract drama of her work, saying, "the abstraction is often the most definite form for the intangible thing in myself that I can only clarify in paint" (1976).

It was not her intention to copy reality exactly as she saw it, but rather to convey her response in the hopes that the viewer would share her impression about a place or object. She said, "the color used for the paintings had little to do with what I had seen—the color grew as I painted" (1976).

Positive and Negative Space

A strong point in O'Keeffe's work is the balance of positive and negative space. An example of positive space may be a wall, while negative space may be an open door in that wall through which a vista or other intimation of depth might be seen. Walls and doorways form a repeated graphic element in her work and it was a specific adobe wall with a doorway that made O'Keeffe want to buy the house at Abiquiu.

A further example of positive and negative space is found in her depiction of pelvic bones within whose holes the sky shines through. Speaking about the pelvic bones and her emphasis on their holes, O'Keeffe (1976) said that she was always the kind of child "that ate around the raisin on the cookie and ate around the hole in the doughnut either saving the raisin or the hole for the last and the best." She said that it was the holes in the bones that held her interest—the way they framed the blue sky in their contours. For O'Keeffe, the blue sky represented her idea of the eternal, lasting beyond the time of humans and bones.

Focus on Work

What characterizes successful artists is not only talent but their ability to work and their interest in working as a way of life. As O'Keeffe said,

One works because I suppose it is the most interesting thing one knows to do. The days one works are the best days . . . (you) can get at the paintings again because that is the high spot—in a way it is what you do all the other things for. . . . The painting is like a thread that runs through all the reasons for all the other things that make one's life.

Even with advancing years, O'Keeffe continued working and made efforts to break new ground. When she was 78 years old, she painted the largest canvas of her life, the 8 × 24-ft *Sky Above the Clouds IV* (1965). Because of its enormous size, the painting could not fit in her studio, so O'Keeffe worked on it in the garage. She mixed the paints in her kitchen Mixmaster and then brought them outside. Painting from 6 in the morning until 9 at night, she wanted to finish the canvas by winter because there was no heat in the garage. Still, in evening because the garage was warmer than the surrounding desert, O'Keeffe was afraid that rattlesnakes attracted by the warmth would come in behind her as she worked.

Painting Technique as Language

Early in her life O'Keeffe spoke about the various techniques, such as pastel, watercolor, and oil paint, as being languages. She saw the artist becoming proficient in the language of a given media and then being able to express herself creatively in that language. When she grew old and her eyesight failed, O'Keeffe could no longer see well enough to paint. She turned to pottery, saying "it could become still another language for me" (1976).

Symbolism and Communication

O'Keeffe insisted that her work was not symbolic, saying it just was what it was and that was an aspect of the world. Her flowers have been compared to female genitalia, but O'Keeffe admitted no such connection. When a seashell that she painted was also seen as sexual, O'Keeffe said it brought the ocean to her and that was its meaning.

Artists work on conscious and unconscious levels. An artist who consciously may not be aware of the symbolic content of a work may nonetheless be using symbolism on an unconscious level. For example, in her repeated imagery of skulls and flowers, there may have been an unconscious symbolism of death and rebirth, but O'Keeffe insisted on reading her work on a conscious level only. She saw her art not as symbolic, but rather as a depiction of the landscape of her world, an image of her perception and her method of communication. In speaking about the objects she painted—the flowers, rocks, trees, shells, pieces of wood, and bones—O'Keeffe said she had used these things to describe the wideness and the wonder of the world as she experienced it. And it is through these objects and her paintings that O'Keeffe transmits her world to us.

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Organizational Culture

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Glossary

Creation of meaning The process by which individuals or organizations develop an understanding of the situation and how it might evolve over time.

Creative knowledge environment Surroundings that exert a positive influence on persons engaged in the production of new ideas and innovations.

Empowerment The process of increasing the ability of individuals or groups to think and perform autonomously.

Shared vision A common imagination of the future of the organization or its tasks that give the basis for action.

Subculture Groups of people who share values which distinguish them from the values shared among the organization they belong to.

Introduction

According to Edgar Schein the essence of an organizational culture is a set of values that has a number of norms related to it. These norms define what is considered to be correct or incorrect behavior and what counts as valuable to the organization. Examples are power differentials between individuals, equality between men and women, and whether it is important to avoid risk or whether it is acceptable to take chances. The values are not always observable but are often taken for granted.

The organization's culture is an important aspect of innovation. All decisions are both affected by and also affect this culture. If the organization's culture is authoritarian and conformist, it is often tied to a bureaucracy. This results in limitations when it comes to making dynamic decisions. Where the organizational culture is innovative and progressive, leaders are expected to be more adventurous and to make decisions based on their own initiative. There are also examples of organizations that fluctuate between an authoritarian and innovative culture. Schein argued that a strong culture is characterized by an organization being so ideologically driven that individual action is affected and inhibited by the pattern of shared basic assumptions. Some theorists like Gareth Morgan argue that leaders can make use of a strong culture as a means of ideological control. According to this view, to lead an activity is equivalent to the reinforcement of the 'right' attitudes, values and norms of an organization. As a result, the employees are kept under control (see also Cameron Ford).

There are basically three perspectives on organizational culture represented in the research literature, according to Debra Meyerson and Joanne Martin:

1. The integration perspective implies that the organizational culture is seen as a unifying and inclusive force. Central

concepts are 'shared values' and 'common goals and beliefs.' The basic idea is that consensus is important for creativity and innovation.

2. The differentiation perspective involves a focus on cultural differences and the existence of subcultures. Individuals and groups are expected to have their own needs, perceptions and values, be they organizational or personal. Since cultures, by definition, are interpretative systems, variability must be expected between individuals and between groups. Mats Alvesson argued that a group can differentiate itself by standing in contradiction to the main culture or by representing something additional.
3. The fragmentation or ambiguity perspective is characterized by the organization being regarded as an arena in which social actors constantly negotiate and renegotiate what is perceived as meaningful in life. The focus is on how collective interaction and action lead to meaningful processes. Sensemaking, as well as individual and group-related cognitive processes, are therefore of key interest. Conflict is not seen as a bad thing for creativity and innovation but, on the contrary, is regarded as an asset.

The Integration Perspective

An organizational culture can be defined as the values that manifest themselves in an organization in the form of action. Intrinsic in all values are norms and expectations about how one should act in various situations. An organizational culture affects the extent to which creative solutions are encouraged, supported, and implemented. A culture that supports creative thinking encourages innovative problem formulations and solutions. In such a culture creativity is regarded as something both desirable and normal.

Of particular interest in this context is the behavioral pattern of the top leadership. The leaders of an organization are usually in the best position to influence the organization's own culture. In stable organizations the leaders are usually part of the culture. They must know the culture and express it in order to appear legitimate. The culture controls management as much as management controls the culture. This sets the limits of what is possible when it comes to changing attitudes and behavior. Leaders who come from outside or are strong reformers often encounter strong opposition.

An important way for leaders to influence creativity in organizations is to introduce creative goals. These have a positive impact on people's motivation, which in turn has a positive effect on creativity. By setting creative goals the employees are informed about what is demanded and valued by the organization. Several studies have shown that when employees are informed that creativity is important for the organization they also act more creatively. The goals introduced should not be too specific as this may prevent action. Instead, leaders should communicate relatively broadly defined expectations about the outcome. This will in most cases open up the possibility of various creative solutions. It is therefore important that leaders ensure that employees are able to display autonomy.

A consistent organizational culture is largely based on the organization's employees being able to share a common vision. A shared vision is different from an idea in that it constitutes an important force in the employee's heart. In many ways, this vision is the answer to the question; what do we want to create? Shared visions can therefore achieve consistency in an organization's various activities in several ways. A shared vision is often developed on the basis of a personal vision, and usually has its origin at the top leadership level in the organization.

Leaders can improve the conditions for visions being shared by employees by working actively with the communicative climate. A knowledge-based vision requires a strong commitment and can only be communicated effectively through social interaction. Key elements of this vision are new thoughts, ideas, phrasings, and actions. These provide a foundation for new forms of imagination in the organization. The vision must in addition communicate to all employees what kind of values and skills the organization requires.

A unitary culture has a vital creativity-related problem. The ideas shared by the organization's members have a tendency to decrease in value over time. There are several reasons for this. One is that organizations that have been successful for a long time usually become increasingly closed when it comes to accepting new ideas that are culturally legitimate. Another is that business models that once led to industrial dominance have a tendency to become outdated over time. For this reason, mature organizations are rarely active in industrial change initiatives.

The Differentiation Perspective

A consistent organizational culture expresses the core values shared by most members of the organization. When we speak of an organizational culture, we are thus referring to

the dominant culture. It is by using a macro-perspective that we can perceive an organization's special personality.

However, most large organizations are characterized by the fact that different subcultures evolved. These reflect common problems, situations or experiences that members have taken part in. Subcultures often occur as a result of an organization's division into sections. They can also be the result of geographical separation. An individual department can have a subculture that is unique for its members. Usually, such subcultures include the core values of the dominant culture and additional values that are unique to that particular department. Organizations can therefore be seen as collections of various subcultures that operate with different systems of meaning. This means that there is no monolithic culture. Different departments or professional groups have their own subcultures, and these are sometimes at odds with each other. These subcultures sometimes compete for power, control, and resources. The conflicts are normally resolved through adaptation and negotiation.

According to Deborah Dougherty, the reason for this division is that innovation often requires insights based on collective interpretation developed by various specialist groups. Within these groups people think differently and give priority to different types of information. Dougherty suggests four basic types of subcultures that characterize functional departments: (1) the engineering culture; (2) the market culture; (3) the production culture; and (4) the planning culture.

In recent years, the concept of creative knowledge environments has been launched by Sven Hemlin, Carl Martin Allwood, and Ben Martin. This refers to environments in which knowledge is produced by people in a work-life context. Creative knowledge environments may be small. They occur both at the individual level and the team level. In these environments, factors such as personal interaction and physical work conditions are important. Knowledge environments can also be large. They can consist of a research institution or a knowledge-intensive company where employees work. However, the basic idea with the concept of creative knowledge environments is that some form of differentiation of the dominant culture takes place.

The general principles of how a creative knowledge environment works apply at all levels of an organization, whether we are talking about a leadership or a production environment. Creative knowledge environments may be divided according to team and management responsibility. In many knowledge environments the common responsibility is to carry out the assigned work. This common responsibility is something that is special for a knowledge environment. We are talking about a creative knowledge environment that normally has a leader.

If the knowledge environment also leads, we obtain what is commonly called a self-governed knowledge environment. Where the knowledge environment in addition creates itself by selecting the members to be included, we obtain a self-designed knowledge environment. Such a knowledge environment is often made up of members with diverse skills and experience. They solve tasks for which knowledge and skills are required from different parts of their organization, and no single department can cover all areas of the field. It may for example be a case of product-, market-, quality-, or customer-focused knowledge environments.

The Fragmentation or Ambiguity Perspective

As has been shown, it is characteristic of researchers influenced by the differentiation perspective to assume relatively clear boundaries between the different subcultures in organizations. These subcultures are generally based on different departments or professional groups. However, many organizations are characterized by the fact that it is difficult to discern clear boundaries between defined subcultures. The reason is that organizational changes lead to borders shifting very quickly since they are constantly subject to different negotiations. This fact is important for the fragmentation or ambiguity perspective.

A central concept in understanding an organizational culture is meaningfulness. The individual development of reference frames does not take place in social isolation. Jill Perry-Smith pointed out that the creation of individual meaningful structures usually implies that the individual explores relationships with other individuals who are involved directly or indirectly in the same project. The interdependence of employees is often high in large-scale creative projects leading to development of a kind of collective reason emerging from collective interaction, as Karl Weick and Karlene Roberts showed. When people engage in interaction with others it creates an intersubjective meaning in the sense that a common understanding of the creative process emerges, according to Andrew Hargadon and Beth Bechky. Individual reference frames are thus linked together into intersubjective frameworks. When a mutual understanding emerges in this way Carl Martin Allwood and Marcus Selart argued that an organizational culture is developed.

Traditionally, research such as that of Teresa Amabile focused on the motivational and contextual factors influencing creativity in organizations. However, recent evidence suggests that cognitive meaningful structures also have a strong influence on how creativity unfolds. Such structures may have a major role in how organizational problems are defined and solved. They are thought to operate at many different levels of an organization, that is, at both the individual and the intersubjective levels.

Nevertheless, all creation of meaning is governed by perceptions that may be related to ideologies, paradigms, and organizations. It is therefore not unusual that various groups try to argue for their views in order to influence the development of the intersubjective creation of meaning. Sometimes differences in opinion may lead to the emergence of conflicts in organizations. However, as indicated by Carsten De Dreu there is a nonlinear relationship between the level of conflict in groups and innovation. Moderate levels have been observed to stimulate innovation while high levels appear harmful. Minority dissent can therefore prove to be beneficial to creativity, and thus to innovation. This is especially true for groups with a high degree of participation. For this reason, groups that are too homogeneous may lead to low levels of creativity, innovation, individuality, and independence. Conflicts about ideas can sometimes be beneficial. It is therefore important that minority views be ventilated and considered as an asset.

In many successful companies empowerment-oriented leadership is applied. In such organizations both rhetoric and economic resources are used to develop the intellectual resources. In these organizations employees are characterized

by qualities such as self-confidence, inner motivation and skill. Such properties are characteristic of individual creativity in organizations. Individual creativity is in turn thought to translate eventually into innovation and economic profit. As previously mentioned, a shared vision requires an integrated understanding of the organization's goals. However, a belief in empowerment allows a lot of fragmentation on how these goals will be achieved. In such organizations it is the management's task to set goals, secure resources, and then leave the arena.

Conclusion

There are three distinct perspectives on the characteristics of an organizational culture:

1. The integration perspective implies that an organizational culture is a unifying and inclusive force. Central concepts are shared values and common goals and beliefs. However, most scientists representing this perspective agree that subcultures exist. They see the unitary organization as an ideal, and regard political tactics and conflicts as harmful to the innovation process. It is through consensus that a creative environment that provides a basis for innovations should be built. The managerial challenge within this perspective is thus to direct the unitary culture toward creativity and innovation. This may be a great challenge given that many organizations feel forced by competition to focus on efficiency (exploitation) rather than innovation (exploration). Introducing clear-cut creative goals and establishing a communication climate that builds a shared vision are some options managers have in their toolkit.
2. The differentiation perspective involves a focus on cultural differences and the existence of subcultures. Individuals and groups are expected to have their own needs, perceptions and values, be they organizational or personal. Since cultures, by definition, are regarded as interpretative systems, variability among individuals and between groups must be expected. The focus is on the emergence of subcultures rather than on individual and intersubjective cognitive processes *per se*. The managerial challenge in the differentiation perspective is to handle the subtle conflicts that arise between different cultures. Subcultures may often adopt their own goals which may be at odds with those of the organization (suboptimalization). A possible solution might be to look for how creative knowledge environments of different sizes and at different levels can be created. Letting parties from different subcultures gain common responsibility might help the organization enhance creativity and innovation.
3. The fragmentation or ambiguity perspective is characterized by the organization being regarded as an arena in which social actors constantly negotiate and renegotiate what they perceive as meaningful in life. The focus is on individual and intersubjective cognitive processes rather than on the emergence of subcultures. Representatives of this perspective are interested in how meaningfulness emerges in the organization as a result of collective interaction. Conflicts and disagreements are not seen as something negative for the creative process, but on the contrary, are regarded as an

asset. It is by allowing groups and individuals to compete that creativity and innovation are developed. The managerial challenge within the fragmentation perspective is essentially to balance the level and type of conflicts so that it does not become counterproductive. Conflict and heterogeneity may spur creativity and innovations, but there is a limit.

In reality, across the perspectives, managers usually face the delicate task of trying to form cultures that build on the best of the various perspectives. Trying to balance the unitary and cohesive culture in the integration perspective with the need for heterogeneity and conflict advocated by the differentiation and fragmentation perspectives may prove difficult. However, the reward if one succeeds – a creative and innovative organization – is usually worth the effort.

See also: Innovation; Knowledge; Organizational Development.

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Organizational Development

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Glossary

Adaptability An ability to change something (e.g., product(s); the process) or oneself to fit to occurring changes.

Efficiency The capacity of an organization to produce desired results with a minimum expenditure of energy, time, money, personnel, and material.

Innovation Innovation is a process of creation and application of new ideas resulting in the development of goods and services required for the success of an organization.

Job enrichment A way to motivate employees by giving them increased responsibility and variety in their jobs.

Organizational change Specific actions taken by the organization to transform internal structure or other characteristics/policies, apparently in response to environmental conditions and the need to survive and progress in a dynamic scenario.

Organizational learning Refers to the processes in which an organization makes use of information from past events to better adapt to future events.

Thinking organization Organizations which not only focus on acquiring and spreading knowledge but also utilizing it creatively when needed for giving a company a competitive edge.

Introduction

A visionary company doesn't simply balance between idealism and profitability: it seeks to be highly idealistic and highly profitable. A visionary company doesn't simply balance between preserving a tightly held core ideology and stimulating vigorous change and movement; it does both to an extreme. (Jim Collins 2002: 44)

Organizational development can be defined as a long-term effort to improve those aspects of an organization critical to survival and success. Wendell L. French and Cecil Bell's definition of organizational development includes the organization's vision, organizational learning, problem-solving processes, organizational culture, team configurations, and the theory and technology of applied behavioral science.

With the advent of globalization, organizational development can also be defined as an ongoing, systematic process that utilizes behavioral sciences for implementing effective change in an organization and for improving effectiveness. Thus organizational development is both a field of applied behavioral science focused on understanding and managing organizational change and also a field of scientific study and inquiry. It is interdisciplinary in nature and draws on sociology, psychology, and theories of learning and motivation as well as other fields.

Kurt Lewin, who is widely recognized as the founding father of organizational development, stressed organizational change. Following in his footsteps many theorists and practitioners have talked about the need for organizations to change and adapt in order to remain competitive. Another definition which captures the essence of organizational development was coined by Donald D. Warrick who referred to organizational development as a planned, systematic, collaborative, and primarily behavioral science-based process for understanding and changing organizations and improving their present and future health and effectiveness.

Efficiency, Adaptability, and Innovation

Efficiency, adaptability, and innovation are the three important aspects of an effective organization. Efficiency involves doing routine and standardized work in the best possible way. Efficiency was stressed in General Electric under the leadership of its then CEO, Jack Welch. He developed groundbreaking programs – including Six Sigma and Work-Out that helped transform GE into the global benchmark for maximized productivity and labor efficiency. Recently Welch, who is also regarded as father of the 'shareholder value' movement, said the obsession with short-term profits and share price gains that dominated the corporate world for over 20 years was 'a dumb idea.' Efficiency leads to higher productivity and consequently to higher profits, but the result is short-term benefits if it is not coupled with adaptability and innovation.

Adaptability is learning and being open to ways of changing routine and standardized job, in response to changes in the environment. Most organizations' response to change is 'reactive,' that is, after the change has occurred they take steps to adapt to it. To be effective it is vital that organizations be proactive rather than reactive and adapt to changes they foresee. Organizations must constantly check their environment, pick up cues, and anticipate problems and opportunities. They must recognize the influence of future markets, governmental policies, technological opportunities, competitor strategies, and a wide array of influencing factors. Organizations which are flexible, solution-oriented, and adapt quickly to changing conditions, not only survive but even flourish during turbulent economic times as their leaders capitalize on opportunities.

Finally innovation is dependent on the creativity of both individuals and teams, and must be an ongoing process. In some highly competitive fields such as technology; innovation is the first rule for survival. Creativity is considered to be the process by which new and competitive ideas are generated. Thus it is the foundation for efficiency and adaptability as well as innovation.

Creativity and Organizational Development: A Reciprocal Relationship

A creative organization is any business entity in which creativity is an integral part, affecting every aspect of the organization, and there is an ongoing and constant flow of novel ideas and innovative processes. Organizational creativity thus combines the two constructs of creativity and organizational development. In order to understand the essence of organizational creativity it is pertinent to understand the relationship between these two constructs (see Figure 1).

In the corporate setting practitioners have observed that organizational development and creativity have a reciprocal relationship. On the other hand organizational development can nurture or kill creativity at the workplace based on an organization's approach to creativity. Warren Bennis said:

There are two ways of being creative. One can sing and dance. Or one can create an environment in which singers and dancers flourish.

Thus organizations can create an environment in which creativity can flourish.

The Organizational Environment: Nurturing Creativity

In 2008 Jing Zhou and Christina Shalley examined theoretical frameworks which have focused not only on the contextual factors and antecedents of creativity, but also on factors enhancing or constraining creativity at the individual, group, and organizational level. Teresa Amabile proposed and tested a componential model of creativity which focused on domain and creativity skills as well as motivation. This model will be discussed in the next section. Richard Woodman, John Sawyer, and Ricky Griffin suggested an interactionist model of creativity (which was an extension of the model developed by Richard Woodman and Lyle Schoenfeldt). They found that creativity is affected by the interaction of (a) organizational or environmental factors; (b) groups (factors such as group composition,



Figure 1 Creativity and organizational development: A reciprocal relationship.

characteristics; and processes); and (c) individual factors (such as cognitive style/ability, personality, knowledge, and intrinsic motivation). Organization development activities influence the interactions of employees in vital areas including formal and informal teams, work ethics, characteristics of the job, culture and climate, and organizational structure.

Researchers identified organizational factors that impact the level of creativity in an organization. On the left side of Figure 2 are some of the key organizational factors (organizational climate, culture, structure, and policies) that can enhance or restrain creativity. Job autonomy and enrichment are determined by organizational policies and hence are factors governed by the organization. Discussing all organizational factors is beyond the scope of this article – interested readers are invited to look through the further reading suggestions.

Organizational Climate and Culture

Organizational climate refers to conditions that encourage or hampers employees' creative efforts. Climate may be broadly defined as the shared perception among employees of the organizational environment which they deal with every day. There is a rich interplay between organizational climate forces (structures, procedures, rules, and policies) and personal psychological forces (thoughts, fears; desires). To nurture creativity, the organizational climate needs to allow room for these forces to have a positive effect on employees. For example, the rules and policies should be flexible and lenient to allow employee risk-taking since the process of creativity often results in mistakes and false starts. Organizational leaders can encourage employees by letting them know that they are open to a little disorder or messiness in creative projects.

Organizational culture encompasses broader normative structures that shape employees' assumptions about appropriate or desirable behavior. Every organization has a unique culture; it may be weak (no specific cues) or dominant (clear signs of favorable and unfavorable behavior), but it sends a message to its employees.

Some companies like 3M are famous for their creative culture. At 3M, employees are allowed to spend as much as 15% of their time on their pet projects so they can be researched and developed. For example, the Post-It Note was developed by 3M because the company had allowed its inventor – Arthur Fry – to spend time working on the concept. When CEO Jim McNerney introduced the Six Sigma mindset, he unintentionally displaced the creative culture needed to innovate. To continue its 100-plus year history as the corporate innovator, present CEO George Buckley changed the focus from Six Sigma to more innovative breakthroughs restoring an environment where the creative juices can flow freely.

Organizational Structure and Policies

Organizational structure and policies play a vital role in affecting other organizational variables such as climate, culture, job structure, etc. Many companies have changed from a traditional hierarchical structure, where power was centralized in the hands of few, to a flat structure, where the employees are empowered and participative decision making is encouraged. In 2008, Shalley outlined the organizational supports for

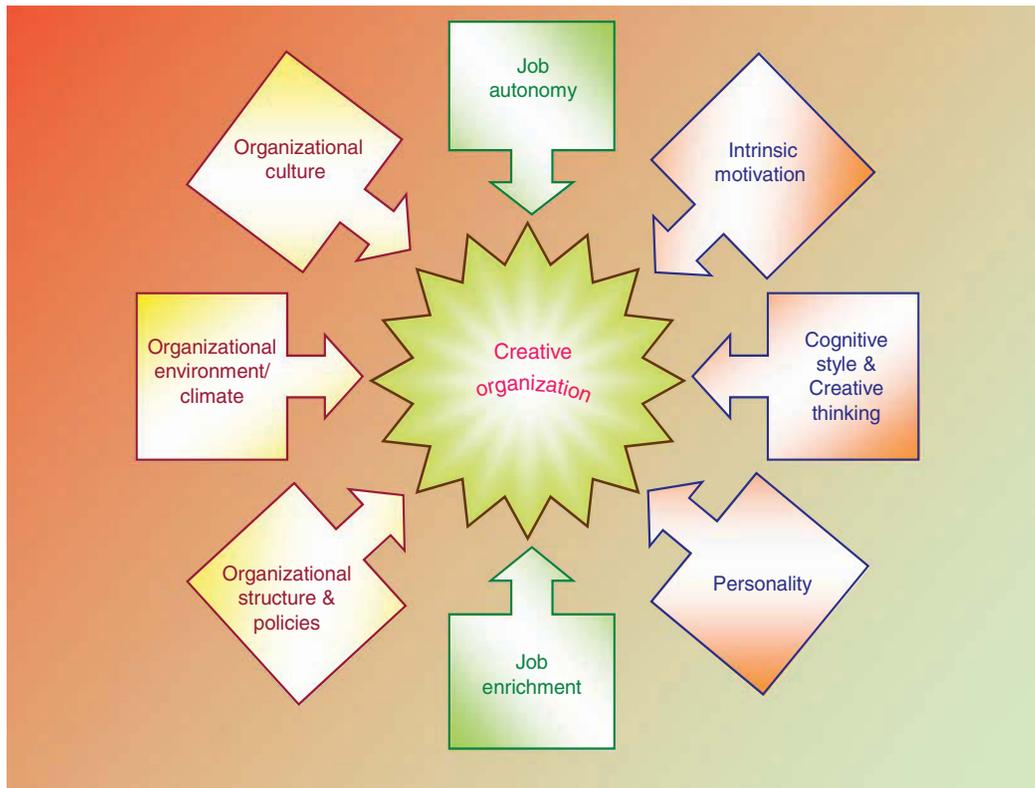


Figure 2 Organizational and individual factors contributing a creative organization.

creativity. Those included providing supervisors who model and encourage creative work and self-efficacy, an atmosphere where employees feel nurtured, and appropriate compensation packages and recognition.

Job Autonomy and Enrichment

Job autonomy refers to extended freedom at work including the power to make decisions and a feeling of responsibility for the job. When supervisors behave in a noncontrolling fashion they are empowering their employees and giving them more autonomy in their job. Greg Oldham and Anne Cummings found that employees produced the most creative work when they had appropriate creativity-relevant characteristics, worked on complex challenging jobs, and were supervised in a supportive and noncontrolling fashion.

The following example illustrates the importance of job autonomy. While working with the anthropologist Margaret Mead during the Second World War, Kurt Lewin was asked to help reduce civilian consumption of rationed foods, mainly meat. Even though traditional meats were scarce, families resisted trying nonscarce meats such as beef hearts, sweetbreads, and kidneys. Knowing that housewives were the shoppers and preparers of food, Lewin reasoned that if they were provided with new information and allowed to participate in deciding what to do, they would be more likely to change their shopping habits and prepare meals with nonscarce meats. To test his hypothesis, Lewin set up a controlled experiment with several groups of housewives. In one group, a nutrition expert lectured the group on the facts as well as the benefits of

cooking and consuming the nonscarce meats. In other groups, women were given the facts and asked to discuss and create their own meal plans. While 3% of the lecture group served nonscarce meats, 32% of the 'discuss and decide ourselves' group prepared the meats for their families. The latter group of women were given more autonomy; consequently they participated more and felt more responsible for their actions.

Job autonomy can be considered as a part of job enrichment which is a way to motivate employees by giving them increased responsibility and variety in their jobs. There are essentially five areas that are assumed to affect an individual employee's motivation and job performance: skill variety, task identity, task significance, autonomy, and feedback. Job enrichment involves addressing each of these areas in a positive way and therefore develops employee motivation and personal satisfaction.

The objective of job enrichment is to make the job challenging thereby enabling the employee to tap their potential and get the best out of them. Teresa Amabile stated that matching creative employees to assignments, based on their skills and interests, augments their motivation toward work and consequently favors creativity. Organizations can boost their employees' internal drive by helping them perceive projects as a new creative challenge.

The Employee: Source of Creativity

Today most CEOs and top leaders echo the belief followed by companies such as Southwest Airlines that employees are their

most valued asset. Southwest rose from being a small company to one of the largest in the airline industry even though it had the same airplanes as its competitors. The company had a very motivated staff that was encouraged by management to interact freely with customers and consistently rated among the highest in on-time performance and customer satisfaction.

Teresa Amabile's componential model of creativity posits that there are three key components of creativity: domain-relevant skills – which relates to the expertise in the given field; creativity relevant processes – knowledge about appropriate strategies, cognitive and work styles required for creative idea production; and task motivation – attitude toward task and perception of motivation. She found that while formal and informal education affected domain-relevant skills, training considerably helped to enhance creativity relevant skills. Following is a brief discussion of three important factors – intrinsic motivation, cognitive style, and personality (see Figure 2).

Intrinsic Motivation

Amabile defined intrinsic motivation as:

the motivation to engage in activity solely for the enjoyment, challenge, or personal satisfaction that arises from the activity itself. (1999, vol. 2: 251)

Intrinsically motivated employees are doing work that satisfies their personal needs and appropriately challenges them.

Supervisors can encourage motivation through goal setting. When workers were assigned both creative and productive goals rather than only productive goals, their creative performance increased.

Cognitive Style and Creative Thinking

Cognitive style refers to the manner in which we characteristically process information so it plays a role in creativity, problem solving, and decision making. Michael Kirton's Adaption-Innovation theory defined two types of managers based on his research. Adaptive style managers were able to initiate change but were unable to identify opportunities outside the system. Innovative style managers generated ideas that led to more radical change, but failed in getting their radical ideas accepted. The literature on creativity has concentrated on describing innovators but Kirton believes that adaptors possess equal levels of creative potential. Specifically it is the innovative creativity that breaks down old paradigms and creates new ones, while it is the adaptive creativity that improvises on the current paradigm. Hence effective organizations innovate and adapt.

Personality

Gregory Feist discussed the fact that both personality psychology and creativity focus on the uniqueness of an individual:

The essence of a creative person is the uniqueness of his or her ideas and behavior, whereas *personality psychology* is the study of what makes a person unique from others (i.e., individual differences). Both disciplines also focus on the consistency and stability – or lack thereof – of such uniqueness. (1998: 290)

The bulk of research on creativity over the years has emphasized various characteristics of individuals successful in creative endeavors suggesting a profile for creative individuals. Feist said that the research:

... makes a rather convincing case that creative people behave consistently over time and situation and in ways that distinguish them from others. It is safe to say that in general a 'creative personality' does exist and personality dispositions do regularly and predictably relate to creative achievement (1998: 304)

Creative individuals varying in age and working in different fields have been found to share common characteristics.

Harrison Gough's 30-item Creative Personality Scale gave insight into problem solving approaches, recognizing divergent information, possessing self-confidence, and tolerance for ambiguity. Openness to experience, reflecting characteristics such as imaginativeness, curiosity, originality, and broad-mindedness, has the most empirical support as being closely related to creativity. Openness to experience facilitates multiple perspectives building interest in the task itself. Strong self-efficacy, one's perceived capability for performing a specific task is also an important requirement for creativity. This ability influences performance through the adept use of inventiveness and resourcefulness. Although traits are inherent, if the culture of an organization is such that it is open and encouraging, to new ideas, some employees may become more open-minded and creative.

Conclusion

Creativity should be an integral part of an organization's everyday experiences. An important aspect of organizational creativity is organizational learning – processes in which an organization makes use of information from past events to better adapt to future events. Min Basadur suggested that organizations should go beyond being a learning and knowledge sharing organizations – they should strive to be 'thinking organizations' which not only focus on acquiring and spreading knowledge but also utilizing it creatively to gain a competitive edge.

In a borderless world, where change is constant, organizational creativity is vital for survival. Today's employees can be tomorrow's creative thinkers if organizations ensure that they nurture creativity at the workplace by providing an environment that nurtures and encourages creativity.

See also: Creativity Training; Innovation; Socio-Economic Status and Performance on Creativity Tests; Teams.

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- <http://www.odnetwork.org/aboutod/index.php> – Organization Development Network - What is Organization Development?
- <http://www.odportal.com/> – Organizational Development Portal.

Overexcitabilities

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Glossary

Developmental potential Innate endowment composed of talents, intelligence, overexcitabilities, and the capacity for inner transformation.

Overexcitability An innate tendency to respond with heightened intensity and sensitivity to intellectual, emotional, and other stimuli. Also called psychic overexcitability.

Theory of positive disintegration A theory of personality development proposed by K. Dabrowski. Development is viewed not as a stage-wise progression through the lifespan,

but as inner transformation powered by the tension between the higher and the lower, the good and the bad, experienced within the self. Inner seeking, figuring out the world, questioning the meaning of human existence, experiencing anguish, testing one's values and ideals, growing in empathy and understanding of others constitute human development characterized by reflection, self-evaluation, and the urge for inner transformation. The theory emphasizes the role of inner conflict, moral sensitivity, compassion, and self-judgment in personal growth of creative people and spiritual seekers.

The Concept of Overexcitability and Its Origin

In 1937, the Polish psychologist and psychiatrist Kazimierz Dabrowski published a monograph entitled 'Psychological Bases of Self-Mutilation.' Examining clinical cases of gifted and talented youngsters and biographies of creators, such as Michelangelo, Dostoevski, Tolstoy, and Nietzsche, Dabrowski pointed to clashes of opposing tendencies that create enormous inner tension resulting in various forms of self-torment. He identified psychic overexcitability as a factor predisposing toward physical self-mutilation and emotional self-torment. This was the initial germ of his theory of positive disintegration.

Stimulation and stress create tension. When emotional tension becomes unbearable, self-inflicted pain through physical injury to oneself or through emotional self-torture brings release. The stronger the tension, the stronger the need to release it. Dabrowski saw that people prone to self-mutilation were more susceptible to being excited, tense, thrown off balance by their overstimulation and inner turmoil. In other words, they were highly strung and subject to nervousness. At the same time they tended to have a rich inner life.

The ability to sustain intense inner conflict was to Dabrowski a sign of inner strength because rather than injuring others the person injured himself. He observed that an emotional crisis and mental suffering, so great that it could bring on a psychotic episode, at times results in personality integration at a higher level. Consequently, various forms of neuroses and psychoneuroses acquire a positive value as part of the process of inner growth.

Strong overexcitabilities make for rich and vivid experiencing but they also produce a disequilibrating, disorganizing, and disintegrating effect on the self. Disintegration is positive when it fosters emotional growth, hence the name Theory of Positive Disintegration.

Overexcitability is defined by the following characteristics: (a) the reaction exceeds the stimulus, (b) the reaction lasts

much longer than average, (c) the reaction is often not related to the stimulus, and (d) emotional experience is promptly relayed to the sympathetic nervous system (accelerated heart-beat, blushing, trembling, perspiring, headaches).

As Dabrowski kept developing his theory, the five overexcitabilities became components of the concept of *developmental potential*, together with talents, intelligence, and the autonomous factor of inner transformation. It is the potential for emotional development to a higher level such as, for example, self-actualization. In fact, Maslow and Dabrowski began a friendship which was cut short by Maslow's premature death in 1970. The overexcitabilities are ways of experiencing with great intensity, aliveness, vividness, depth and richness in the sensory, intellectual, imaginative, and emotional realms. They are also the means of expressing and transforming emotional tension.

Each form of overexcitability can be looked upon as a mode of being in the world, or as a dimension of mental functioning:

- psychomotor – expressed through movement, restlessness, action, excess of energy seeking an outlet;
- sensual – expressed in love of textures, delight of touch, vision, sound, taste, and also luxuriating in comfort and hedonism;
- intellectual – favors analysis, logic, questioning, the search for truth;
- imaginal – generates analogies and metaphors, inventions, creative problem-solving vivid dreams, imaginary worlds, imagined experience visualized to the point of being 'as real as real';
- emotional – expresses itself in attachments and affectional bonds with others, empathy, the despair of loneliness, the joy of love, the enigma of existence and human responsibility.

Overexcitabilities are modes of personal experience and personal action. Each mode can be viewed as a flow of information in the form of sensations, feelings, experiences, images, ideas, hopes, and desires. The five dimensions are like color

filters or multichannel and interactive dish antennas through which the world is received and felt.

The response is specific to the person's most dominant form, or forms, of overexcitability. For instance, persons characterized by emotional overexcitability when asked what triggers for them the feeling of being incredibly happy, may answer that the love of family and friends moves them to tears, or that the feeling of oneness with all creation makes them ecstatic. If the answer is the speed and excitement of water-skiing, playing a hard game of racquet ball, or racing on a motorcycle to feel its roar, it indicates psychomotor overexcitability. In the latter case, although the question was asked in the emotional dimension (What makes you feel incredibly happy?), the response came in the psychomotor dimension.

These channels can be wide open, narrow, or operating at bare minimum. They are assumed to be part of a person's constitution and to be more or less independent of each other. If more than one of these channels have wide apertures, then the abundance and diversity of feeling, thought, imagery, and sensation will inevitably lead to dissonance, conflict, and tension. Consequently, experience becomes multidimensional – enriching, expanding, and intensifying the individual's emotional development and talent. At times the inner tensions and conflicts can be overwhelming.

The five overexcitabilities, plus specific creative gifts, talents, and abilities constitute the original equipment with which a child enters life. Parental, peer, school, historical, economic, and cultural forces all influence how this original equipment will fare.

Today we can say that individual differences, such as heightened versus average excitability, lie in the speed of information processing, in the developmental experiences that stimulate the brain to grow denser and more efficient neural connections, in the extensiveness of cognitive and other networks, and in the rate of emotional processing by the brain. With current advances in tapping the activity of the living brain, the overexcitabilities could be tested directly by comparing the responses of individuals who score high on a given overexcitability with those who score low.

Measurement and Cross-Cultural Validity

Early research depended on an Overexcitability Questionnaire with 21 open-ended questions. The OEQ-II, a 50-item Likert-scale inventory, has facilitated research and has been translated into a number of languages.

The concept of overexcitability has been shown to have cross-cultural validity in a study carried out by R. Frank Falk and his colleagues. Comparison of overexcitability profiles of American and Venezuelan artists found a close similarity. Comparison of overexcitability profiles of gifted students in Turkey, Taiwan, Spain, Mexico, and the United States showed strikingly similar patterns. Wieslawa Limont has extended this research to creatively gifted students in Poland.

Expressions of Overexcitability in Creative People

The following illustrative examples come from biographies and from overexcitability questionnaires obtained from

writers, poets, musicians, fine artists, film makers, and choreographers.

Psychomotor Overexcitability

Psychomotor overexcitability describes the surplus of energy characteristic of gifted and creative people as well as the funneling of emotional tension into psychomotor forms of expression. As shown in **Table 1**, the heightened energy erupts in speaking rapidly, outward gestures of excitement, intense athletic activity and physical work, the urge to act and to compete. Emotional tension can be funneled into actions that help to discharge it through compulsive talking and chattering, acting on impulse, nervous habits, working compulsively, or acting out destructively. The higher energy level of creative people is readily noticed though it is not universal.

Some creators were highly spirited and energetic when they were young but were not so in their adult years. Chopin did not have a strong constitution to begin with and it was later weakened by tuberculosis. Once she returned from boarding school, the once lively Emily Dickinson gradually became so agoraphobic and fearful of strangers that she never again left her family house. Richard Wagner, Antoine de Saint-Exupéry, Sergei Rachmaninoff, and Thomas Alva Edison are a few examples of the many creators who as children were impetuous, hard to control bundles of energy. Today highly spirited gifted children are often mistakenly labeled as hyperactive or having Attention Deficit/Hyperactivity Disorder (ADHD).

Saint-Exupéry as a boy was wild and fearless, fond of violent games in which he tyrannized over others. Edison was always getting into scrapes because of his inquisitiveness. One day, he attached wires to two large cats and then attempted to rub them vigorously to produce static electricity. The scratches and claw marks he got were deep. Rachmaninoff's favorite sport was to jump on and off horse-driven streetcars in motion, even in winter on icy pavement.

In response to the question 'How do you act when you get excited?' a poet in Jane Piirto's study of writers said "I wave my hands, stumble over my tongue & yak at hyperspeed «until my lips are ready to fly off»." A dancer said: "I feel the most energy in the a.m. Or during or immediately following dancing. I try to 'stay with it,' ride the wave as long as it lasts." The question 'What kind of physical activity gives you the most satisfaction?' evoked this response from a young actress: "Swimming but most of all water skiing. It's the most exhilarating sport I've done – the feeling of movement, water and wind against my body all at once." These examples illustrate high energy that finds ways to be discharged physically.

Sensual Overexcitability

Sensual overexcitability intensifies and enhances the delights offered through seeing, smelling, tasting, touching, hearing, sex, or any combination thereof in multisensory experiences. Persons so endowed immerse themselves in the delight of beautiful things, sounds of nature, sounds of words and music; they note the form, color, balance, and texture in anything around them. Specific aversions to certain tastes, smells, or touch and the like, are also common. Sensual pleasure tends to be relaxing and temporarily satisfying.

Table 1 Forms and expressions of overexcitability

PSYCHOMOTOR	
<i>Surplus of energy</i>	Rapid speech, moving when excited, love of fast games and sports, energy to do things (e.g., organizing), competitiveness
<i>Psychomotor expression of emotional tension</i>	Compulsive talking and chattering, acting impulsively, nervous habits (tics, nail biting), workaholism, acting out
SENSUAL	
<i>Enhanced sensory and esthetic pleasure</i>	Seeing, smelling, tasting, touching, hearing, and sex; delight in beautiful objects, beautiful people, sounds of words, music, form, color, balance
<i>Sensual expression of emotional tension</i>	Release through overeating, shopping for pleasure, sex, wanting to be admired
INTELLECTUAL	
<i>Intensified activity of the mind</i>	Thirst for knowledge, curiosity, sustained concentration, avid reading; keen observation, detailed visual recall, detailed planning; passion for precision
<i>Passion for probing questions and problem solving</i>	Search for truth and understanding; forming new ideas; tenacity in problem-solving
<i>Reflective thought</i>	Thinking about thinking, love of theory and analysis, preoccupation with logic, moral thinking, introspection (but without self-judgment), independence of thought (at times highly critical)
IMAGINATIONAL	
<i>Free play of the imagination</i>	Frequent use of image and metaphor, facility for invention and fantasy, facility for detailed visualization, poetic and dramatic perception, animistic and magical thinking
<i>Immersion in the world of imagination</i>	Predilection for magic and fantasy, creation of imaginary worlds, multiple imaginary companions; dramatization
<i>Spontaneous imagery as an expression of emotional tension</i>	Mixing truth and fiction, elaborate dreams or nightmares, illusions, persistence of imagery
<i>Low tolerance of boredom</i>	Need for novelty and variety
EMOTIONAL	
<i>Feelings and emotions intensified</i>	Extremes of emotion: positive and negative, awareness of a wide range of feelings, complex emotions and feelings, identification with the feelings of others
<i>Strong somatic expressions</i>	Tense stomach, sinking heart, blushing, flushing, pounding heart, sweaty palms
<i>Strong affective expressions</i>	Timidity, shyness (inhibition); enthusiasm, ecstasy, euphoria, pride; strong emotional memory; feelings of unreality, fears and anxieties, feelings of guilt, concern with death, depressive and suicidal thoughts
<i>Capacity for strong attachments, deep relationships</i>	Strong emotional ties to persons, animals, trees, plants, places; difficulty adjusting to new environments; compassion, responsiveness to others, sensitivity in relationships; loneliness;
<i>Inner dialog and self-judgment</i>	Dispassioned self-evaluation, taking steps toward becoming a better person

In contrast, when emotional tension is diverted to the sensual channel it may become excess in eating, smoking, shopping, sex, and a constant desire to be admired. For example Tchaikovsky began smoking for the pleasure it gave him but soon found that it pacified his high strung nerves – sensual pleasure that offered reduction of emotional tension.

Painters smell paint, feel the texture of their material, feel the brush strokes in a painting, just as potters feel the clay being molded in their hands, with heightened sensibility in their whole physical being. Many poets are acutely sensitive to the sound of words and their rhythms, the touch of paper, and the look of print fonts. Musicians are supremely aware of

timbres of instruments and the distinct color and timbres of voices, sounds of nature, and of their everyday surroundings (e.g., John Cage).

Chopin's description of Henriette Sontag's singing – one of the greatest sopranos of the early nineteenth century – is extremely sensual: "You feel as if she was blowing at you perfumes of the freshest flowers and caressing you with the delicious pleasures of her voice, but she rarely moves one to tears." Chopin is making a distinction between a purely sensual delight and sensuousness that also is deeply moving emotionally. Charles Darwin derived such intense pleasure from listening to music that his "backbone would sometimes shiver."

Intellectual Overexcitability

Thirst for knowledge, curiosity, capacity for concentration, and sustained intellectual effort, avid reading as well as precision in observation, recall, and careful planning describe a mind operating at a high level of intensity. Habitual or relentless inquisitiveness, questioning, puzzling over things, is one of the distinct characteristics of intellectual overexcitability. The person is driven to seek understanding and truth. Perceiving patterns and relationships, solving problems, finding it difficult to let go of a problem, and finding new problems to solve is typical. Another trait is reflective thought, watching one's own thought processes, delighting in analysis, theoretical work, and logic. On a more personal level we encounter moral thinking, introspection, and reliance on intuition. People strong in intellectual overexcitability are forceful thinkers and often highly critical of the shortcomings in the thought of others.

Intellectual overexcitability is not the exclusive prerogative of scientists and philosophers, but is also characteristic of artists and creative people in all domains. The more original an artist's work was judged by experts the more facility the artist had for asking questions. The Allport–Vernon–Lindzey Study of Values similarly defines 'theoretical value' as an interest in and pursuit of truth, a desire to gain knowledge, systematize it, and bring order to it.

Darwin described his curiosity, concentration, and the thrill of learning a logical principle. As a youth, he had much zeal for whatever interested him, and took keen pleasure in understanding any complex subject. Taught Euclid by a private tutor, he felt intense satisfaction from working the clear geometrical proofs. He remembered vividly the delight when his uncle (the father of Francis Galton) explained to him the principle of the vernier of a barometer.

In his autobiography, *Ex-Prodigy: My Childhood and Youth*, Norbert Wiener stressed that he was motivated by the ideal of service to truth rather than service to humanity even though his father exerted a strong moral influence on him to serve humanity. Wiener also described how when working on a problem "the unresolved ideas were a positive torture to me until I had finally written them down and got them out of my system." The excerpts from Darwin and Wiener show the crucial involvement of emotion in learning and solving problems.

These examples demonstrate several aspects of intensified activity of the mind that lead to ever more probing questions and search for understanding, shared by scientists and artists

alike though their questions and methods of inquiry may be quite different. There is a strong emotional component in the process.

Imaginational Overexcitability

The role of imagination in creativity is well documented. As a broad personal characteristic the concept of imaginational overexcitability looks at the creator's underlying predisposition, manifested in childhood, to engage in free play of the imagination, to fantasize and daydream, to generate unusual associations. The ability to convert experience into imagery depends on an exceptional ability to see analogies. For instance, Saint-Exupéry as a boy acted as a sunset caretaker when he explained: "Here are the chests where I lay dying sunsets to rest." In the *Pastoral Symphony* Beethoven created a visual image with sounds. By means of rapidly descending violin tremolos he conveyed the image of the wind slashing the rain in a storm.

The impulse to explore new possibilities and take what is given to change into something new is ever present. For example, in the film *Amadeus*, after hearing a court composer's piece Mozart goes to the keyboard, begins to play it and then starts to change it to make it more interesting, more dynamic, and forward moving.

Imaginational overexcitability is easily noticed as facility for visualizing elaborate imaginings, perceiving life experiences poetically and dramatically, and in animistic and magical thinking. Animistic thinking involves endowing inanimate objects with personality, character, and will of their own. Magical thinking rests on the conviction that to think something is as good as making it happen. The private rituals and formulas to ensure that everything works out all right are examples of such thinking. The capacity for living in a world of imagination requires that one spend certain amount of time daydreaming, watching movies, reading fairy tales and stories, creating private imaginary worlds, or engaging several imaginary companions in childhood, and sometimes even into adulthood.

Emotional tension is easily diverted into the theater of imagination where feelings and emotions find their form. For understanding one's emotional life finding an image to what is felt is enormously helpful. Words are inadequate and limited, but an image carries the energy and felt quality conveying the meaning of an experience. For people with overexcitability of imagination, spontaneous imagery is as natural as breathing. This does not mean that such persons are not capable of sorting out fantasy from reality. On the contrary, for them the difference is quite enhanced. The boundary may blur when intense emotions take over in a rush of vivid images. Frank Lloyd Wright once imagined that his mother was going to give a party for him. He told his friends in detail what will be served and how special this occasion was going to be. So they came, all dressed up. Wright's mother was surprised, but knowing her son she improvised a party. Because he imagined it, he actually believed the party was going to take place.

Richard Wagner was so fascinated by Beethoven and Shakespeare that he created in his mind a vivid image of each one: "I used to meet them both in ecstatic dreams, saw them, and spoke to them; on awakening I was bathed in tears."

His imagination was so graphic that whenever he thought of ghosts he was terrified. As a boy he visited relatives who lived in a big house. In their stately guest room were old portraits of young ladies "in hooped petticoats and white powdered hair" that seemed to him ghostly apparitions come to life. Every night of his stay he was drenched with perspiration, a victim to his frightening visions.

Absorption and imaginal experience

These examples demonstrate that it is possible to so become absorbed in an imagined experience that it becomes real. Sounds are heard as real sounds, smells are inhaled, tastes are savored, textures and sensations of warmth or cold are felt on one's skin. Auke Tellegen and Gilbert Atkinson examined the degree to which people are open to absorbing and self-altering experiences. They distinguished between reality and fantasy absorption. Involvement in an experience, such as listening to music, or acting out a role, being in character represents reality absorption. In fantasy, or imaginal, absorption the imagined scenes and actions may be experienced as completely real with full engagement of the senses. This ability first appeared to be related to the ability of being hypnotized, but on closer examination it was the ability to be absorbed in the experience that explained hypnotizability. Sheryl Wilson and Theodore Barber found that people with this ability experience their imaginings 'as real as real' or even as more vivid and palpable than the surrounding environment. This work was later confirmed by Steven J. Lynn and Judith W. Rhue.

The sensory cortex of the brain does not distinguish between a vividly imagined experience and one in tangible external reality. For this reason such experiences should not be called imaginary, in the sense of not being real, but *imaginal*, because they are experienced as truly felt. They are not hallucinations because the imaginer retains control over the experience. Nevertheless, strongly imagined experience can create changes in the body such as shivering with cold when watching movies with winter scenes, developing warts when believing being touched by a toad, or having an imaginary pregnancy with all the symptoms of a real one. Obversely, this enables healing by the power of the mind.

Recent reports show that the brain becomes active differently when real memories are recalled than when imaginary memories are recalled. In real memories the sensory areas light up, in imagined memories they do not. But people who report experiencing their visualizations as real, their sensory areas light up equally strongly. In other words, for people capable of full sensory engagement in their imagined experience, the brain does not distinguish between what is experienced when stimulation is external, from internal when it is imagined. Such an experience is not imaginary, meaning unreal, because it is real to the person. For this reason it is called *imaginal*.

Creative people do not tolerate boredom well. They don't enjoy routine and unimaginative practice. As a boy Rachmaninoff took up improvisation because the music he had to study was too dull for him. He told his naive listeners that he was playing Chopin or Mendelssohn and no one realized he was playing his own music. People capable of imaginal experience escape boredom by creating novelty to their own design.

Emotional Overexcitability

Feelings and emotions are frequently at a higher pitch, and the person has a keen awareness and sensitivity to nuances of feeling in oneself and in others. Because the vehicle for emotion is the body, blushing, getting flushed with color, perspiring, trembling, feeling tension in different parts of the body, feeling hot or cold, present psychosomatic signs of overexcitability. Positive as well as negative feelings are experienced with great intensity, openly by extroverts and inwardly by introverts. We live in a culture in which being emotional is criticized and tampered with. Children are often told what they should or should not feel rather than accepting what they do feel. When this happens children with high overexcitability are intensely miserable and confused. Consequently, emotional individuals have a tendency toward depression, suicidal thoughts, feeling of being out of place and not belonging. Feelings of profound alienation, even suicide, are often the result. Ways of recognizing and respecting children's overexcitabilities and protecting their sensitivities are described in *Living with Intensity*.

Highly emotional individuals become strongly attached to people, living things, and places. They experience great difficulties adjusting to a new location and a new environment. To pull up so many roots and strike them in new soil takes up much energy. Adjusting to a new place often takes a long time, or it fails to happen. Hence compassion toward others, their loneliness, and being out of place. Friendships are strong and enduring.

Being emotional often means to judge oneself, to carry on an inner dialog and self-evaluation on how well one does toward others, how well one carries out one's responsibilities toward others. In the first entry of her *Journal of Solitude*, May Sarton wrote: "I feel too much, sense too much, am exhausted by the reverberations after even the simplest conversation. But the deep collision is and has been with my unregenerate, tormenting, and tormented self." Such great intensity of feeling as well as an inner struggle and self-judgment used to be viewed as mental disturbance. Now they are understood to be essential to inner growth. The sculptor Malvina Hoffman said: "Language is a clumsy medium to express the pounding surge of intense feeling. . . . Music could drive my blood and suffuse my entire being."

Intensity, passion, and sensitivity to nuances of feeling are expected in creative people in the arts but not in science or mathematics. Herbert Simon, a Nobel Prize winner in economics, said that there was no emotion in his creative process – only hard cognitive work. Simon took for granted his wife's contribution to his emotional well-being and overlooked the obvious fact what drives his work is the powerful emotion of intense interest. Louis Pasteur and Norbert Wiener, to cite just two examples, were deeply emotional and highly sensitive people. Darwin and Einstein also had a strongly emotional aspect to their personalities. The spectrum of emotions and feelings is immense and exceedingly intricate. The portion of the emotional spectrum that is characteristic of each creator is undoubtedly unique.

In his autobiography Darwin made frequent observations on his friendships and their personal importance to him in contrast to his association with scientific colleagues. In

describing people he always noted the emotional impact each person had on him. Recalling his childhood, Darwin confessed to an act of cruelty. He beat a puppy and it troubled his conscience for a long time. "The exact spot where the crime was committed" was engraved in his mind. It was all the more troubling to him because he loved dogs and they often preferred him to their masters. Darwin also recalled that he was more affectionate in his youth when he had many friends among the schoolboys whom he said he loved dearly. When he attended the clinical ward of the hospital as a student some of the cases distressed him and left vivid imprints on his mind. Two surgeries he attended were performed without anesthesia – it was not yet introduced – he could not bear to stay and see them completed.

Einstein said about himself: "I am not much with people, and I'm not a family man. I want my peace." In personal relationships he kept a distance. He concentrated all his energy on solving the riddle of how God created the universe. And yet he was also animated by deep emotions and sensibilities. He was close to his mother and his sister Maja, and to his uncle Căsar Koch. He was deeply honest and abhorred German militarism so strongly that from the age of 15 he sought to give up his German citizenship; he became stateless at 16. Eventually he became a Swiss citizen. He cherished those few with whom he could discuss physics. Einstein said that he suffered nervous conflicts "at the very beginning when the Special Theory of Relativity began to germinate" in him. Similarly Max Planck described the 6 years of his own seminal work on the equilibrium between radiation and matter as 'a process of despair' because the solution was eluding him.

As a boy, Einstein had a great sensitivity to beauty and a deep religiosity. About the age of 12 he came to the conclusion that many Bible stories could not possibly be true. Religion lost its authority. He suspected that all institutional authority was intentionally deceiving the young and lying to them. The resulting emotional crisis made him distrust any authority. Einstein loved music and studied the violin but was making little progress with teachers who stressed mechanical practicing and accuracy without feeling. When he was 13 he fell in love with Mozart's violin sonatas: "The attempts to reproduce, to some extent, their artistic content and their singular grace compelled me to improve my technique . . . I believe, on the whole, that love is a better teacher than sense of duty."

Pasteur as a boy liked to fish but abstained from trapping birds – he couldn't bear to see a wounded bird. The contact with his family and friends was vital to the young Pasteur. Away from home he constantly begged for more frequent and longer letters. Pasteur was also deeply religious and it pained him to see in the practice of religion so much controversy, intolerance, and lack of peace and love.

Wiener's account of his boyhood and youth is very emotional. He remembered his first sweetheart from kindergarten – charmed by her voice he loved to stay close to her. He suffered fears of the dark, injury, violence, and death. The injustice and cruelty suffered by others affected him deeply. He was quite shaken when at the age of 13 he was told that his mother had a second child who died at birth. Realizing that his own family was not immune to tragedy, shattered his sense of security. Lacking religious upbringing he learned the story of Christ's

crucifixion from his Catholic friends. The image of the crown of thorns and of Christ's wounds filled him with pain.

Despite his extraordinary abilities and being radically accelerated in school – Wiener graduated from Tufts College at the age of 14½, spent a year at Cornell, and earned his doctorate at Harvard before he turned 19 – his self-confidence was undercut by his father's demand for perfection. Even worse, his father stated publicly in print that all the boy's accomplishments were due to the training he gave him and none to his abilities. Wiener was devastated; he felt that all his successes were his father's and the failures were his own. He dreaded graduation which forced him to leave the protection of childhood and face adult responsibility for himself. He seriously doubted he could succeed. "My achievement of independence during the year at Cornell had been incalculably retarded by the confused mass of feelings of resentment, despair, and rejection which had followed early in the year upon discovery of my Jewishness."

Studies comparing artists and scientists in regard to emotionality have shown that as a group scientists tend to be less emotional. But this comparison overlooks at least two things. First, the comparison is made of adults. The examples cited make it clear that as children scientists often are emotional and sensitive but later the involvement in research restricts their emotional range – recall Darwin saying that he was more affectionate as a boy. Second, there is a distinct difference in the artists' and the scientists' material. Scientists study phenomena outside themselves which are analyzed, experimented with, and explained in objective terms. And yet the process of working out solutions to problems is often described as despair or torture. The scientist's passion and agony do not enter the final result. Science tends to be seen as an unemotional and objective endeavor. In fact, objectivity is the outcome not of the individual but of the *collective* enterprise of science in which replication of results and confirmation of theories are carried out by different people checking on each other's work. The very substance of art is human subjectivity, the life of feeling to which an artist gives expression. Artists work with the complexities of human emotion and feeling. Before experience can be portrayed and expressed it has to be felt, whether in reality or in imagination.

In some cases emotional overexcitability is expressed negatively. For instance, Wagner was so self-centered that he believed that to be his friend a man had to be totally dedicated to him. Picasso, emotionally equally intense, was not far behind, being destructive in most of his intimate relationships. Somerset Maugham was often cruel to the boys procured for him. To understand what tips the balance toward a negative expression of overexcitability would require a close examination of the person's emotional development.

Conclusion

Overexcitabilities, according to Dabrowski's theory, are fundamental attributes of a creator's makeup. Without them a talent would lack richness and power. The model of developmental potential offers a way of examining the palette of expressions of overexcitability as its spectrum changes from individual to individual. Advances in brain research present the possibility of examining the nature of overexcitabilities directly.

As a property of the nervous system, each overexcitability contributes significantly to the creative process by not only heightening the experience but by making it also more complex, especially when the emotions are engaged as they always are.

Psychomotor overexcitability imparts a high level of energy and drive. Sensual overexcitability contributes a richer and more vivid sensory experience frequently in conjunction with emotional overexcitability. Intellectual intensity generates relentless questioning and searching for truth. Enhanced imagination brings the power to envisage undreamed of possibilities, to create new realities. Emotional overexcitability endows the creator with greater intensity, sensitivity, and complexity of feeling in all dimensions.

Scientists have greater emotional intensity than it is generally believed. We know today that intellectual processes divorced from emotion are ineffectual. Antonio Damasio described cases in which damage in a very small frontal area of the brain disrupted the connection between reasoning and feeling. One patient was perfectly rational on all psychological tests and yet could not bring his reasoning to any practical conclusion. Without feeling he was unable to decide which of two rational alternatives was the better one. It is therefore not surprising that creative scientists show clear evidence of emotional overexcitability, even those who would deny the role of emotion in their cognitive processes.

The problems of science are difficult. The gaps and the contradictions in our knowledge are never obvious, they have to be discovered first before they are solved. The problems of art are also difficult. The artist has to discover what experiences or humanly significant trends need to be expressed. The artist

may be aware of something pushing for expression yet may need years to express it just as a scientist working on a basic problem may go through years of despair and torment before the solution appears.

See also: Ludwig van Beethoven 1770–1827; Pablo Picasso 1881–1973.

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Paradigm Shifts

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Glossary

Conceptual framework or conceptual scheme A set of basic categories, rules, and/or entrenched practices that organize experience, thought, and action; a paradigm (in one sense), a world view or a 'take' on a particular domain of inquiry or activity.

Convergent versus divergent thinking Psychologist J. P. Guilford's distinction of routine thinking, constrained by a set of norms or conventions, from unconventional, imaginative activity that disregards established rules to strike out in new directions. Convergent thinking raises standard questions and produces orthodox answers, while divergent thinking is iconoclastic, 'outside the box.' Brainstorming, free association, and planning retreats are common ways of generating divergent ideas.

Creative innovation A creative product, novel design, or increase of fit to an environment that 'sticks,' that is accepted and employed by a community.

Evolutionary change Slow, incremental change, as in Darwin's theory of biological evolution, in contrast to revolutionary jumps and rapid structural reorganizations, including paradigm shifts. A major issue is whether evolutionary change alone is sufficient to produce genuinely divergent outcomes.

Holism The doctrine that the whole is more than the sum or aggregate of its parts in the sense that the functional relation or structural organization of the parts determines the nature of the whole; and the holistic significance of a part derives from its relation to the other parts – from its place in the organizational structure – rather than from its own intrinsic nature. Holists deny that reductionist, analytic methods are adequate to understand the emergence or transformation of structures and phenomena in complex systems.

Incommensurable paradigms Thomas Kuhn's claim that there is no paradigm-neutral language and no neutral, objective standard against which competing paradigms can be compared. There is much disagreement about what incommensurability is and whether it actually exists in the history of the sciences and other disciplines.

Logic versus rhetoric An old dispute about how to conduct serious inquiry. Logical thinking, in the strict sense, must be clear and must conform to deductive or inductive inference

rules. Rhetoric, as the art of persuasion, is sensitive to context, audience, and our embodiment as emotional beings and makes use of nonlogical tropes or figures such as analogy, metaphor, and simile. Thinkers such as Plato and Descartes considered logic and mathematics to be constitutive of rationality and criticized rhetoric as a sophisticated tool for undermining rational deliberation. By contrast, many theorists today, including Kuhn, consider rhetorical stretching of current modes of thought and practice to be one key to creative imagination. The claim that logical thinking is convergent while rhetorical thinking is divergent is an oversimplification.

Paradigm A model, template, or matrix for making, doing, or evaluating something. For Kuhn a paradigm in the small sense is an 'exemplar' – a successful concrete problem solution that serves as a model for further work in the relevant, mature scientific community. A paradigm in the large sense is a 'disciplinary matrix' – an entrenched point of view and a corresponding set of practices that structure the efforts of such a community to emulate its exemplars. Others have extended the term to designate any organizing framework, major policy, or set of constitutive rules of operation, for example, as used in government or business.

Relativism The view that truth or correctness is relative to a culture, conceptual framework, or individual and that there is no objective way to resolve disagreements. What is true for me may be false for you.

Selectionist models of creativity and innovation:

Undirected variation plus selective retention The type of model discovered by Darwin and employed in his theory of biological evolution. A mechanism of undirected or partially 'blind' variation is coupled to a process of selection of those variants that happen to be favored by the selection criteria in play (e.g., the biological environment) and further coupled to a mechanism that transmits the favored features, to some degree, to the next generation (e.g., genetic inheritance). When the process is iterated over many cycles in an environment with relatively stable selection pressures, adaptive modification is almost inevitable. Today selectionist mechanisms are widely applied in many fields beyond biology, for example, to problem solving by computer. Universal evolutionists assert that selectionist

models are the key to understanding all forms of creativity and innovation, because something creative is basically a novel design and only a selectionist process can explain how more design can emerge from less.

Structuralism Originally the label applied to Ferdinand de Saussure's theory of language as a system of signs in which the linguistic units themselves are arbitrary and get their significance from their complex relations to the other elements in the system. Claude Lévi-Strauss and others extended the idea to the social sciences, literature, architecture, etc., contending that many everyday human activities are explainable by postulating the existence of deep

structures that generate common patterns – cultural genetic codes, so to speak. These deep structures are theorized to vary from culture to culture and from one historical period to another. Since the relations in question are typically rigidly synchronic, critics argue that structuralists are unhistorical and forced to postulate sharp breaks or ruptures in order to handle dynamical change – a charge that has also been leveled at Kuhn. Ontologically, structuralism takes relations seriously: systems of relations among items at one structural level of description constitute new, emergent levels of reality. Today, complexity theorists study networks and their sometimes-sudden transformations.

Paradigm Shifts as a Theory of Creativity

The physics-trained historian and philosopher of science Thomas Kuhn popularized talk of paradigms and paradigm shifts in his controversial 1962 book, *The Structure of Scientific Revolutions*. Paradigm shifts in Kuhn's technical sense are scientific revolutions. In the everyday sense a paradigm is a model or ideal, a standard of comparison, something to be emulated. Like its near synonyms 'archetype,' 'pattern,' 'template,' and 'prototype,' the word 'paradigm' is ambiguous, designating either a particular, concrete item or something more abstract and universal. A particular case may serve as a 'paradigm case.' An artwork or industrial prototype (a particular physical object) may serve as a model for replication. But a paradigm can also be a general type, pattern, template, matrix, or set of rules or specifications that the particular cases exemplify or embody. Since Kuhn regarded himself foremost as a philosopher, this article will emphasize the philosophical background and implications of Kuhn's work, while touching on contributions from other fields; and the focus will be on the early work for which he is best known. After the 1960s Kuhn took surprisingly little notice of the dramatic developments in the cognitive and complexity sciences that might have helped him articulate his position.

Kuhn employed several senses of 'paradigm' to describe and explain the development of mature sciences, that is, sciences such as physics (especially mechanics), chemistry, and evolutionary biology. During most of its history, according to Kuhn, the practitioners of such a science do 'normal science,' that is, science defined and guided by a paradigm. Occasionally, however, a crisis develops and a revolutionary paradigm shift may then occur. This 'paradigm change' language caught on in the politically turbulent 1960s and 1970s and was eventually uncritically extended to signify just about any major change in a policy or practice. The entry 'paradigm shift' appears in William Safire's dictionaries of American politics, and talk about 'breaking the rules' makes good advertising copy. There also have been scientifically serious extensions of Kuhn's work, as in theories of the cognitive development of children by Susan Carey and others. Among creativity theorists, Robert Sternberg's propulsion model (for example) extends Kuhnian insights to cover the range of movements through design space. On the other hand, those psychological and social theorists who believed they could quickly transform their enterprises

into mature, progressive sciences simply by deciding to adopt a paradigm had missed the point, Kuhn said.

The paradigm concept is important to studies of creativity at the personal, community/institutional, theoretical, and policy levels. Problem solving within a paradigm, according to Kuhn, requires conservative, convergent thinking, which other analysts have considered to be routine and hence modestly creative at best; while paradigm change signals bold, divergent thinking. Apparently, then, the best way to achieve creative innovation is to be divergent rather than convergent. A related view is that work within a paradigm is logical whereas paradigm changes involve nonlogical, rule-breaking, rhetorical moves. Some historically important thinkers and institutions have held that rhetoric has no place at all in serious intellectual enterprises. Kuhn challenged all of these received ideas.

Thomas Kuhn's Account of Paradigms and Scientific Creativity

According to Kuhn, an enterprise becomes a mature scientific discipline once it gains a paradigm that makes routine, consensual problem formulation and problem solving possible. The typical historical pattern of development of a mature science (one that has already achieved its initial, discipline-defining and unifying paradigm) is long periods of 'normal science' punctuated by occasional, short periods of 'extraordinary science,' that is, crisis situations that in some cases result in full-scale scientific revolutions. In those rare instances a new paradigm displaces the old and subsequently underwrites a new period of normal science strikingly different from the old one. Normal scientific problems are so well defined and highly constrained that Kuhn labeled them 'puzzles,' by analogy with crossword puzzles. The paradigm not only guarantees that the puzzle is solvable but also points fairly precisely toward its correct solution. Nonetheless, Kuhn insisted that even normal science is creative in its way. Extending the reach of the paradigm demands the best efforts of the brightest people. This is not drudgework. Moreover, disciplined normal science is essential in laying the groundwork for eventual crisis and revolution, for it is normal science's ability to focus on the most esoteric details that eventually produces the anomalies that resist all efforts to bring them into line with the paradigm; whence a crisis ensues.

Normal science involves highly convergent problem solving, whereas a revolution is so divergent that Kuhn introduced the term 'incommensurable' to describe the relation of the new paradigm (or lack thereof) to the old. The new paradigm points the science in a new direction, and work under the two paradigms is not mutually translatable. Since paradigms carry with them their own goals and standards, up to a point, scientists facing a revolutionary divide do not possess a single, coherent set of standards for evaluating the competing claims and practices. Kuhn emphasized that logic plus empirical data are insufficient to determine paradigm choice. (This is the most serious form of the so-called underdetermination problem.) Accordingly, members of the competing paradigm communities often reject each other's work as sloppy, out-of-date, or misguided. ("That's not the way to do good solid state physics!") Reliable signs of incommensurability are systematic communication breakdowns and failures to agree on what is a good problem and what counts as a solution. Lost is the "ease and fullness of communication" among practitioners and their "unanimity of agreement" over correct problem solutions – harmonies normally guaranteed by work within a common paradigm. Paradigm change is cultural change. A revolution splits the once tightly bound community of specialists.

According to Kuhn, revolutionary paradigm changes, although unpredictable, are inevitable, and we cannot expect them to become milder as a field matures and becomes even more tightly wound. This means that the growth of scientific knowledge, that is, scientific progress and scientific creative innovation, is not cumulative – a shocking conclusion that Kuhn claimed to find in his historical research as well as in his epistemological theory. Yesterday's scientific successes may be rejected or ignored today, and today's heretics may become tomorrow's heroes. However, the winners typically rewrite history to make the new paradigm appear to be the natural, rational, objective successor to the old. That, Kuhn wrote, is why paradigm shifts have been invisible to less historically sensitive analysts. (Moreover, the losers often rewrite their own history to make it seem to anticipate the change.) In advancing his controversial model of scientific development, Kuhn himself was attempting to overturn the old view of science as converging on the final truth by using a routine, scientific method. Most commentators agree that he succeeded in his critical aims but remain skeptical of his positive model.

As regards creativity, then, Kuhn seems committed to two varieties. The more modest sort of creativity involves working within a guiding framework that defines the research enterprise in that particular specialty area and thereby makes esoteric research intelligible. The divergent sort generates a new defining framework that sends the field in a different direction.

Educational psychologists from J. P. Guilford on have often operationally defined creativity as divergent thinking, as if divergence is part of the very meaning of 'creativity.' This view contains an important grain of truth; however, Kuhn largely rejected the view that creativity requires divergent thinking – although he would surely agree with psychologists such as Sternberg and Simonton that normal and revolutionary science feature different degrees of creativity. At least in mature, normal science, Kuhn claimed, innovation is normally the product of convergent thinking for the purpose of filling gaps in, and extending, the established paradigm. By contrast, the

human sciences and philosophy are too undisciplined, too divergent, to build consensual structures of theory and practice. They expend too much energy debating fundamental questions. Kuhn's paradox is that, in the mature sciences, convergent research is the most efficient means to divergent results. Convergent research is the fastest way to a revolutionary leap forward, since resistant anomalies can generate crisis and revolution. So divergent and convergent thinking cannot be decoupled in the way that some creativity experts have claimed, at least not in the sciences.

Kuhn's view also contrasts sharply with that of philosopher of science Karl Popper, who argued that the way to speed up scientific progress is to propose bold, conjectural hypotheses and then to criticize them as severely as possible by attempting to refute them. But to heed Popper's call for scientific revolution in perpetuity would have precisely the opposite result, Kuhn replied. It would destroy science as we know it. To label something a revolution only makes sense against a background of disciplined stability, for revolutions destabilize the constitutive framework that defines the activity in the first place. Popper's "critical approach to science and philosophy" is precisely what mature science excludes. For Kuhn a mature science is dogmatic. Mature, normal science shuns criticism of fundamentals and even discourages major innovation as disruptive.

It follows from Kuhn's view that a mature field must also be monolithic: it can possess only a one master paradigm at a time. To be sure, subspecialists within a larger field will work under their own smaller, specific paradigms, but these will articulate pieces of the overarching paradigm. This is a quite different situation from that found in the social and behavioral sciences, in which a large field divides up into loosely organized schools. Kuhn's year spent interacting with eminent social scientists at the Stanford Institute for Advanced Study in the Behavioral Sciences convinced him that social scientists are playing a very different game from that of physicists and chemists. The social sciences, he observed, remain too close to philosophy in inviting constant challenge to fundamentals.

Philosopher of science Imre Lakatos disagreed with Kuhn's monolithic claim, on both descriptive and normative grounds. Historically, the mature sciences have featured major, long-term research programs, he agreed, but usually two or three simultaneously, engaged in a quasi-Popperian competition. In this manner Lakatos attempted to strike a compromise between Popper's scattergun competition of isolated hypotheses and Kuhn's view that a single major research program characterizes each mature discipline. Meanwhile, Paul Feyerabend rejected both Kuhn's and Lakatos's view as too conservative. He advocated a proliferation of divergent theoretical claims ('methodological anarchism'), on the ground that testing one major theory against another is necessary to bring out its hidden empirical content. Kuhn found Feyerabend's celebration of divergent thinking absurdly impractical.

Kuhn's theme of an 'essential tension' between tradition and innovation affords a second perspective on his account of convergent and divergent thinking. Inquiry at the frontier of any creative enterprise involves a tension between convergent and divergent thinking. Every progressive field places a premium on creativity, which implies moving beyond the current frontier; but if a particular move is too divergent, it risks not

being recognized as a serious constructive contribution to that field. Margaret Boden's example is that an attempt to introduce atonal music in the seventeenth century would not have been recognized as music at all. Kuhn himself denied that the arts and humanities are as constrained as the mature sciences (a view since confirmed by extensive historico-psychological researches by Simonton and others). However, the general point seems to hold: insofar as a field permits less constrained contributions, it risks losing the coherence needed to recognize it as a rigorous scientific discipline at all. Esoteric research becomes pointless without a common basis of shared meaning and without a significant potential audience. That is why a crisis period is so traumatic for mature scientists. A full-scale revolution amounts to a culture change with the accompanying culture shock for traditional practitioners. Yet the revolutionaries typically insist that they are rescuing the discipline from crisis in such a way as to preserve its integrity.

Kuhn's account of scientific creativity differs from standard accounts of creativity in two additional ways. First, although highly routinized, Kuhnian normal science is not a rule-based enterprise that follows a 'scientific method.' It is misleading to regard Kuhnian paradigm shifts literally as changes in the rules of the game, although Kuhn himself sometimes employed such metaphors. Second, Kuhn denied that normal science is logical as opposed to rhetorical. He therefore rejected the traditional view, running from Plato down through Descartes and the Royal Society of London in the seventeenth to the twentieth-century logical empiricists, that serious inquiry must shun the corrupting influence of rhetoric and stick to logic. Kuhn was among those who insist that rhetorical tropes such as analogy, metaphor, and simile are crucial to creative conceptual and practical growth. He contended that normal research amounts to solving new puzzles by direct modeling on exemplars; and scientific education involves learning to use the exemplars as reference points in a network of 'learned similarity relations.' A paradigm carries the promise that its set of exemplars is sufficient to guide the process of solving any puzzle that can arise legitimately within that paradigm.

Normal scientists typically solve puzzles by rhetorically morphing the new puzzle and the old solution(s) until a sufficient match is obtained. One striking puzzle-solving genealogy that Kuhn provided begins with Galileo's realizing that a ball rolling down and then up a frictionless inclined plane is analogous to the motion of a point pendulum. Huygens subsequently transformed Galileo's solution of the problem of an idealized point pendulum into a solution of the physical pendulum problem. Decades later Daniel Bernoulli finally solved the apparently very different puzzle of the mechanics of fluid flow from the orifice of a tank. He did this by making his hydrodynamic phenomenon resemble Huygens' physical pendulum. The mechanistic paradigm under which he worked enabled him to see the two phenomena, and hence their mathematical explanation, as analogous. In this manner, a successful normal scientific paradigm integrates a variety of phenomena that don't appear at all similar to the layperson. And the integration is rhetorical rather than purely deductive or inductive, by contrast with the logical empiricist and Popperian conceptions of theoretical structures as deductive logical systems. In this respect, for Kuhn the overall structure of science is as rhetorical as it is logical. And the same is true for

his account of human cognition itself, a theme that Howard Margolis has developed. More recently, theorists such as Ronald Giere, Paul Teller, Nancy Nersessian, Paul Thagard, Hanne Andersen, Peter Barker, and Xiang Chen, building on the work of psychologists such as Eleanor Rosch and Lawrence Barsalou, have developed even more thoroughgoing accounts of the role of models in scientific work.

To sum up, a Kuhnian paradigm change (revolution) has five distinctive features. First, revolution implies successful revolt – overturning the old regime. Hence, a rapid advance, in itself, is not revolutionary. Relatedly, a paradigm shift does not typically result from a massive infusion of new empirical results. Rather, it amounts to a conceptual reorganization of the old materials. (Kuhn pointed out how thought experiments can function to alter basic structural intuitions.) Third, revolutionary overturnings do not occur in a vacuum, with the old regime simply giving way to anarchy. Rather, practitioners must be drawn to a new paradigm that they find more promising. The new one displaces the old, shoving it into the dustbin of history. As economist Joseph Schumpeter famously noted, as did Darwin before him, creative enterprises are also necessarily destructive. Fourth, in any progressive, creative, mature scientific discipline, revolutions are necessary, occasionally, to break free of the prison of the old framework. Fifth, paradigm change is wrenching cultural change that temporarily destroys community solidarity.

Some Questions and Criticisms of Kuhn's Account

Kuhn's model of scientific development has attracted a great deal of attention, both favorable and critical. It kicked off the 'battle of the big systems' that characterized attempts in the 1960s and 1970s to provide comprehensive models of scientific development. Few analysts now pursue this project, given the emphasis in social studies of science on the diversity of the various sciences and their shaping by socio-political and technological context – developments that Kuhn's work also stimulated. Kuhn was accused of relativism and irrationalism and vilified as a debunker of our more progressive institution. Donald Davidson argued that the idea of alternative conceptual schemes is incoherent.

Stephen Toulmin contended that Kuhn remained too close to the logical empiricists in positing an overly rigid and inflexible account of normal science and, as a consequence, was forced to introduce overly revolutionary breakouts from the old framework. Kuhn could claim to find such dramatic ruptures only because he attempted to project in the forward direction of scientific work the intellectual shock he experienced as a novice historian of science when he had to jump back across the centuries to make sense of the physics of Aristotle in comparison with that of Galileo and Newton. Working scientists at the research frontier are opportunistic pragmatists, the criticism runs, not sensitive historians – nor rigorous mathematicians either. Rigorous mathematics is for mathematicians, and history is for historians.

Toulmin, David Hull, and others proposed thoroughgoing evolutionary models of scientific development. Already in the late 1950s, psychologist Donald Campbell had proposed a universal evolution model of creativity, including scientific

advance. Richard Dawkins, Daniel Dennett, and others followed with their own versions. According to universal evolutionists, selectionist mechanisms suffice to explain not only all biological life, wherever in the universe it has arisen, but also all production of novel design, including that of human arts and technologies.

On this account, selectionist processes are the secret to creativity – the key to understanding creativity and innovation of all kinds, albeit a highly abstract or general key. Darwin discovered the power of selectionist mechanisms in the biological and behavioral realms. William James, B. F. Skinner, computer scientist John Holland, and many others since have greatly extended the scope of selectionist models to the degree that they are now routinely used to ‘evolve’ problem solutions on a computer under such labels as ‘evolutionary computation’ and ‘genetic algorithms.’ These variation-selection methods are generally not strictly analogous to biological evolution. The latter is just one (in fact, several) of a large family of selectionist mechanisms. All selectionist mechanisms, however, involve a highly iterated process of somewhat constrained but otherwise undirected variation plus a process of selection of superior variants plus a mechanism for passing the advantageous features, to some degree, to the next generation of variants.

Campbell argues that all innovation, all increases of fit to relevant environment, must, at least, be the product of BVSR: partially blind (undirected) variation plus selective retention of variants that happen to survive in the existing environment upon pain of commitment to providentialism, inductive instructionism, or a mysterious, nonnatural clairvoyance.

The BVSR models sound divergent, but the variation can be so constrained, so local and limited, that it is part of an overall convergent process in Guilford’s sense. In Kuhnian normal science, the variants produced amount to blind trial and error only within whatever search space remains for exploration after the known constraints have narrowed the search considerably.

If something like Kuhnian normal and revolutionary science exist, is an evolutionary account of creativity sufficient to explain both? Here one thinks of Stephen Jay Gould and Niles Eldredge’s account of ‘punctuated equilibrium’ to explain the long periods of stasis in the biological record, interrupted by periods of rapid innovation such as the Cambrian explosion. Complexity theorists such as Stuart Kauffman and Brian Goodwin also maintain that emergent structures that transform complex systems often have a more creative role in the biological world than Darwinian evolution does, a central issue of today’s evolutionary developmental biology (Evo-Devo). If these authors are correct, there are two major sources of emergent novelty, not one. Other complexity theorists such as Per Bak contend that no special explanation is needed for Kuhnian revolutions and other sorts of cascading failures such as mass extinctions, on the grounds that these systems are highly nonlinear. A quite ordinary development can occasionally trigger a major event.

Cognitive Economy: Categories, Sets, Schemas, Frames, etc.

At the most elementary level, it is obvious that we must lump and split into usable categories the ‘bloomin’ buzzin’

confusion’ of world input (as William James called it). Given our cognitive limitations, we cannot track each individual item separately but must organize experience, thought, and action into general kinds of things and standardized types of interactions. We must impose pattern on the world, and we thereby run the risk of stereotyping, or worse. Cognitive sets govern our interaction with the world and with each other, and Kuhn’s paradigms are cognitive sets or conceptual ‘boxes’ writ large.

The idea of a conceptual scheme or framework supported by a complex of cognitive processing rules originated with the philosopher Immanuel Kant (d. 1804), who was also, arguably, the first sophisticated cognitive psychologist. Kant held that all human beings represent their experience of the world in terms of a dozen underlying ‘categories’ plus two ‘forms of intuition’ – space and time – so that we perceptually project the world in terms of physical objects causally interacting with one another in space and time. This was a major improvement on the radical empiricist theories of associationist philosopher-psychologists such as David Hume, for it recognized the need for cognitive rules or regularized processes of some kind to account for the integration and coherence of our perception and thought. For Kant, Newtonian mechanics was the outward projection of our inward processing rules.

The cost of Kant’s ingenious account of cognition and of Newtonian science is that it presents us with the problem of skepticism about our knowledge of the universe. For if the world input must be transformed in various ways so that we can make sense of it, what reason do we then have to believe that ours is the correct representation of the universe as it really is? Isn’t the world as we experience it just a creative fabrication of our own minds or perhaps of our cultures and languages? Kant’s response was to deny that we could know the “things in themselves.” Our best science will always be the science of the world as we humans experience it. While the real world does make a contribution to the content of our experience, the constitutive form of that experience is imposed by the human mind. As Kant put it, the mind does not draw its laws from nature but imposes them on nature. This is one important version of the position known as idealism.

For Kant the system of categories was absolute and unchangeable, innately prewired, so to speak. But once he formulated the idea of a comprehensive conceptual framework, it was not long before the philosopher G. W. F. Hegel introduced the idea of alternative conceptual frameworks. In Hegel’s grand vision, the major epochs of human history are structured by different conceptual frameworks. However, the ultimate source of the frameworks themselves is neither nature nor the human mind but human social life – nurture, not nature – and historians have confirmed that social formations have undergone major historical changes. Thus Hegel postulated a kind of sociological reversal of the received views of mind and world: rather than society at large reflecting the structure of the individual human mind, we individuals acquire our cognitive apparatus from the social milieu into which we are born.

Informed by the deep, German historiographical work of his day, Hegel’s radically historicist position implied a completely new conception of creativity and its generation:

1. The creative projection that we call human experience is not innate but learned from the cultural system into which we are born.
2. Human history itself is radically creative in the sense that major new formations such as the modern nation-state, capitalist economic systems, and conceptions of human nature are not eternal entities but instead come into existence in historical time.
3. The most novel structures are not the product of intelligent human design, however, for such novel designs are beyond the horizon of imagination of people living during the time that those structures emerge. Rather, the latter are the unintended and unconscious consequences of a vastly parallel process of people going about their daily lives.
4. Therefore, people living in different historical periods literally "live in different worlds" of human experience.
5. Hence, there exists no permanent system of representation. Even the self-evident truths of one epoch may not be recognized as such in others.
6. This model, like Darwin's, implies that intelligence is not at all necessary for adaptive creativity. Creativity, and especially creative innovation, has more to do with distributed processes of complex systems.

No one doubts that imagination outruns our rational justification capacities, but Hegel broached the idea that non-conscious processes outrun in creative originality all forms of deliberate human design, even those based on the most active imagination. Later in the nineteenth century, Darwin also dispensed with intelligent design in explaining the emergence of novel biological design from the massively parallel process of natural selection, in which every single organism is a natural biological experiment.

This background provides a larger context within which to locate current discussions of creativity, including Kuhnian paradigm shifts, for Kuhn's paradigm concept owes much to Kant's formal framework of categories. Kuhn's move away from logical empiricism parallels Kant's move away from Hume, also parallels Hegel's subsequent move away from Kant – and raises many of the same difficulties. Kuhn frequently described his conception of science as "Kantian with moveable categories," and his most radical statement of the incommensurability of competing paradigms was that scientists on opposite sides of a paradigm shift "live in different worlds" – worlds historically created by research that constitutes the paradigm and the corresponding education regimen. The implication, from which Kuhn soon retreated somewhat, is that scientific revolutionaries and their followers are creators of new worlds. Kuhnian paradigms are 'moveable' and, in this respect Hegelian, since science students educated within different paradigms will acquire different cognitive programming. Beyond knowing what are the exemplary problems and solutions, this 'knowledge' of the world remains largely tacit, however (an idea that Kuhn apparently borrowed from the physical chemist Michael Polanyi). The programming is not available as an explicit scientific method any more than it was for Kant or Hegel. Present in Kuhn is also the idea that major innovation is largely the unwitting by-product of communities of scientists going about their normal scientific work, thinking that they are providing true descriptions and explanations of the world

while actually producing fuel for the next paradigm debate. For Kuhn there exists no true final theory of the world, since there is any number of ways in which we might successfully construe it. There is no end to future science. Nonetheless, Kuhn denied that he was a relativist and insisted that there is a clear sense in which scientific paradigm shifts represent genuine progress.

Work by francophones Ferdinand de Saussure, Gaston Bachelard, Georges Canguilhem, Claude Lévi-Strauss, Michel Foucault, and others anticipated or paralleled Kuhn's themes. Writing early in the twentieth century, Saussure treated language as a relational system. Particular words are arbitrary. They derive their meaning from their complex web of relations to one another. Change the relations and you change the meaning. The so-called structuralists took up this idea, and we find something similar in Kuhn. Insofar as the meaning of scientific terms is constituted by a relational system, a systemic reorganization alters meaning and thus, after all, injects new content of one sort into a Kuhnian paradigm.

Bachelard and Canguilhem held that the underlying organizational structures occasionally rupture to produce new forms of scientific life, and Foucault introduced large discursive formations or *epistèmes* that demarcated historical periods in terms of constellations of thought and practice far more pervasive than Kuhn's. Recently, Ian Hacking has built on Foucault's insights by promoting the idea of 'historical ontology,' according to which the conceptual grids of thought and practice that we lay down bring into existence a host of entities such as statistical averages, population cohorts, and diseases that did not exist before. Scientists themselves create many features of the reality that they study!

Recent work on the history of logical empiricism has revealed the surprisingly strong neo-Kantian influence even in that movement, calling into question the received view that it was simply old empiricist wine in new logical bottles. Particularly Hans Reichenbach and Rudolf Carnap anticipated Kuhn's conclusion that the science of a given period is underlain by an *a priori* structure of a sort. Michael Friedman terms this a "historically relative but constitutive *a priori*." He strongly defends one use that Kant made of the *a priori*, arguing that disciplined inquiry requires a stable framework or constitutive intellectual grid on which to operate. Friedman ends up accepting the existence of Kuhnian revolutions (although with greater continuity), especially those involving the profound mathematical changes in the history of space-time theories.

In artificial intelligence, too, we find attempts to organize inputs and outputs into larger structures. Schemas, frames, and scripts are three examples of structures postulated to explain how we (or computers) recognize and classify items and situations. There has also been much recent work on case-based and model-based reasoning, in which human beings or computer programs attempt to solve new problems by modeling them on one or more already solved problems stored in a case library, rather than using rules to derive a solution from scratch each time. This seems close to what Kuhn had in mind with his idea of exemplars. American law, business, and medical schools much use of the case method. Critics hold that human beings as well as computers must really be using rules at subconscious levels, for example, rules for finding similar cases. But as the philosopher Ludwig Wittgenstein noted, we must avoid the vicious regress of rules, rules for applying those rules, and so

on. At some point a more direct mechanism must take over. Psychologist Eleanor Rosch and associates have long contended that people recognize birds, chairs, and most everything else not by applying sets of necessary and sufficient rules or definitions of 'bird' and 'chair' but instead by matching the new item to a stored model or prototype. Rules tend to have an all-or-nothing character: something is either a bird or it is not, while human judgment seems to operate with something like a Kuhnian or Roschian similarity metric that admits of degrees of resemblance. Thus we judge a robin to be a more typical bird (and more easily recognized as a bird) than a penguin is, and legal experts judge a new case as resembling one precedent more closely than another. Once again, rhetorical matching and stretching turn out to be as fundamental to cognition as logic is.

Conclusion

The focus of this article is Thomas Kuhn's study of scientific revolutions in the mature sciences, but others have extended the term 'paradigm shift' far beyond Kuhn's intentions, especially to political and business contexts. Although problematic, Kuhn's work on paradigm change challenges previously dominant conceptions of inquiry and creativity by contending that scientific research involves major 'Kantian' framework presuppositions that are not directly testable but instead constitute the very intelligibility of the various fields of specialization. Both 'normal science' and 'revolutionary science' are creative, but in different ways. The article locates Kuhn's ideas in terms of intellectual history and briefly indicates connections of Kuhn's ideas to Darwinian conceptions of creative inquiry and their critics, including recent work in cognitive psychology, artificial intelligence, and complexity theory.

See also: Analogies; Divergent Thinking; Metaphors; Problem Solving.

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Perception and Creativity

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Glossary

Allocentric perception The tendency to perceive nonhuman objects from their own perspective.

Laws of perception Universal, automatic, and inborn principles through which organisms perceive complex stimuli.

Perceptual learning Perceiving complex objects better and better thanks to systematic exposure to them.

Physiognomic perception The tendency to perceive feelings and motion in inanimate objects.

Visual thinking Thinking in images rather than words.

Perception is the process through which people acquire, interpret, and organize information coming from their sensory organs. It starts with sensory registration of the information and ends with construction of mental representations of the perceived object. Perception influences every act of creation because the way people perceive things determines how they think about things. If perception is inventive, it leads to creative thinking, but if it is mundane, the result cannot be especially amazing.

Creative Organization of Perception

Perception is not just passive reception of incoming stimuli, but involves active construction of mental representations. The classic viewpoint, rooted in philosophical associationism and introspective psychology but also typical of lay theories of the human mind, assumes that perceptual experience is the sum of simple, basic sensations, such as sounds, odors, or flashes of light. According to this standpoint, perception of a red square, for instance, amounts to summing up basic sensations of straight lines, angles, and redness. Objects are assumed to be perceived in the same way regardless of external conditions (unless these are extremely difficult or atypical) and notwithstanding internal states of mind (unless the mind is disturbed, as in the case of illusions or hallucinations). Their perception is also regarded as independent of individual differences: all people are supposed to see a red square in the same way, although they may differ in personality, values, life history, culture, and many other dimensions.

The classic view was first questioned by *Gestalt psychology*, particularly Kurt Koffka, Max Wertheimer, and Wolfgang Köhler. According to them, people perceive the world in a holistic way, that is, they see the 'forest before the trees.' The primacy of high-level structures over basic sensations is supposedly possible thanks to the so-called '*laws of perception*,' which are universal, inborn, and automatically triggered by incoming stimuli. For instance, the law of continuity makes people perceive separate elements (e.g., stones) as something more complex (e.g., a road) due to the fact that separate elements are arranged in a way that suggests spatial continuity. The law of similarity makes people perceive a set of objects (e.g., basketball players) as a unity (a team) thanks to their being dressed identically. And the law of closure is responsible for perception

of 'flawed' or 'incomplete' objects as if they were 'fixed,' that is, closer to their ideal representations. For instance, on being exposed to an incomplete circle people still see a circle, although they are aware of its imperfections.

If perception is organized according to Gestalt laws, it must be regarded as creative by nature. In other words, people demonstrate creativity in every act of perception, because they are able to compose complex and holistic mental representations before, if ever, they focus on details. The law of closure seems particularly important from this point of view. A human tendency to 'improve' in the mind objects which, in reality, are not perfect at all takes many different forms, some of which are not entirely perceptual in nature. For instance, an unsolved problem may be perceived as an incomplete figure that needs completion; a decision not made yet may be represented in the mind as something that needs improvement. Therefore, the need for closure postulated by the Gestalt school usually leads to enormous mental transformations, potentially resulting in new and valuable (i.e., creative) products, although if the closure is premature, the results may lack relevance and effectiveness, and thus creativity. Perception of the problem at hand is not synonymous with perception of relatively simple physical objects, in the sense that the former involves not only perceptual but also thinking processes, but the tendency to 'improve in the mind' objects that lack perfection seems very similar in both cases.

A question arises, though, whether this tendency to create complex, holistic representations has different levels of intensity depending on abilities, personality, temperament, and other individual traits. The Gestalt psychologists were not interested in individual differences; rather, they focused on general laws of perception. But if the Gestalt laws are universal, inborn, and therefore stable across individuals, perception may be called creative only in a very specific sense, namely, as a creative 'invention' of nature or evolution, but not from an individual person's point of view. If, on the other hand, these laws are common and universal but acquired through development and therefore much more differentiated among individuals than the Gestalt psychologists would like to admit, we can hypothesize that some persons are more skillful in the creation of holistic perceptual representations than others.

This problem was investigated by Morris Stein who exposed his participants to Rorschach inkblots for different durations, that is, 10, 100, 3000ms, or without any time pressure.

The task was to interpret every inkblot by saying what was shown in a given picture. Participants' interpretations were evaluated for consistency and integrity. Responses with some central organizing idea were ranked higher than responses focused on separate details. People who provided consistent and integrated interpretations in the case of very complex inkblots and were able to do so in spite of time pressure obtained particularly high scores. It appeared that the individual scores of integrity of perception correlated very highly ($r = + 0.88$) with peer rated creativity. It seems, then, that even though all people perceive the external world through complex, holistic, and meaningful ideas, some people are particularly good at this task and such people are judged more creative than others.

Physiognomic and Allocentric Perception

The classic view of perception was also questioned by the so-called New Look approach. According to Jerome Bruner, people perceive the external world through their internal states, particularly motivational factors, like needs and goals. For instance, hungry people are set to smell food easily, poor children tend to overestimate the size of coins, and anxious people usually notice signals of threat everywhere in the environment. These effects are first described under the labels of perceptual defense and perceptual sensitivity. Internal states of mind are regarded as essential factors in perception and the interpretation of external events. In general, subjective feelings influence perception to a great extent, particularly if perceived objects show incoherence or ambiguity.

If perception is affected by inner states of mind, mental states can be projected onto external objects. In particular, people can attribute feelings and emotions to non-living creatures, which is called *physiognomic perception*. The term comes from Heinz Werner who defined it as the ability to perceive affect in inanimate things, as well as a tendency to see dynamic movements in normally static objects. For instance, people say that a stone is angry, a book is dancing, or a house is missing its residents. Perceptions of this kind are creative in a sense, because they produce results (i.e., a mental representation of an angry stone, etc.) that are both novel and appropriate. Furthermore, they may lead to eminent creativity if transformed into pieces of art or poetry. Everything depends on the amount of novelty and appropriateness. If it is small, physiognomic perception is just an act of everyday creativity, that is, a kind of potential rather than actual achievement. But if the amount of novelty and appropriateness is large, this phenomenon results in eminent pieces of art.

Physiognomic perception has been demonstrated in experimental studies of creative visual perception. Participants were exposed to a series of drawings representing 'still life.' Exposure time was very short at the beginning of every series (10ms) but was made systematically longer and longer. Participants were asked to interpret the drawings by giving them meanings and titles. The authors were interested in the extent to which these interpretations violated the realistic, usual ways of perceiving objects. As the exposure time was increased, the interpretations became more and more realistic, which makes sense because an object shown for several hundred milliseconds is more

explicit and less ambiguous if compared with the same object shown for a much shorter period. The series would stop when a person used the 'proper' name of the object. The drawings were then presented in a series with systematically decreasing exposure time, which resulted in increasing frequency of idiosyncratic and unusual interpretations. The authors believed that the number of original and idiosyncratic interpretations represents the creative potential of a person.

Psychologists make use of the phenomenon of physiognomic perception in two ways. First, there are attempts to assess individual creativity by means of physiognomic perception ability. The Physiognomic Cue test consists of schematic drawings that may be interpreted in one of two ways suggested to a testee. The first interpretation is commonplace, such as 'sun,' the second is more original and 'physiognomic,' such as 'joy.' People are asked to indicate a preference for one of these two interpretations using a standard Likert scale. Second, physiognomic perception is widely used in creativity enhancement and training. Participants in such training may be asked to attribute feelings to bricks, or to imagine social interactions between pieces of furniture. Such exercises improve creative imagination and creative skills through deliberate manipulation of human perception.

A term very close to physiognomic perception is *allocentric perception*. Ernest Schachtel uses this term in reference to a tendency to perceive nonhuman objects from their own perspective. The opposite tendency, called *autocentric perception*, consists in perception of nonhuman objects from a purely human point of view. For example, the autocentric perception of a laptop computer would concentrate on its functions, the extent to which it is useful or useless for humans, or its potential to be improved as an even better tool for humans. The allocentric perception, on the other hand, would concentrate on the laptop's traits and attributes that surpass its human-centered functions. In other words, in allocentric perception people concentrate on the laptop as such, not on the laptop as a tool. This kind of perception may be difficult in the case of artifacts, that is, objects made by people for some specific purpose. In such cases, autocentric perception looks natural and easy, whereas nature can be perceived in the more allocentric way. According to Schachtel, allocentric perception is a key to creativity, particularly in fine arts.

Visual Thinking

Humans, in opposition to other species, can perceive the external world through images or through words. In consequence, they can think and process information in two modes: verbal and nonverbal. According to Allan Paivio, humans have two mental systems based on separate codes of information processing. The verbal system uses so-called logogens as forms of representation, whereas the nonverbal system is based on representations called imagens. These two systems can cooperate, meaning that a piece of information obtained through the nonverbal channel can be verbalized, while verbal information can be expressed in mental images. However, one of these systems has priority in given situations, which means that sometimes the processes of translation from words to images or vice versa results in error or inadequacy.

The dual coding theory has consequences for creativity. First, the question arises to what extent images can be equivalent to words or vice versa. Rudolf Arnheim is a persuasive advocate for the idea that people can think with images as efficiently as they can with words, if not better. An act of artistic creativity is just an act of thinking and reasoning with images. Artists can solve problems without words because images, not words, are primary components of their thinking. This idea of Arnheim's is close to the Freudian notion of primary processes, which – apart from being impulsive and unconstrained – were assumed to be imaginary in nature. Visual thinking is perhaps vital for artistic creativity and less common in other domains, such as scientific or technological creativity, although introspective data from eminent scientists, including Albert Einstein, do not leave any doubt concerning the importance of mental images in problem solving. The same should be said about literature and poetry; although writers operate with words, they must constantly visualize. The use of metaphor is an interesting example of how verbal and nonverbal codes cooperate in production of something that is called 'figurative language.'

Second, the question can be put whether mere exchange between verbal and nonverbal systems can increase the likelihood of creative outcomes. Conceivably none of these systems is more creative by nature, but their interaction may result in remarkable outputs. The use of metaphor in poetry looks again like a perfect illustration of such an output. Typically, culture relies on words; therefore, the mere change of code to nonverbal must produce original effects. Writing and reading is the dominant mode of cultural exchange and tradition. If the culture were rooted in images rather than words, verbalization instead of visualization would be regarded as a potentially creative action. Arnheim claims that all thinking, not only in artistic creativity, operates on visual representations, and this idea may look exaggerated, but a more moderate idea that creativity is stimulated by exchange between words and images looks acceptable.

Perception and Appreciation of Art

Perception is important not only for production of novel and valuable, or at least appropriate, ideas but also in understanding and appreciating them. Without sensitive and well-prepared audiences, creativity would be useless; one can even doubt if it would appear at all. The problem seems particularly important in the field of art education.

People can be taught how to listen to music or how to appreciate a painting, although 'naïve' and unprepared perception may have the value of fresh, uncontaminated experience. People may prefer listening to a piece of music without too much knowledge about the composer, his or her biography, or the particular musical genre. The same is true of visual arts: sometimes it is better not to know too much about the artist and his or her style of painting. One does not need to know the culinary details in order to be fond of food. However, we should not ignore the fact that knowledge influences the way people perceive pieces of art to an enormous extent.

There are two ways of studying perception in cognitive psychology and cognitive science. The bottom-up approach

to perception underscores the importance of basic sensory processes, deeply rooted in the physiology of vision, hearing, and other senses. The top-down approach to perception underlines the importance of psychological traits and states as factors determining the way objects are perceived. These factors include mental sets, expectations, feelings and emotions, values, abilities, personality traits, and complex models of the world. Any act of perceiving needs both bottom-up and top-down processes, although their proportion may differ depending on the object of perception and the overall context in which it is being perceived. For instance, listening to birds' singing is less dependent on acquired knowledge than listening to human speech, simply because the former does not involve semantics and the latter would be impossible without acquired knowledge of the meaning of words. If a person listening to birds singing is an ornithologist, his or her knowledge may be more important and more influential than in the case of lay listeners. Still, the amount of top-down processes is relatively small if listening to birds is compared with speech comprehension.

Previously acquired knowledge may affect current perception in a negative way. First, it accounts for the perceptual constancy effect. For example, people perceive grass as green regardless of light conditions, although sometimes grass reflects light in a way that produces the color of blue or violet. People know that normally grass is of green color; therefore they usually cannot perceive it as blue or violet. Similarly, they know the actual size and shape of well-known objects and therefore perceive them correctly, regardless of disproportions that may arise from seeing them from a distance or at a specific angle. Perceptual constancy is beneficial in standard situations requiring 'normal,' mundane perception, but it may hinder appreciation and acceptance of particular styles of expression in visual arts. The impressionists painted grass in many different colors, usually not in green. Second, previously acquired knowledge is likely to cause perceptual set. People are likely to see (hear, sense, etc.) what they expect to see, and the opposite is also true – they are unlikely to notice things that they do not expect to exist or appear in the particular circumstances. Perceptual set is so strong that people can swear they did not see objects that were shown to them but did not fit the scene. For instance, if shown a photograph of a professor's study they are sure that they saw many books on the shelves although, as it happened, there were no books whatsoever in this particular photo. They know that professors have many books and this knowledge is likely to disturb reliable perception of a particular image. Such effects, clearly demonstrated in laboratory experiments, influence the way people listen to music or appreciate paintings.

Previously acquired knowledge may also be useful in art understanding and appreciation. First of all, knowledge makes people sensitive to those aspects of a piece of art that are less salient than others but still very important. For instance, listening to a Bach fugue requires at least basic acquaintance with the structure of this particular musical form, that is, the idea of different transformations of the same motive pursuing one another. Moreover, knowledge helps perceive similarities between an object of perception and other objects, and therefore stimulates thinking by analogy.

Perception is influenced not only by explicit knowledge that can be acquired through art education but also by implicit

knowledge rooted in one's own experience. Frequent exposure to a complex stimulus, such as a painting or musical composition, makes people more and more sensitive to many concealed aspects of this stimulus. This is the phenomenon called *perceptual learning*. Typically, people are not aware of being better and better prepared for analysis of a complex structure, because these processes take place automatically. Perceptual learning improves sensitivity to previously concealed aspects of stimulation thanks to attention weighting, imprinting, unitization, and differentiation.

Attention weighting involves a change in the amount of attention paid to different aspects of a stimulus as a result of learning. If people 'inspect' a favorite painting many times, they can learn to direct their attention to those aspects of the painting that were entirely concealed from them at the beginning of the learning process. Imprinting amounts to development of specialized receptors or modules of the mind that can capture previously concealed aspects of a stimulus. Unitization is the process of combining previously separated aspects of stimulation, and differentiation is the opposite – it is the process of dividing what used to be perceived as a whole. These four mechanisms of perceptual learning can produce enormous change in people's sensitivity to various aspects of stimulation. They are particularly important in art education because pieces of art are usually very rich in stimulation.

Repeated exposure to an object results not only in perceptual learning but also in changes in its esthetic appreciation. This phenomenon is called the 'mere exposition' effect. A melody heard for the first time may not be appealing, but it tends to gain artistic value if played repeatedly. Of course, there are limits to such increases in attractiveness, meaning that the melody soon becomes 'worn out.' This is rarely the case with Beethoven's or Bach's compositions, but happens quite frequently with pop music and pop art in general. It seems that high-level creativity is less dependent on the mere exposition effect but also more resistant to depletion of artistic power due to the process of familiarization.

Conclusions

Perception is an ambiguous term. In a broad sense, it refers to every instance of mental assimilation of an object, not only physical but also social or symbolic. In this broad sense it is possible to speak of perception of the social climate or perception of US policy around the world. In the narrow, technical sense, perception means construction of mental representations on the basis of sensory processes, mostly auditory and visual. This article focused on the narrow sense of the word. However, perception is important in creativity in the broad sense too. In particular, the way people perceive a problem is of utmost importance for creative problem solving. Inadequate or stereotyped problem perception may result in adoption of inappropriate problem solving strategies or general inability to tackle the difficulty. Although very important, these issues refer to thinking and problem solving rather than perception per se.

See also: Aesthetics and Creativity; Behavioral Approaches to Creativity; Problem Solving.

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Personal Creativity

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Glossary

Discretion Knowing when to be creative and when to be conventional instead.

Intentions Usually a reflection of a value system and may lead to mindful efforts and are thus often apparent in what the person is motivated to do.

Interpretation The result of cognitive processes, and in particular those involved in the construction of meaning.

Personal creativity Original and effective thinking and behavior that may have no social expression and may not lead to manifest product.

Self actualization The highest form of psychological health that allows true spontaneity and the expression of authenticity.

Introduction

Scientific theories are not static. They develop and change. Some things are added, some are refuted and taken away. Hopefully there is progress, which means that a better understanding of ourselves and our world is constructed. What is unique to the sciences is that the methods, standards, and goals are maximally objective.

Creativity studies have adopted objective methods, standards, and goals and have thus become quite scientific. Yet creativity studies are in some ways unique. The topic, creativity, is different from all other human behaviors and potentials, for example, and this translates into unique difficulties for scientific research on the topic. Few other research topics are as unpredictable as creativity. Indeed, creativity is by definition unpredictable because originality is required. If something is original, it is unlike everything that came before it and is therefore unpredictable.

An enormous stride toward scientific respectability was made when J. P. Guilford, President elect of the American Psychological Association, argued so convincingly for empirical studies of creativity. He described creativity as a natural resource and pointed to the pressing need to invest in both its study and its encouragement. He also described various methods for the study of creativity, or at least for the study of creative potential. His own structure of intellect model has proven to be quite useful and, although it has been around for decades, is still cited with regularity. Another large step was taken at the *Institute for Personality Research and Assessment* (IPAR), not long after Guilford's Presidential address in 1949. Objective information about architects, writers, and various other professional groups was collected at IPAR, mostly with reliable personality inventories and tests of cognitive skill and style. In this manner a great deal was learned about domain differences, and all kinds of objective information about those creative professions was reported in the psychological literature.

Personal Creativity and Optimal Objectivity

The theory of personal creativity is much newer than the work at IPAR and those other seminal efforts. It differs from them

because it views the highly objective work to be incomplete. It suggests that we can be too objective about creativity, and if we are, we lose the most important part of creativity, which is in fact personal and is therefore not entirely objective. This may sound like an extreme claim about what is most important but it is based on the fact that personal creativity is required for everyday and ordinary creative problem solving, as well as world class creative achievement. World class creative achievement certainly requires more than personal creativity, including persistence, determination, large and diverse knowledge bases, and social impact, but it starts with the same personal processes that characterize everyday and ordinary creativity. Personal creativity is in that sense a prerequisite to all creativity. This article briefly describes the theory of personal creativity. Since it was developed largely as a response to social and product views of creativity, it begins with a summary of them, to put personal creativity into context.

Product Views of Creativity

Products represent one of the primary strands in creativity studies. The other strands, according to the 4P framework, include process, person, and press (or place). There really are several product strands. One focuses on tangible results of creative work. There is, for example, a detailed 'matrix' for assessing products which can be used with all kinds of things, from chairs to new tools for writing. Robert Weber has also presented detailed analyses of individual products, though his interest seems to be more in invention than in isolating the characteristics of creative products. Inventions certainly represent a good example of creative products. A list of creative products would also include works of art (e.g., paintings), compositions, publications, presentations, performances, copyrights, patents, motion pictures, films, or videos, computer software, 'apps' for cellphones, designs, and video games.

Many of these imply that product research involves only the work of adults, but checklists of productivity have also been used successfully with adolescents. These tend to be used as criteria in studies of predictive validity or longitudinal research. Almost always the score provided by such checklists reflects the quantity of creative work (the number of products, and

perhaps the number of awards and the like as well) rather than their quality. In fact this leads us to the second way that products are used in creativity research. Sometimes the kind of product is entirely disregarded and the issue is on *productivity*. Here the products themselves are not important at all; the only concern is with the count or quantity of things produced. Research using productivity may not even identify the products; it may just analyze some number that represents how many things each participant produced. Not surprisingly, this kind of research is often archival. It may involve an analysis of age, for example, and thus look to encyclopedias or other records to see how many things tend to be produced when the creator is in his or her twenties, in comparison to how many are produced when the creator is in his or her thirties, forties, fifties, and so on. This kind of developmental comparison is interesting, but the connection between productivity and creativity is dubious at best.

Social theories of creativity do not make the same mistake. They take quality into account by examining judgments or attributions of creativity, originality, aesthetic appeal, and effectiveness. Some of this work is still historical, in which case some of the issues mentioned above are still apparent. But sometimes judgments are obtained in experimental research and used as data. Judges in the consensual assessment method, for example, are explicitly asked to rate poems, collages, or the like for creativity, in which case there is still a reliance on the product.

Systems theories of creativity, which are quite popular, assume that attributions by judges are required of all creative work. In the best known systems theory of creativity, an individual produces an original idea, and if its value is recognized (which assumes that the domain and culture value work in that domain), the idea may become known by others working in the field. If it is truly a good idea, it may change the way they think, and thus become part of the shared knowledge base and assumptions of the domain. Individuals entering the domain at that point will therefore be exposed to that idea as a part of the existing dogma, in which case the idea has gone the full cycle, from a person, to the field, to the domain, and then to other individuals. In the extreme view of this kind of systems theory, a creative idea is only creative when it survives the entire system and has interpersonal impact.

There are several problems with product, social, and systems views of creativity. Some are circumvented by the theory of personal creativity. Indeed, the theory of personal creativity was developed in direct response to what was seen as an exaggerated and unrealistic use of products and social attributions and judgments in theories of and research on creativity. Put differently, the theory of personal creativity was proposed to insure that the scientific study of creativity does not go too far in the direction of objectivity. Social and product theories of creativity are highly objective – products can be counted, interrater reliability easily determined – but too often they exclude much of what is most important about creativity.

The most notable problem with product and attributional theories of creativity may be that they focus on the results of creative work – the products that result from creative efforts or the reactions by some audience to the creative person or the products. They dismiss the process used. This is unfortunate because if we really want to understand creativity in a way that will allow its encouragement, the process and underlying

mechanism must be defined. Product and social theories do not allow that. They focus on reactions rather than on creation.

A second problem involves historical shifts and revisions. The basic idea here is that attributions of creativity change. They vary from era to era. This kind of variability indicates that social judgments are unreliable. Indeed, reliability is defined in terms of consistency and stability. How can we rely on social judgments if a person is deemed creative at one point in time but not creative later? Examples of this are easy to find (e.g., Rembrandt). Clearly social judgment is indicative of more than creative talent. It reflects many factors that are extraneous to creative talent (including luck!) and are much more indicative of fame, reputation, impact, and the like.

Defining Personal Creativity

The theory of personal creativity focuses on the individual. No impact or reputation is required, which separates personal creativity from social and systems perspectives. Personal creativity is, on the other hand, congruent with the humanistic view. As exemplified by Carl Rogers and Abraham Maslow, humanistic views of creativity emphasize self-expression and self-actualization and de-emphasize products, attributions, and the like. Both Rogers and Maslow eventually concluded that creativity and self-actualization are inextricable from one another. That suggests a divergence of the theory of personal creativity and the humanistic approach. The latter is tied to a definition of psychological health that is not a part of the former.

Probably more important is that the theory of personal creativity makes precise predictions about the mechanisms that are required for all creative achievements. As implied above, this mechanism is involved not only in children's creativity and the everyday creative problem solving of noneminent persons as they go through their day to day lives. It is the same mechanism that is used by eminent creators as they strive to solve large-scale problems or produce world-shaking work.

Personal creativity involves (a) the construction of original interpretations of experience, (b) the intent to construct and use those interpretations, and (c) the discretion to recognize when to rely on original interpretations and when to rely on rote and conventional thoughts and actions instead. On a behavioral level it is discretion that is necessary for the individual to know when to be creative and when to act in a conventional fashion instead.

The first of these – constructions of interpretations – can be understood by considering how *sensation* differs from *perception*, on a cognitive level. Sensation is entirely dependent on the five sensory systems. Each of these (sight, smell, taste, touch, or hearing) brings experiential data into the cognitive system. The sensory systems do not alter data in any way; they merely detect information and bring it in, where it can then be processed. The information brought into the cognitive system via one of the sensory systems is therefore raw data. At that point the cognitive system can attempt to make sense of it. This is where perception begins. At that point information is analyzed, translated, transformed, considered, compared, and so on. All of this allows the individual to understand his or her experience. The key point is that sensation differs dramatically

from perception in that the first uses only raw data and the second transforms that into meaningful information. The transformation may occur in various ways, but it allows the construction of interpretations. Indeed, an *interpretation* is synonymous with the construction of meaning. That is the process that supports personal creativity. If the construction of meaning – the interpretation – is original and effective, it is creative. It is creative only on a personal level, but it might later be made social or elaborated into some sort of product. At first, it is personal creativity.

The process used to construct interpretations can also be viewed as *assimilation*, as defined by Jean Piaget. It is not the same as adaption, which, for Piaget, also involved accommodation and changes in cognitive structures. In fact, creativity is distinct from adaptation in a number of ways. Creativity can be proactive, for example, while adaption is by definition reactive. Creativity can even be maladaptive, as is suggested by the dark side of creativity and the destructive tendencies of some creative individuals. Assimilation is only one part of adaptation. It is defined as a manipulation of information. It is what is known as a top-down process in the cognitive sciences and is manifested whenever a personal interpretation is constructed. Interpretations are constructed; they are not merely representations of the external world.

None of this implies that all thinking is creative. As we age we develop assumptions, routines, and habits, and much of our behavior depends solely on them. They are not original. Occasionally we do mindfully construct an original interpretation if it is also effective. That is a creative act. We may then elaborate on it, refine it, apply it, and perhaps even share it, and it might eventually make itself known in the form of a product or performance. But at first it is just a new interpretation.

There is research on individual differences in the use of creative interpretations. Gudmund Smith developed a technique to assess interpretative tendencies, or what he calls *percept-genesis*. This technique involves presenting ambiguous figures to individuals and asks them for possible interpretations. Since the stimuli are ambiguous, varied interpretations are possible. Results from several studies confirm that creative persons are able to construct meaning with less information, when the stimuli are more ambiguous. There are age differences, with less creative performances at age 7 and 12. Another drop occurred in middle age. Smith and colleagues have reported good reliability and several kinds of validity in the *Creativity Research Journal*.

Recall here that personal creativity is not identical with self-actualization. Personal creativity is not necessarily tied to sound psychological health, nor is it dependent on the fulfillment of lower level 'needs' as is assumed by humanistic theories. Still, the originality that is expressed by psychotic individuals is not creative. It is not an attempt to understand the world and not intentionally constructed, as is required by personal creativity. As stated above, the original interpretations of experience that contribute to personal creativity are intentional.

Contrarianism, blind nonconformity, and other forms of unconventional behavior are also distinct from creativity. They might lead to originality but they are not at all good indicators of creative talent. Truly creative individuals tend to the unconventional, but the vast majority of them also fit well into society. They are able to do so, even though they have original

insights, because they exercise their *discretion*. They know when to be original and when to fit in. They are not blindly original, out of control in their originality. Frank Barron described it nicely, in 1995, as 'controlled weirdness.' All of this reinforces the idea that creativity is not equivalent to originality, and that sometimes original individuals are not creative.

Enhancement

The fact that discretion is a part of personal creativity suggests a method for enhancement. That is because techniques have been developed to encourage and exercise discretion. These techniques have been used with the hopes of facilitating the development of moral reasoning skills, but since they focus on discretion, there is every reason to believe that they could be adapted to creative thinking as well. If they are effective, individuals should recognize that it is good to be original, but only some of the time. This would parallel the recognition that it is good to fit in, some of the time, or to use the terminology from the research on moral reasoning, it is good to be conventional, some of the time. It is also good to be *postconventional*, which is the most mature level of moral reasoning. Postconventional individuals understand rules and conventions, and to take them into account when making decisions, but they think for themselves. It allows mindful action rather than either blind conformity or blind originality.

Another approach to enhancement emphasizes (a) providing opportunities for self-expression and originality as well as (b) appropriately rewarding and (c) modeling those same two things, self expression and originality. The last of these is especially relevant to personal creativity because modeling has a twofold impact: it provides actual examples of creative behavior, which can be imitated, and it demonstrates that creativity is a valuable thing. It thus communicates appropriate values. These values are critical for intentionality. If individuals do not value creativity, they will not put any effort into being creative, nor try to develop creative skills. They will not invest in their own creativity. They simply will not appreciate it and thus not care about it. But if individuals see the value of creativity, they will try to be creative and try to become more creative. They will appreciate it in others as well. The value of creativity can be communicated via creative models, including parents, teachers, or supervisors.

Conclusions

The most important part of personal creativity is that it is universal. It is not just a part of the creative efforts of ordinary people and everyday actions, but also plays a role in eminent levels of creativity. It does not just describe what an individual does, but it also describes the efforts that precede and are required for socially recognized creativity. Recall here that personal creativity precedes attributions of creativity and the completion of creative products.

A second important part of the theory of personal creativity is that it attempts to get at the actual mechanism that is involved in all creative work. This mechanism is hypothesized as interpretive and assimilatory. Given that everyone can assimilate, this underscores the universal nature of personal

creativity. Admittedly, many people put less and less effort into originality as they age, but that simply means that some people rely more and more on habit and routine as they age and exercise their creative self-expression less and less. With that in mind the practical implications outlined above are especially noteworthy. They offer techniques that may counter the tendency toward habit and routine and encourage discretion and the intention to be creative and to develop creative skills.

See also: Consensual Assessment; The Four Ps of Creativity: Person, Product, Process, and Press; Systems Approach.

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Personality: Autonomy and Independence

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Glossary

Autonomy The inclination to be free from and independent of other people.

Creativity A person's ability to produce new ideas or to display original behaviors that are unique and useful.

Independence The state of being free from other people's influence or control.

Meta-analysis The method of synthesizing the results of existing but relevant empirical studies and calculating an order to generate an overall index of effect size.

Personality A specific person's distinctive behavioral or dispositional qualities and traits that are stable over time.

Introduction

Expanding upon the article by Gregory J. Feist on autonomy and independence in the previous edition of the Encyclopedia of Creativity, this article discusses the relationships among personality, autonomy, and independence. When studying creativity and personality, it is essential to regard the individual as having a set of unique ideas or characteristics. The term 'unique' is central to understanding the creativity and personality of an individual because what matters are the originality of the ideas and the behaviors displayed by the person. Not surprisingly, empirical studies that have been conducted to date on the uniqueness of ideas and personal characteristics have focused on creative individuals.

The interest in creative individuals can be traced back to Plato and Aristotle. However, empirical studies on creativity and creative personality have been mostly conducted since the 1950s. Although, for many years, the concept of creativity has been considered difficult to operationally define, research conducted in the creativity literature over the last 50 years has revealed that originality and usefulness are the two essential traits of creativity. Accordingly, in order for any thought or behavior to be regarded as creative, it must demonstrate both originality and usefulness. In other words, contrary to the predominant belief that originality and creativity could be considered identical or synonymous, it is possible and important to keep these separate. Originality is required for creativity, but creativity requires more than originality. It requires some sort of usefulness.

Rather than reviewing research literature on the characteristics of creative individuals, this article discusses autonomy and independence as the vital qualities of creative personality. They support originality of creative thought and creative behavior. Creative individuals differ from their counterparts in that they frequently express strong desire for being isolated from typical social environments when working on their creative products. That is to say, creative individuals demonstrate considerable tendency to become autonomous and independent of other people. At this point, clarifying the differences among autonomy, independence, and introversion will be helpful in understanding the sections to come.

Independence refers to the actual state of being free from other people's influence or control. Autonomy refers to one's

strong inclination to reach such a state. Introversion, in contrast, refers to one's desire to be away from social interactions that generally occur in a variety of social environments. It is also very important to illuminate the fact that autonomy generally occurs as a result of one's willingness to free him or herself from the psychologically binding influence or constraints of others. Therefore, unlike individuals with typical personality characteristics, creative people express greater interest in autonomy and independence, ultimately leading them to generate original and useful ideas through various creative endeavors. This article discusses the relationship among autonomy, independence, and creative personality.

Developmental Dimensions of Autonomy, Independence, and Creativity

Introversion could be defined as one's desire to be removed from social interactions and be regarded as strongly relevant to autonomy and independence. In keeping with this close relationship, the following sections address some facets of introversion as a personality trait underlying autonomy in individuals.

Neurophysiology of Introversion and Creativity

Hans J. Eysenck, a well-known personality researcher, proposed that every essential dimension of one's personality involves a biological basis. Of these essential dimensions, including extroversion, neuroticism, and psychoticism, the primary emphasis in this section will be placed on the extroversion-introversion dimension. Research on the biological basis of personality has revealed that introvert and extrovert individuals differ remarkably in their physiological reactions to different stimulations. That is, introvert individuals have been found to have lower thresholds for and to be more reactive to stimulation. Moreover, this greater reactivity is evident in the central and autonomic nervous systems of introvert individuals. Research, for example, has reported significant increases in the cortical (electroencephalography - EEG) reactivity, papillary response, heart rate, and skin conductance of introvert individuals when they are exposed to stimuli at a moderate level.

In many respects, there is a strong tendency in creative people to be more introverted than extroverted, with a great number of personality characteristics supporting this trend. Therefore, it would be reasonable to suggest that both creative people and introverts demonstrate the same kind of physiological reactivity to different stimuli. In attempts to explore such a connection, Colin Martindale and his colleagues studied creative individuals and found that there is a higher resting arousal level in creative people. This is, of course, not to say that a simple relationship exists among physiology, introversion, and creativity. Examining the EEG activity during the process of creative problem solving, Colin Martindale and James Armstrong reported that there is a significant difference between creative people and less creative people in terms of the resting cortical arousal levels, with the creative people having higher levels than their less creative peers. At the same time creative individuals have lower cortical arousal levels than less creative individuals during the inspiration stage of creative problem solving. This supports the notion that low cortical arousal is considered to be strongly related with an increase in defocused attention which is among the correlates of creative problem solving.

Birth Order and Creativity

It was first proposed by Francis Galton in the nineteenth century that an individual's personality development is strongly influenced by birth order. Among the researchers and theorists having pursued this idea, Alfred Adler proposed that firstborns, compared to the laterborns, are more likely to have stronger desires and feelings for power and superiority. The impact of birth order on people's personality has been more recently explored by Frank Sulloway in his book entitled *Born to Rebel: Birth Order, Family Dynamics and Creative Lives*. Frank Sulloway draws particular attention to individuals' tendency toward nonconformity, rebelliousness and unconventionality, and asserts that laterborns, compared to the firstborns, have much more inclination to challenge and reject social norms while also demonstrating rebellious and nonconformist behavioral characteristics. Moreover, according to Sulloway, firstborns are more likely to pursue or maintain power for their privileged positions, resist radical and unconventional ideas, have tendency toward power, authority and status quo, and express their creativity through the intellect dimension. On the other hand, laterborns, as opposed to the firstborn individuals, are more likely to react against power and authority, accept radical and original ideas, show greater interests for new experiences and ideas, and express their creativity through the unconventional and nonconformist dimension.

On the contrary, many other researchers who have examined the relationship between creativity and birth order have found that there is an overrepresentation of firstborn individuals among the highly creative people. For example, in her classic study of creative scientists, Ann Roe found that firstborn scientists were overrepresented in her sample. Similarly, a study conducted by Gregory Feist revealed that there was an overrepresentation of firstborn and lastborn individuals among highly creative scientists. Although this is the most apparent contradiction between the results of Sulloway and other researchers regarding the impact of birth order on creativity and personality

characteristics, Sulloway's main focus is on the tendency of creative people for accepting or rejecting new and radical ideas, rather than the influence of birth order on their creativity and inclination toward autonomy and independence.

Personality Traits as the Basis for Autonomy and Creativity

Any discussion of autonomy and creativity must take into consideration several personality traits, including introversion, internal locus of control, intrinsic motivation, self-confidence/arrogance, nonconformity/norm-doubting, desire for solitude, and asocial and antisocial leanings. Conceivably, one reason for the need of such consideration is that these are some of the crucial personality traits contributing to the emergence and subsequent development of one's creativity.

Introversion

Among the consistent findings of the personality literature of artists and scientists, is the tendency toward introversion. An example is found in a classic study concerning scientific creativity: Ann Roe showed that the scientists who are more creative are also more achievement oriented and less affiliative compared to scientists who are less creative. Bernice Eiduson, Jack Chambers, and Ravenna Helson found much the same. Additionally, J. P. Rushton and his colleagues recently found some difference between creative research-oriented psychologists and teaching-oriented psychologists, and suggested that the former group was higher in independence but yet less extraverted than the latter group.

Internal Locus of Control

As with introversion, the internal locus of control offers an important insight into understanding the relationship between autonomy and creativity. In the 1950s, Julian Rotter argues that the locus of control is related to someone's ideas about who or what is the source of reinforcement for someone's own behavior. We see many studies that look to the relationship between creativity and internal locus of control over the last 20 years. According to those studies, it should be appropriate to say that creative people are more internally oriented than less creative people.

Intrinsic Motivation

As a result of being internally oriented, creative people demonstrate a tendency to be intrinsically motivated. According to Teresa Amabile, an individual's intrinsic motivation, as demonstrated through enjoyment, pleasure and satisfaction, could boost the level of his or her creativity. Another characteristic of her theory is that people become less creative if they are motivated by external factors such as evaluation, competition, reward, surveillance, and restricted choice. Even though some of the empirical evidence regarding intrinsic motivation comes from research on children, there are some other studies that look at adults in general and college students in particular. For instance, Amabile experimentally created intrinsic and extrinsic

motivational states using students of English or creative writing. The participants completed a questionnaire based on intrinsic or extrinsic motivational state. After also having a participant group complete a neutral questionnaire, they were asked to write a short haiku-style poem. Professional poets rated these poems on the level of creativity. The poems written by writers in the intrinsic and control groups were more creative than the ones written by extrinsically motivated writers. Amabile argued that creative performance can be increased by reward and competition in education. Given that evaluation, reward, and competition are used as motivators in classroom settings, this argument makes important implications for education. The reason that so many children have test anxiety and do not achieve the desired levels may be considered as the result of pressure coming from that kind of evaluation. In this regard, Amabile's argument may give an idea to educators that they should motivate students by intrinsically motivating conditions.

Mark Runco suggested that in order to motivate a person to be creative, some degree of negative affective state may also be important. In order to create something new and better, someone should be dissatisfied with the current situations. Robert Eisenberger and his colleagues went further and gave the evidence that some kind of rewards can increase the creative performance of children if they can be directed with explicit instruction to be creative. Amabile also argued that intrinsically motivated creative people can be positively motivated by extrinsic factors. Looking at all these results and findings, we can say that relying solely on extrinsic motivation in achieving creativity may weaken it in the absence of intrinsic motivation.

Self-Confidence and Arrogance

Self-confidence and arrogance represent another set of traits that involve internal locus which are related to autonomy. The argument is that people are more confident in terms of expressing their ideas if they do not have to think about others' influence, and most of the time they may even be more superior to others. In our world, where competition is an important factor in achieving success, accomplishment depends highly on the level of dominance, arrogance, and self-confidence of any given person. In this respect, the paper of Raymond Van Zelst and Willard Kerr shows that there is a statistically significant correlation between being productive and describing oneself as 'argumentative,' 'assertive,' and 'self-confident.'

Nonconformity and Norm-Doubting

It is very common that people who demonstrate different traits of creative personality tend to be against social norms. These people are generally regarded as societal misfits. Behaviors seen in those people do not always receive a warm welcome from the remaining part of society. Several studies examining the influence of society and societal pressure on individuals were conducted in the 1960s. For example, Solomon Asch conducted a very simple experiment in which the participant was placed in a group of people who were asked to find out the length of a target line by comparing it to another three lines. The participant was asked to evaluate the length of the target line, which corresponded to only one of those three lines, after

all of the group members had given their judgments. Results revealed that 76% of the participants complied at least once when other group members deliberately had a wrong agreement on the length of the target line.

The results of Asch's study drew the attention of social and personality psychologists. Social psychologists, on the one hand, became strongly interested in the potential reasons leading the 76% of the participants to rely on the group judgment. On the other hand, personality psychologists became more concerned with the factors preventing the 24% of the participants from being influenced by the group judgment. For example, Richard Crutchfield, using Asch's method, examined the same question and found that the decisions of highly creative people in that 24% group were never affected by conditions. According to Crutchfield, this can be explained by "intrinsic, task-involved motivation for creative thinking."

Many artists show great reluctance toward any kinds of group influence. In a sense, they can be defined as a group that questions and challenges the limits of society. The nonconforming and rebellious nature of artists is supported by the empirical literature on personality and artistic creativity. For example, according to the studies conducted by Wallace Hall and Donald MacKinnon, the most creative architects are conflicted, impulsive, nonconformist, rule-doubting, skeptical, independent, and not concerned with obligations or duties.

Solitude, Asociability, and Antisociability

Highly creative individuals are generally characterized as having a strong desire to be isolated from the society in order to avoid the influence of others and environment. In his book entitled *Solitude*, Anthony Storr discussed how people view interpersonal relationships as the only means of happiness, leading them to overlook the importance and necessity of intellectual and creative development. It appears, at this point, to be helpful to distinguish between creative skills and interpersonal skills, with the former necessitating solitude that brings discomfort to many people. But, since creative people actually require solitude to a certain extent, it is not an issue for such people. As Storr says:

Yet some of the people who have contributed most to the enrichment of human experience have contributed little to the welfare of human beings in particular. It can be argued that some of the great thinkers ... were self-centered, alienated, or 'narcissistic'; more preoccupied with what went on in their own minds than with the welfare of other people.

There is also a tendency among creative people to be asocial as well as resistant to the norms of any given culture. For example, through a meta-analysis of the literature on personality and creativity, Gregory Feist found artists to have low scores on the responsibility, socialization, good impression, and achievement via conformance subscales of the California Psychological Inventory that assesses individuals' personality. In addition, they were found to score higher on the Eysenck Personality Questionnaire's psychoticism subscale that comprises a variety of personality traits including aloofness, impulsiveness, coldness, and antisociality. Of the various domains that require high levels of creative ability, artistic creativity has been particularly considered to be

associated with a great deal of personality dispositions that require asocial and antisocial tendencies. Looking specifically at the relationship between artistic creativity and personality, John Drevdahl and Raymond Cattell studied writers, visual artists, and science fiction writers, and found all three groups to have considerably lower scores on the warmth subscale. In the same way, Jacob Getzels and Mihaly Csikszentmihalyi reported that successful art students have significantly low levels of warmth as measured by the Sixteen Personality Factor Questionnaire. Additionally, another study by Gregory Feist on scientific eminence revealed a direct and significant path between eminence and observer-rated hostility as well as an indirect but significant path between eminence and arrogant working style. Finally, according to Hans Eysenck, artists have higher tendency toward aggression, aloofness, tough-mindedness, and egocentric behavior than their non-artist peers.

Conclusion

Research to date has revealed an obvious relationship among creative ability, creative achievement, and various autonomy-oriented personality dispositions. As well, there is a biological basis for the fact that creative individuals have a strong desire to be away from others, giving rise to the ultimate development of autonomy and independence. As a result, it has become clear that the autonomy-oriented personality involves such traits as introversion, intrinsic motivation, nonconformity,

solitude, asocial/antisocial behavior, self-confidence, and internal locus of control, with each nurturing individuals' creative performance to a considerable extent.

See also: Birth Order; Conformity; Motivation; Novelty; Risk-Taking.

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Perspectives

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Glossary

Creative license Analogous to artistic license but not limited to the arts. Behaviorally, the strength and willingness to bend rules, question assumptions, break with tradition, and act in an unconventional fashion in order to insure originality.

Egocentricism Being stuck in one's own perspective; being unable to take another's point of view.

Fixity Occurs when an individual views a problem from one perspective and is unable to break a routine or change perspective.

Incubation Time away from a problem which allows a relaxation of effort and eases shifts of perspective.

Paradigm shifts Dramatic changes in world views and assumptions which occur periodically in the sciences.

Sociocentric thinking The ability to take someone else's point of view. It is a mature capacity; young children are egocentric.

Tactics Intentional efforts to increase originality and creativity.

Introduction

Changes of perspective are related to creativity in many different domains. Many artistic styles develop, for instance, when an artist or group of artists recognizes the need to change the way the world is viewed. The new style, in this sense, presents an alternative perspective.

Dramatic shifts also characterize the sciences. In Thomas Kuhn's well-known model, *normal science* involves the accumulation of factual information, which is collected with theories and methods that reflect a similar perspective of the world. At some point, however, existing theories are found to be inadequate to explain certain observation. A dramatically new perspective results from a paradigm shift. These are dramatic in the sense that they do not merely extend the thinking that came before but instead introduce a completely new way to view the world. Examples include the scientific revolutions of Copernicus, Darwin, and Einstein.

Albert Einstein seemed to have developed some of his most significant insights using thought experiments. He imagined himself riding a beam of light, for example, or on a train moving in the opposite direction to another train. These thought experiments gave Einstein a unique and useful perspective on the relativity of our physical world.

Picasso has often been quoted as saying that he learned to paint only after he remembered how to think like a child. Picasso was well aware of the assumptions and routines adults too often develop. More often than not an adult's perspective will differ from that of a child.

One of the most dramatic changes in literature occurred when Dorothy Richardson and James Joyce developed stream-of-consciousness styles. They shifted the perspective within the novel, away from the observer or third person and to the individual or protagonist.

As I described this in an article on problem finding,

Richardson, author of *Pilgrimage*, seems to have been the first to use stream-of-consciousness in literature. Her insight was that a new perspective in literature was needed. This led her to reorganize her

thinking and writing about the protagonist of *Pilgrimage*, Miriam Henderson. Rather than describing the character and her actions, Richardson began to *take the character's point of view* and describe the 'inner psychic existence and functioning' for the reader. (Runco, 1994: 374)

I am quoting Doris Wallace on this issue of 'inner psychic existence and functioning.' Wallace concluded that the organization and reorganization in Richardson's writing

reflects a type of problem finding, for no one before Richardson saw the need for a new perspective. Wallace also described the history of insights, arguing that they are constructed over a long period of time. This is apparent in the work of Darwin and Richardson, and other creators who had insights only after they considered a problem for a long period of time. (Wallace, 1991)

Perspective Shift as Fundamental to Relation Processes

As this discussion of paradigm shifts may suggest, shifts in perspective, like those of Copernicus, Einstein, and Darwin, can lead to dramatic changes in world views. In this sense the shift is the mechanism which leads to the insight. Shifts of perspective may underlie other processes related to creative work.

Recall here that shifts in perspective may be literal or metaphorical. Consider the tactic (often used in the research and in programs designed to enhance creative potential) to 'stand the problem on its head.' The idea here is to turn the issue upside down – to obtain a different view. Programs sometimes suggest magnifying or minifying a problem. In the former the problem or its representation is enlarged. In the latter the problem or its representation is reduced. Again, this requires a shift of perspective.

Another recommendation for finding creative ideas is to stand back and change one's 'level of analysis.' Related to this is the suggestion to alter the medium being used to represent the problem. Use words instead of numbers or pictures instead of words. There may be several benefits to these changes, but certainly one of them is that a change of perspective is involved.

There are various explanations of the *incubation* that is often tied to creative insight. There may be a preconscious relaxation of constraints, allowing alternatives to be found. Incubation may be effective precisely because it allows one individual to find a new perspective and to break away from an existing viewpoint. Most of us have probably had the experience of taking time away from some difficult problem, only to return and solve the problem easily because we saw something that was obvious after the break (the incubation) that we were overlooking or taking for granted before it.

Mood Swings and Perspective

A large amount of attention has been directed to the affective disorders of creative persons. Typically these are bipolar disorders, which are characterized by mood swings. Such mood swings may be functionally tied to creative work; and here again it is possible to speculate that there are relevant changes of perspective. Put briefly, the mood swing may provide the individual with more than one perspective of his or her own work.

This hypothesis is supported by anecdotal reports by creative persons that they are (a) highly productive but not critical when they are experiencing the mania of a mood swing, and later (b) highly critical – an effective editor so to speak – when they experience the depression which characterizes the opposite extreme and other polarity of the mood swings.

Developmental Trends

Individuals may intentionally change their perspective in order to increase the likelihood of a creative insight. There may, however, be developmental trends in the capacity for shifting perspective. These would suggest that changes of perspective are more difficult for younger individuals and perhaps should not be encouraged early on.

Most obvious here is the tendency for young children to be *egocentric* in the sense that they cannot take someone else's perspective. Only in adolescence do individuals recognize that others hold different perspectives from one's own. To the degree that these general cognitive tendencies relate directly to creative problem solving, we would expect age differences in the capacity for using changes of perspective in a tactical manner to increase one's originality and creativity. This certainly would be consistent with theories of metacognition, with younger children not recognizing that tactics and intentional efforts are necessary for problem solving.

Cognitive and Extracognitive Influences on Shifts of Perspectives

Shifts of perspective require particular cognitive capacities. Some shifts may require visualization or other sensory capacities, as would be the case when the individual literally imagines what another perspective would look like. Higher order abilities are also required. The shift may, for example, take the individual to a hypothetical perspective; and this requires formal operational thinking. The shift may require that the

individual imagine him- or herself in someone else's shoes. That is a special kind of hypothetical reasoning that reflects *sociocentric thinking*. This too is cognitively demanding. Young children, for example, are egocentric rather than sociocentric and unable to shift to someone else's point of view. This is not a matter of choice but is instead a reflection of the maturity (or lack thereof) of the nervous and cognitive systems.

Extracognitive capacities are also required for shifts. Open-mindedness is required, for example, because the individual must acknowledge that there are other possibilities. A courageous attitude may be necessary so the individual is willing to try something new, and perhaps take a risk with it. Ego-strength will certainly be necessary. This provides the confidence to actually use one's personal creative license. Ego-strength may be especially important because creative ideas and insights are often unconventional; and if they are found by shifting perspective, that shift may be away from conventions, norms, traditions, and expectations. It is analogous to what has been called *artistic license* but it may not involve art; hence the term *creative license*.

Beauty is in the Eye of the Beholder: Perspective Differences Influence Judgments of Creativity

To the degree that creativity is a social phenomenon, it is dependent on interpersonal judgments – and these will very likely vary depending on the perspectives held by the different persons involved. As a matter of fact there is a principle in social psychology that predicts that two people will tend to form different hypotheses to explain their actions. The person doing the action will tend to explain it in terms of the immediate environment and context. An observer of the same action will focus his or her explanation on the person involved. This follows from the divergent perspectives of the two individuals. The person doing the action will tend to look away from him- or herself. Their physical perspective will be oriented outward. The observer, on the other hand, will probably see the person doing the action as salient and spend most of the time viewing that actor. This may apply to creative work, and a creator may explain his or her work contextually while an audience will emphasize the creator. The most important point is that discrepant perspectives lead to different opinions.

No wonder that (a) different judges often disagree about the qualities of creative work, or even about the level of creativity in the work, and (b) opinions of creators often differ from those of audiences and judges.

This line of reasoning about interpersonal judgments implies that implicit theories are relevant. Implicit theories are held by parents, teachers, or any group of nonresearchers. Scientists and researchers hold explicit theories, which are explicit in that they are articulated, shared, discussed, presented, published, tested, and so on. But nonresearchers also have stable views of creativity. They are not shared nor articulated, so they are implicit instead of explicit. They are quite important since they can lead to the expectations that in turn have a notable impact on development and behavior.

Simply put, implicit theories probably assume a particular perspective. Consider the example of a teacher whose perspective on creativity is that it is domain specific. He or she may not

look for an artistically creative student to do much in science or some other domain. Conversely, if a teacher's perspective on creativity reflects the implicit theory that creative talent is general rather than domain specific, he or she might expect the artistically creative child to also perform in an original fashion in science and other domains. Much the same applies to the explicit theories of creativity held by researchers and individuals actually studying creativity. Their perspectives will lead them to expect certain things and ignore others (i.e., those traits that are thought to be irrelevant to creativity). The point is that there is probably a strong relationship between implicit theories and particular perspectives on creativity.

Conclusions

Shifts of perspective are fundamental to several facets of the creative process. Some tactics may work effectively because they force the individual to shift perspective. Even though perspective is not mentioned in many programs which present recommendations to individuals who hope to maximize their creativity, a change of perspective may be implied in some of the recommendations that are suggested, and its occurrence (a shift of perspective) may explain the benefits.

A change of perspective may have several benefits. A shift of perspective may, for example, break the individual's routine and allow him or her to find an approach that is uncommon or novel. Novelty is of course a correlate of originality; and originality is in turn vital for creative insights. Shifts of perspective may thus have their effect because they lead directly to novelty. The breaking of routine may be sufficient for the finding of creative ideas and solutions. Much research has demonstrated that fixity precludes originality, and that avoiding fixity or breaking one's mental set can lead to original problem solving. The benefits of changes in perspective are numerous.

See also: Implicit Theories.

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Fernando Pessoa (Alberto Caeiro, Alvaro de Campos, Ricardo Reis, Bernardo Soares, and many more) 1888–1935

Writer

Works include *Message by Fernando Pessoa*, *The Keeper of Flocks* by Alberto Caeiro, *The Tobacconist* by Alvaro de Campos, *Odes* by Ricardo Reis, and *The Book of Disquietude* by Bernardo Soares

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FERNANDO ANTÓNIO NOGUEIRA PESSOA was Portugal's major 20th-century writer. Over the span of his lifetime, he produced a vast array of poetry and prose that included commentaries on literature, aesthetics, philosophy, religion, and politics. In addition to his wide range of subject matter, Pessoa was extraordinarily original. This originality manifested itself not only in the form and content of his work, but in the manner in which it was conceived. Pessoa devised a creative universe with and through the use of what he referred to as "heteronyms"—72 in all. Heteronyms were personas, devised by Pessoa, from which to write. Although it is not unusual for writers to make use of a *nom de plume* or pen name as a creative device, Pessoa's creation of heteronyms extended well beyond this approach—particularly with four of them under which the bulk of his work fell: Alberto Caeiro, Alvaro de Campos, Ricardo Reis, and Bernardo Soares. These four were assigned biographical details, physical descriptions, specific aesthetic sensibilities, ideological inclinations, and relationships to each other. The creation of Bernardo Soares possessed a further distinction—that of being a "semiheteronym"—part autobiographical, part fiction. It was under this particular semiheteronym that Pessoa wrote his most autobiographical work, *The Book of Disquietude*.



Fernando Pessoa. Used with permission.

Background

Fernando Pessoa was born on June 13, 1888, to Joaquim de Seabra Pessoa, a civil servant in the Ministry of Justice who wrote for Lisbon's leading daily newspaper, *Diário de Notícias*, and Maria Madalena Pinheiro, a well-educated woman who was well versed in music, languages, and the written word. Pessoa's young life, however, was soon to be disrupted by the death of his father in 1893—when Pessoa was only 5 years old—and by

the death of his brother 1 year later. It was in 1894 that Pessoa invented his first heteronym—one Chevalier de Pas.

Pessoa's mother remarried in 1895. Her new husband, João Miguel Rosa, was a Portuguese consul in Durban, South Africa. In 1896, the family moved to Durban. Upon arrival, Pessoa was enrolled in the West Street Convent School. Three years later, he continued his education at Durban High School. Pessoa proved to be a successful student and proceeded to learn English and French in addition to his native Portuguese. This ability in languages allowed him to read extensively and to be influenced by British, American, French, and Portuguese authors such as Milton, Shakespeare, Shelley, Keats, Tennyson, Carlyle, Poe, Whitman, Baudelaire, Verde, and Pessanha, respectively.

In 1901, due to the death of his half sister, Henriqueta Madalena, Pessoa returned with his family to Lisbon. He was 13 years old at the time. One year later, the family returned to Durban, and Pessoa entered a commercial school where he learned business English and bookkeeping. Two years later, back in high school, he published an essay on the historian Thomas Babington Macaulay. In addition, he was awarded the Queen Victoria Memorial Prize for his performance on his university examinations. Already proving to be an excellent student, Pessoa had to decide where to continue his studies. In 1905, at the age of 17, Pessoa decided to return to Lisbon, where he would remain all his life. However, despite the return to Portugal and a brief stint at the university, Pessoa had little or no formal academic training. His plans to attend a university were thwarted by a student strike against João Franco, who at the time was the dictator of Spain. Throughout his life, Pessoa would rely primarily on his previous commercial business training for his livelihood as a bookkeeper and translator of foreign correspondence. This work would provide him with nearly sufficient income to write.

The Writing Pessoa

And write he did. Pessoa wrote nearly all the time and on nearly anything he could find, including scraps of paper. Although some of these "scraps" were published during his lifetime, most of them remained in a wooden trunk he left behind. Recent inventories have established that well over 25,000 items remain—still to be sorted and published.

Although many persons live to write, only a select few write to live. Pessoa was one such person. Certainly, he lived an

everyday life—eating, drinking, working, sleeping, and interacting with friends, relatives, and associates. However, for the most part, he spent his time writing. This approach to living and writing has earned him such enigmatic titles as “The Man Who Never Was”—precisely because it often appears that, despite the engagement in the gestures of everyday life, Pessoa seemed to have lived predominately through an imagination that unfolded in and through his writing (this title is from the title of an essay written by Jorge de Sena. See Bibliography for source.) Also, given that he wrote very little under his own name of Fernando Pessoa, a question emerges as to the precise relationship between the author and the written text. Even his most autobiographical work is written as a semiautobiography by a semiheteronym—as if his life’s story was, in part, a fiction.

The Writing Pessoa as Social Entity

No person creates in a vacuum. Human beings are inextricably linked to a multitude of intricacies that constitute their social world. These intricacies, in turn, formulate the very person and the world in which they create. For this reason, it is important to examine the social, historical, and ideological circumstances of any person’s day—creative or otherwise—that constitute the person’s very world. In Pessoa’s case, his writing—both thematically and stylistically—gave voice to a historical time full of change and misgivings about present and future circumstances.

Modernism, the period in which Pessoa wrote, was formed by the changes that took place in the late 19th and early 20th centuries such as the impact of industrialization, world war, advances in technology, communism, fascism, and the spread of Western imperialism. One of the results of events such as these has been an increased disparity between inner and outer worlds. In previous historical periods, such as the Middle Ages or the Renaissance, people are said to have experienced more congruity between their inner lives and outer worlds. Lives were organized typically around their God, ruler, community, and family. The work that was done was continuous with the satisfaction of everyday needs such as providing food, shelter, and clothing for themselves and their families. However, with modern developments such as the increased use of technology, for example, and the resulting period of industrialization, the machine replaced work that human beings had once done. Although this transition made work more efficient, it also altered the relationship between human beings and the fruits of their labor. Mass production ensued, and with it a new era of reproduction through replication. Urban areas became centers of a new, technologically driven, modern age. Individuals and families often were forced to relocate from rural areas to urban centers to benefit from new job opportunities. Suddenly, there was a demand on persons to relate to their work, themselves, and others in a very different sort of way than they had been previously accustomed. This demand was to contribute to a need to negotiate life in an alternate way—one that would include a stance toward the newfound circumstances being presented. In short, urban life called for an unprecedented pluralism.

Modernism was also somewhat idiosyncratic in that its shape and impact was contingent on the particulars of the

context in which it flourished. In Portugal, for example, certain conditions were present as a result of specific social, historical, and ideological circumstances that contributed to the exigencies of modern times, including the threat of war by Britain unless Portugal abdicated rights to what is now Zimbabwe, the financial and economic crisis of 1890–1891, and the 1910 revolution against the Portuguese monarchy. These specific, culturally bound events are important to the understanding of the factors that constitute the context in which any person—creative included—develops. Although the effect of global changes may have been felt by people throughout, writers and artists typically depicted the effects in their artwork. Many writers and artists, situated in the urban centers of the day (e.g., London, Paris, Berlin, Vienna, New York), began to explore new forms and themes in reaction to the rapidly changing social and political world in which they found themselves.

One such theme was that of representation. Writers, in particular, used language to experiment with the issues of representation, including authorship. Pessoa devised two strategies in keeping with the modernist project. First, he created a universe of heteronyms from which to write that necessarily called into question the notion of authorship. Second, he wrote his most autobiographical work as a self-reflective text. Both these strategies suggest a play with representation, specifically, the relationship between who one is and what one writes—previously assumed to be a continuous relationship—in keeping with the previous view and experience of the world and lived life. It was through the use of both of these strategies that Pessoa also addressed the pluralism called for in persons as a result of the magnitude of changes being experienced at the time—changes that contributed to an increased fragmentation of reality, one of the fundamental characteristics of modern consciousness.

The Writing Pessoa as Excess to His Social World

The creation of a multitude of personas as a creative universe in which to write is certainly one response to a call for pluralism. However, despite Pessoa’s creative response to the social, historical, and ideological circumstances of his day, there was a uniqueness about his approach that was not shared by many of his fellow countrymen and women. Differences such as these point to the way in which the individual, along with being formulated in and through the context in which she or he creates, can come to formulate a vision or perspective that relies on, but clearly exceeds, the very context in which it has been formulated. This excess—along with the finely tuned relationship between the creator, her or his medium, and her or his world—are just a few of the elements that come to constitute a creative person’s life.

Portugal was and continues to be somewhat of a paradox. On the one hand, it manifested a certain sophistication during the Age of Discoveries in the 15th and 16th centuries when it participated in the exchange of goods through trade with China and India. On the other hand, it was, and remains, a largely homogenous population with cultural traditions and practices that, for the most part, have remained untouched to this day. In his day, Pessoa commented on a certain Portuguese

provincialism—one sensibility he did not share with his fellow countrymen and women—perhaps due to the influence of having lived, learned, read, and written in two, very diverse worlds (Portugal and South Africa). As a result, he developed a sensibility uncommon among most others from his country, which, in turn, has earned him the credit of nearly single-handedly bringing modernism to Portugal.

Conclusion

This article has attempted to demonstrate the continuous relationship between the creative person and her or his social world. However, even with this continuity, a creative person, regardless of the shared experience of social, historical, and ideological conditions, brings her or his participation in these conditions to light—through her or his medium and

imagination—in a unique and original way. Pessoa was one such person who, through both his writing and the creation of his universe of 72 heteronyms, demonstrated the way in which one person—an extraordinarily creative person—gave voice to the times in which he lived.

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Jean Piaget 1896–1980

Psychologist

Works include *Language and Thought in the Child*, *Biology and Knowledge: An Essay on the Relations between Organic Regulations and Cognitive Processes*, *The Equilibration of Cognitive Structures*, and *The Origins of Intelligence in Children*

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JEAN PIAGET was one of the two or three outstanding psychologists of the 20th century. He was most widely recognized as a developmental psychologist. But his lifelong effort was guided by biological and philosophical concerns about the nature, origins, and transformations of knowledge. For this reason he coined the term genetic epistemology to characterize his vocation. His published output was enormous, some 60 books and monographs and well over 1000 articles.



Jean Piaget. © CORBIS/Bettmann.

Background

Jean Piaget was born on August 9, 1896, in Neuchâtel. He had two younger sisters. His father, Arthur Piaget, taught literature and history. His mother, née Rebecca-Suzanne Jackson, had no profession and was considered, at least by her son, to be quite neurotic. But she was active in socialist causes and during World War I, although outspokenly pro-French, she went to the aid of German refugees and prisoners. In Neuchâtel, during Piaget's early years, there was considerable interest in science, especially natural history. Piaget's first publication, a paragraph describing an albino sparrow, appeared in 1907,* before he was 11 years old, in *Le Rameau de Sapin (The Fir Branch)*, published by one of two local natural history societies in

*In this article publication dates are given for the first appearance in French. Titles of works are given as published in English translation, except where there is none.

which he was active. During his boyhood and adolescence he studied the mollusks of the region assiduously and passionately. He received his first doctorate from the University of Neuchâtel, with a thesis on mollusks. Piaget went on to study at the University of Zurich and Paris, moving away (but not completely) from his early interest in mollusks to studies in philosophy, theology, psychology, and psychiatry. Beginning in 1921, he taught and did research at the University of Geneva until his death in 1980. From 1929 to 1939 he was professor of psychology, sociology, and philosophy of science at the University of Neuchâtel. From 1929 to 1939 he was also professor of history of scientific thought at the University of Geneva. Among his other parallel appointments at the University of Geneva, he was professor of sociology (1939–1971), director of the Institute for Educational Sciences (1933–1971), and professor of experimental psychology. Meanwhile, he was professor of developmental psychology at the Sorbonne in Paris (1952–1963). Although he retired from his professorships in 1971, he continued as director of the International Center for Genetic Epistemology (1955–1980). Recognition came early and continued long. Among his many honors were more than 30 honorary doctorates, the Dutch Erasmus Prize, and the Distinguished Psychologist Award of the American Psychological Association. Although he wrote relatively little about education, he was director of the International Bureau of education from 1929 to 1967, and on the international stage his ideas have been very important in shaping thought about child rearing and education. The direction of his influence on educational thought has been to advance the conception of the child as a self-constructing knowing system and the conception of the teacher as a person who understands the process of cognitive development and the structure of knowledge according to the tenets of genetic epistemology.

No single work of his can be cited as most representative because his interest was in the cognitive system as a whole, at all organismic levels. Although he considered himself to be also a philosopher and a biologist, the article primarily focuses on his work as a psychologist. Taking his work as a whole, we can say that his network of enterprise was distinctly multidisciplinary but not eclectic. In every field he touched—psychology, biology, philosophy, history of science, and logic—he expressed a consistent and unified point of view. Various facets will be discussed later, but here we might bring out the particular form his biopsychological interactionism took, the elaboration of the idea of an “epigenetic landscape,” borrowed in part from the British biologist Conrad Waddington. Briefly

put, this means that, although the organism is self-constructing, it functions in a setting that provides various constraints on development, thus guaranteeing that all knowing systems will share certain cognitive characteristics. Although this position is certainly genetic, it is not the deterministic genetics of Mendel and his intellectual descendants. For Piaget every developmental step opens the way to new possibilities: Human knowledge has an ever-receding frontier.

Taking his work decade by decade, as a youth he was much concerned with the relation between science and religion and the relationships among the sciences. These preoccupations were expressed in a long prose poem, *The Mission of the Idea* (1915), and in an autobiographical, philosophical novel, *The Search* (1918). As already mentioned, during the same period he continued his work, mainly fieldwork, on mollusks, receiving his doctorate from the University of Neuchâtel in 1921. His first book, *The Language and Thought of the Child* (1923), gained wide recognition. In the 1930s he published a pioneering trilogy about the mental development of his own three children. In the 1940s and 1950s much of his work was centered on elaborating the stage theory of mental growth, with a major focus on the period of concrete operations (i.e., from about 5 to 12 years of age). Toward the end of this period he and Bärbel Inhelder published *The Growth of Logical Thinking from Childhood to Adolescence: An Essay on the Construction of Formal Operational Structures* (1955). In this work he characterized the well-functioning adolescent as being capable of abstraction, thinking not only about things but about thought itself; capable of formulating and testing hypotheses systematically and with considerable combinatorial skill; and capable of distinguishing between the conceptually possible and the real as a special case of the possible. In one experiment it was shown that adolescents could construct an experiment about the period of a pendulum to demonstrate that, among a number of variables, only the length of the cord made a difference. It is striking that adolescents could do that much. In the history of science, it took many centuries until in about 1600 A.D. Galileo made his celebrated observations about pendulum motion. These somewhat paradoxical findings suggest the need for careful reflection on the relations between empirical psychology and the history of science. Between 1955 and 1956 Piaget founded the Centre International d'Épistémologie Génétique, which held its first international symposium in 1956. This led to a long series of monographs constituting a protracted effort to integrate the empirical and theoretical works of Piaget and his collaborators. Subjects taken up included the epistemology of space, time, causality, and chance; also included were works on child logic and on the relation between learning and development, and—going beyond childhood and adolescence—the history of science. Among many elaborations and overviews perhaps the most comprehensive and accessible in English is *Biology and Knowledge: An Essay on the Relations between Organic Regulations and Cognitive Processes* (1967). In the 1960s and 1970s Piaget and others in his entourage moved away from the earlier emphasis on stages and structures toward a more functional concern with intellectual processes and the strategies and procedures subjects actually use. Perhaps the most important work of this period is *The Equilibration of Cognitive Structures: The Central*

Problem of Intellectual Development (1975). It should be mentioned that Piaget was primarily interested in the *epistemic subject*—that is, the characteristics that all knowing systems must develop. In contrast, most psychologists have been interested in the psychological subject—that is, the particularities of individual persons. These two perspectives are not contradictory but complementary. Piaget has often been criticized for his omissions: having neglected the study of affect and the study of interpersonal relations. In reply it might be said, first, that one person cannot do everything and, second, that the criticism is based on an incomplete knowledge of Piaget's work, especially the following: *The Moral Judgment of the Child* (1932), *Play, Dreams and Imitation in Childhood* (1945), and his lectures in 1954 at the Sorbonne on "Intelligence and Affectivity," published later.

For his analysis of different forms of knowledge, Piaget borrowed descriptive categories from philosophers, such as Kant, and from the history of science. Thinkers in these fields either took these categories for granted a priori or explicitly attributed them to learning and association. On the contrary, Piaget believed that these categories develop through the child's interaction with the world, both in its physical and social aspects. Piaget and his collaborators found ways of observing and documenting this development. There are thousands of articles and monographs reporting this work. We can consider only a few examples here.

Conservation

The idea of conservation permeates scientific thought. Nothing is destroyed: Change consists entirely in processes of transformation. In the history of science this perspective was not freely given but hard won, discovered and rediscovered in many settings. Each such rediscovery was a great intellectual victory. Sometimes the search for what was conserved was undertaken deliberately, to solve a particular problem. Sometimes the discovery occurred in the course of trying to solve some other problem. A few key examples follow. William Harvey, in his studies of the functioning of the heart and the circulation of the blood, had to refute the notion that each pulsation of the heart expelled blood from the body so that the blood had to be continually replaced. He calculated the amount of blood that must pass any point on each pulsation and was able to show that if it had to be replenished the amount of blood required would weigh thousands of times the weight of the body, a *reductio ad absurdum*. Thus, by assuming the conservation of the weight of the blood as it circulates, he was able to support his general position that the blood moves through the body in a closed cycle. Around the same time, 1600 A.D., Galileo was able to demonstrate the fruitfulness of the idea of the conservation of momentum. About 200 years later Lavoisier was able to demonstrate the conservation of the weight of matter as it is transformed through burning. About 50 years later several scientists were able to demonstrate the conservation of energy across a variety of transformations, both biological and physical. In modern science the conservation principle is so well established that it can guide the search for understanding of puzzling phenomena. Faced with an unexplained

transformation, the physicist may be heard to mutter, “Something must be conserved—what is it?” Piaget drew on this history for his studies of children’s thinking. At one point, around 1930, he asked one of his students to show a child a lump of sugar dissolving in a glass of water. When the sugar disappears, the question becomes “Where did it go? Does it still exist? Did the level of the water rise when the now-invisible lump was dropped into the glass and if so did it stay up as the sugar disappeared? Children of different ages give different answers to these questions as their conceptual development proceeds. These observations were followed, over the next 2 decades, by some of Piaget’s most famous experiments. Let the child make a ball out of clay, then squash it down into a pancake: Does the amount of clay remain the same? Likewise, if you pour water from a tall thin vessel into a short wide one—or vice versa—does the amount remain the same? The person who worked with Piaget on this problem, and on many others, was Bärbel Inhelder. They became lifelong collaborators.

This work has been repeated in many countries and forms the basis for Piaget’s account of the stage of concrete operations. By operations he meant the mental acts by which the child copes with problems of the type described. For conservation of matter three main operations have been discerned: identity, reversibility, and compensation. That is, “You didn’t add anything or take anything away.” “You could pour the water back again and it would reach the same level.” “It’s taller, but it’s thinner.” To the uninitiated it comes as a great surprise that it takes about 5 to 10 years to move from grasping the elementary conservation of matter to grasping the conservation of volume (i.e., displacement volume when an object is submerged in a vessel of water). The work on the development of concrete operations was done mainly with school-age children. Development within this period has been richly documented in varied social settings and variegated tasks focusing on a wide range of concepts. The preoperational period and the period of formal operations are less well understood. On the other hand, the sensorimotor period was beautifully elaborated in Piaget’s study of his own three children, which remain irreplaceable classics. Piaget liked to describe one child who was spontaneously exploring the idea of number. This boy had about a dozen objects, which he would arrange in some spatial configuration and then count. Then he would rearrange them in another configuration and count them again. After each observation, of course, he got the same result. Finally he exclaimed, “Once you know, you know forever!” This child’s optimistic attitude toward the growth of knowledge resembles the scientist who, committed to the task of discovery, persists in this work in the face of all obstacles. The person who worked with Piaget on the child’s conception of number—a subject that can get very subtle and sophisticated—was Alina Szeminska, a Polish woman who spent many years in Geneva. When World War II threatened, she went home and was eventually imprisoned in a concentration camp, but survived.

In many areas, then, Piaget found that intellectual development moved forward in a stagelike way. There has been some confusion resulting from Piaget’s use of *stage* in somewhat different ways. On the one hand, he speaks of the four great stages: sensorimotor, preoperational, concrete operations, and

formal operations. Movement through these stages is thought to take about 12 years. On the other hand, because in describing the first 2 years of life, Piaget discerned six stages, it will simplify matters if we refer to the stages of infancy as substages. In *The Origins of Intelligence in Children*, Piaget recounted his observations of his own three children in the first 2 years of life. Some phrases from this account give the general flavor: the Third Stage—procedures destined to make interesting sights last; the Fifth Stage—discovery of new means through active experimentation; the Sixth Stage—the invention of new means through mental combinations. The similarity of these concepts used for describing the baby to things we might say about the sciences is apparent. In *The Construction of Reality in the Child*, Piaget’s emphasis is less on the process of thought and more on the content. Piaget takes up the development in the baby of four basic concepts: object, space, time, and causality. Here again we encounter six substages in the development of each of these concepts.

Piaget rarely discussed the concept of stage. Rather, he used it to organize his observations. He took the position that stages are not general. Uneven development, or *décalage*, occurs often in Piaget’s empirical work. Indeed, for disequilibrium to be a powerful force in development, widespread *décalage* is essential. Although Piaget referred frequently to stages in his empirical work, his emphasis changed over time to ideas of process, such as exploring the possible, discovering the necessary, coping with contradiction, and moving toward wider and more stable equilibrations. Piaget has often been criticized for his supposed neglect of two important areas: the psychology of affect and social processes. In reply it can be said that this “neglect” was by no means total. With regard to affect, several of his early works are pertinent: *Language and Thought of the Child* and *The Moral Judgment of the Child*. Moreover, the idea of intense interest as a motivating force permeates Piaget’s work. The twin ideas, that there is a universal thirst for knowledge and that disequibrated cognitive structures are disturbing, are hardly devoid of affect.

With regard to social processes, the criticism is unjust. In addition to the works mentioned earlier, a collection of his sociological essays, which finally appeared in English in 1995, belies the objection. Also, his celebrated experimental work on perspective taking in children showed that the child must learn to grasp the consequences of looking at a scene from more than one position, in other words, how the other sees the world and how different points of view can be synthesized. More generally, Piaget’s work shows the child as moving away from domination by authority and arbitrary convention and moving toward freely chosen, self-constructed social ideas. If so, it can truly be said that in each generation children rediscover the social contract. Obviously, this statement is idealized, even utopian. Among other things it provides no place for leaders or for other exceptional people—and for that matter, no place for evil. Piaget’s whole oeuvre depicts an unbroken series of cognitive victories, a forward march of knowledge, always graciously inclusive, assimilating old knowledge into new schemas. The picture reminds one of the exchange, perhaps apocryphal, between the English painter Turner and a woman who objected that the sunsets she saw were nowhere near as glorious as the ones he painted. Turner’s reply ran, “But, madam, don’t you wish they were?”

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Pablo Picasso 1881–1973

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Glossary

Comparative studies Investigations in which two or more eminent individuals are studied together to determine similarities and differences. Such studies can have both nomothetic and idiographic aspects.

Historiometric research Investigations in which biographical and historical data are subjected to quantitative measurement and analysis in order to test generalizations about creativity or leadership. These studies are almost always nomothetic.

Idiographic studies Investigations that focus on attributes or behaviors that are unique to particular eminent

individuals. An example would be an inquiry into why Van Gogh cut off part of his ear to give to a prostitute.

Nomothetic research Studies that concentrate on testing generalizations that apply to large numbers of individual cases. An illustration would be an inquiry into the relation between intelligence and creativity.

Psychobiographical studies Investigations that scrutinize a single eminent individual. Such single-case studies are often psychoanalytic, but they need not be so. The goals are almost always idiographic rather than nomothetic.

Biography

Pablo Picasso is widely considered to have been one of the foremost artists in the history of Western art. Picasso is also unique in popular culture, having an image comparable to Albert Einstein. Where Einstein was the greatest modern genius in science, Picasso was the greatest modern genius in the arts.

This article starts by narrating his life and work, and then reviews empirical studies of his life and work.

Life

Pablo Ruiz Picasso was born on October 25, 1881, in the Andalusian city of Málaga, at 15 Plaza de la Merced, not far from the port. His father, José Ruiz Blasco, had a relatively distinguished ancestry, and his family had been in Málaga since 1790. Unlike his older brothers, Diego, Salvador, and Pablo who held respectable positions as a diplomat, a medical doctor, and a doctor of theology, respectively, José was undisciplined and unwilling to dedicate himself to a secure job, so he decided to become a painter. In 1880, José married Maria Picasso Lopez, whose family, potentially of Italian origin from her father's side, had lived in Málaga for two generations. A year into the marriage, Pablo was born, and later, his sisters Lola and Conchita (who died a few months after her birth).

In order to support the ever-increasing needs of his family, José accepted a post in the School of Arts and Crafts of San Talemo, and in 1891, a teaching job at the La Guarda Institute, a school in Coruña, a cold city on the Atlantic coast of Galicia. Although José was saddened by this move, for little Pablo this was quite an adventure. Ever since he was very young, Pablo seemed fascinated with drawing. According to his mother, his first word was 'piz-piz' to ask for a 'lapiz' (a pencil). In Coruña, Pablo attended the school where his father taught and as a result, enjoyed a great deal of freedom that allowed him to go to his father's studio and paint rather than stay in class. To the detriment of his regular school studies, Pablo was constantly

absorbed in his drawing. One evening, when Pablo was not yet 14, Don José turned the work over to his son and went for a walk. When he returned, the pigeons that Don José was fond of painting were finished and so astoundingly realistic that he gave Pablo his palette and brushes, announcing that his son's talent was superior to his own, and therefore, he would stop painting.

In 1895, Don José accepted a professor post at the School of Fine Arts in Barcelona, and moved there with his family. Here, Pablo, once again distinguished himself as a prodigy: although not yet of age, he was allowed to take an exam to enter an advanced art course. The examination consisted of drawing from a model, and the time allowed was one month. Picasso finished in one day with astonishing results.

Pablo's eventual fame as an academic painter now seemed assured, so the next obvious stop on his path of attaining recognition was the Royal Academy of San Fernando in Madrid. Aged 16, Picasso passed all the required academic tests; however, the academy setting did not attract him as much as spending hours at the Prado Museum and working on his own projects. His decision to stop attending the academy seemed like a betrayal to his family, and as a result, his uncle Don Salvador stopped paying his monthly allowance. Although his father strived to continuously support him, Picasso started to experience the pains of poverty, which he nevertheless accepted in exchange for his artistic freedom.

Unfortunately, he soon became ill with scarlet fever, and was forced to return to Barcelona. Picasso spent most of 1898 convalescing in the Catalan village of Horta de San Juan in the company of his friend, Manuel Pallarès, a fellow artist from Barcelona. The countryside was a revelation for him and it helped him gain psychological freedom and strength of character. Later he was to say: "Everything that I know I learned at Horta de San Juan."

As a result, when Pablo returned to Barcelona in early 1899, he had made the decision to break with his art school training and to reject his family's plans for his future. Instead, he continued exploring his own ideas, and became a regular

customer of *Els Quatre Gats* (The Four Cats), a tavern modelled after the Parisian *Chat Noir*, a meeting place for intellectuals. Here, Picasso befriended other artists and poets, such as Carlos Casagemas and Jaime Sabartès, and started contemplating the idea of travelling to Paris.

He embarked on a trip with his friend Casagemas, and their final stop was the French capital, where they rented a studio in Montmartre. Here Picasso met other Spanish artists who introduced him to the Parisian art scene. A few days after his arrival, he visited the gallery of Mlle Berthe Weill (who later became Matisse's first dealer), where he sold three paintings and met the Catalan industrialist Manach who decided to pay him a monthly salary in exchange for all his work. However, after only two months, the two painters went back to Spain, and after trying to unsuccessfully entertain a love-hurt Casagemas in Málaga, Picasso moved to Madrid where he worked as an art editor for a new journal, *Arte Joven* ('Young Art'), and later that year he headed back to Barcelona where he had an exhibition at the Sala Parés, a modern art gallery.

Following Casagemas' suicide in 1901, Picasso traveled back and forth between Barcelona and Paris, until 1904 when he decided to move permanently to Paris. His first apartment and studio, nicknamed *Bateau Lavoir*, where Gauguin had lived before, was almost uninhabitable, and Picasso struggled in poverty for the next two years. Despite these hardships, Picasso met his first mistress, Fernande Olivier, an art student, and his studio became an attraction for Spanish and French artists who respected him: among them were Matisse, Braque, as well as the writers and critics Max Jacob, Cocteau, and Apollinaire. During this time he also met Gertrude Stein an American writer who helped the development of modern art.

By 1912 his financial situation had greatly improved, and he moved to Montparnasse with his new mistress Eva (Marcelle Humbert). In 1914, the First World War broke out, and while his friends Apollinaire and Braque enlisted, Picasso stayed in Paris continuing his work oblivious to the war. Following Eva's sudden death due to illness, the artist started a project with Cocteau and the Russian Ballet Company, where he met the ballerina Olga Koklova whom he married in 1918. Three years later, his first son Paul was born in Paris. Olga's high society life style eventually became tiring for the artist, and in 1935 they separated. Picasso moved on to his next mistress, Marie-Thérèse Walter, who was to give him a daughter Maya; nevertheless, Marie-Thérèse was soon replaced by Dora Maar, a French photographer of Yugoslavian descent, who later documented Picasso's work on *Guernica*.

Unlike the First World War, the Spanish civil war and the Second World War left Picasso deeply marked. The brutal bombing of the village of Guernica, the Nazi occupation of France, and his friends dying in concentration camps (Max Jacob among them), turned Picasso vehemently against war. As a result, he joined the communist party. He continued living in Paris during the occupation, but due to his political views, he was not allowed to go to Spain or publicly display his work.

In 1945, after the liberation, Picasso relocated to Côte d'Azur with Dora, and a year later he moved to Vallauris with his new mistress Françoise Gilot. She gave him two children, Claude and Paloma, but left him due to his infidelities in 1953. Picasso was not alone for long, and a year later he had a

new lover, Jaqueline Roque. She became his second wife, and they shared the last 20 years of his life in a large villa above Cannes, 'La Californie.'

Work

Everyone who had ever met Picasso was impressed by his tremendous energy for work. Deeply immersed in his art and highly prolific, Picasso left over 50 000 works, including paintings, drawings, sculptures, ceramics, prints, tapestries, and rugs. He had a curious experiential creative style, constantly exploring not only new techniques and motifs, but also his own feelings.

Although his father was a rather mediocre painter, he did encourage Picasso to boldly combine different materials. As Picasso himself later noted, his childhood experience in Don José's studio might have inspired his interest in mixing materials that eventually took the form of cubist collages. Another influence of his Spanish home is the motif of the bull and the toreador. Picasso's first painting is *The Matador* (1889), and this motif can be found throughout his work.

Under Don José's influence, Pablo produced academic style paintings, such as *The First Communion* (1896). However, by 1900, with the discovery of Paris and its rich art museums, Picasso's style changed drastically. The slavish realism and religious subject matter of his early paintings were forever replaced by the modernist influences of Toulouse-Lautrec, Degas, Van Gogh, Gauguin, and Matisse. His painting *La Moulin de la Galette* (1900) as well as his illustrations in *Arte Joven* (1901) are reminiscent of Lautrec's nightlife scenes, and his pastels exhibited at the Sala Parès in Barcelona (1901) are reminiscent of both Degas and Lautrec.

Following the suicide of his friend Casagemas, between 1901 and 1904, Picasso started using predominantly cold colours (blue), dramatic subject matters, and stylized linear forms. This was Picasso's *Blue Period* and it included works such as *La Vie* (1903) and *The Old Guitarist* (1903), incorporating influences from El Greco and Matisse. Having met Fernande in 1904, Picasso started using warmer tones and lighter themes (*The Rose Period*), as exemplified by *Young Acrobat on a Ball* (1905). Although throughout his work the artist incorporated themes and techniques from a variety of revered painters, he did it with originality and with a sense of exploration that always pushed him toward a new breakthrough.

In 1907, Picasso finished a painting that was to irrevocably change the world's concept of art: *Les Femmes d'Alger (O.J.)*. Depicting the female body with an almost grotesque insight, the mask-like faces (inspired by African art) defiantly stare at the viewer, marking the beginning of analytical Cubism. Picasso's idea was to break preconceptions of form and aesthetics, and to provide the world with a new visual perspective. Initially, all his admirers were shocked and disappointed by his stylistic violations. However, he persisted in his ideas, and together with Braque developed analytical and synthetic Cubism. The *Portrait of Kahnweiler* (1910) is a good example of analytical Cubism. With a restrained colour palette, the main goal of this style is to penetrate into the nature of form, and understand space below the mere surface of objects. Familiar contours and natural opaqueness disappear as the subject undergoes a process of analytic crystallization of form.

Exploring even further the metamorphosis potential of the subject matter, Picasso and Braque began to incorporate elements of *papier collé* (coloured surfaces cut out of paper) in their paintings. This added three-dimensional patterns, texture, and was the beginning of synthetic Cubism. One example of synthetic Cubism is *Woman in an Armchair* (1913).

Picasso's later works include a multitude of portraits depicting his mistresses, such as *Portrait of Dora Maar* (1937). At the pinnacle of his career is, of course, *Guernica* (1936–1939). Motivated by the fascist bombing of the ancient capital of the Basques, *Guernica* has a candor of expression that gives it a strong emotional impact. The sharp angular patterning, the strong contrasts between light and dark, the unbalanced composition, all suggest the chaos brought by the bombing. These universal means of conveying emotion made this painting a transcendental image of war and human suffering.

During his late period, Picasso departed considerably from his own figurative style. Instead of continuing his quest of challenging form through the dissolution of perceptual preconceptions, he started obsessively producing images of musketeers and matadors or other heroic figures inspired by obvious art-historical references. While some critics argue that Picasso's creativity had waned toward the end of his career, others claim that Picasso had reinvented his art once more. To give an example, *Tête de Matador* (1970), where the clothing reminds of Goya, may seem like a technically naïve reinterpretation of the emblematic bullfighter figure. However, given that this is also a self-portrait, one could see this work, along with others, as the artist's ardent desire to defy death just like a Spanish *toreador*. At the same time, perhaps intending to leave one last mark on the world's art history, the artist might have attempted to assimilate and *Picassify* such celebrated elements of the Western figurative tradition. In time, it is conceivable that these works might be someday viewed in the same way as the late-life works and swan songs of other great artistic creators, such as Titian or Michelangelo.

His Life: Empirical Studies

Because Picasso is widely recognized as one of the greatest creators of the twentieth century, his life has sometimes become the subject of psychological research on creativity. This research uses one of the following three standard methodologies for studying historic figures: psychobiographical, comparative, and historiometric.

Psychobiographical Methods

Originally inspired by Sigmund Freud's classic psychobiography of Leonardo da Vinci, many great artists have become the subject of this approach. This method can be characterized as single-case studies that use qualitative analyses to draw idiographic conclusions. By 'idiographic' is meant that the inferences concern explanations for unique characteristics of the psychobiographical subject. For example, a large number of psychobiographies have been written about the Dutch painter Vincent Van Gogh, their purpose being to explain why he cut off part of his ear to give to a prostitute. Although these interpretations often rely heavily on psychoanalytic theory, they do not have to do so.

Probably the best example of a psychobiography of Picasso was published by Mary M. Gedo, an art historian. She compared the chronology of the artist's work with what was going on in his personal life. In doing so, she argued that his creativity was highly autobiographical. The connections were more than just the observation that some lover or friend became the subject of a painting. Sometimes the composition appears to have a deeper significance. As an example, Gedo argued that the 1903 *La vie* reflected the conflict the artist experienced between "his desire for a suitable sexual object and his duty toward a sorrowing, unyielding mother" (p. 50). Sometimes particular stylistic shifts could be connected to specific episodes or conditions in Picasso's life. It was no accident that his famed Blue Period took place when his material and emotional circumstances were usually dire.

Comparative Methods

The comparative approach is also qualitative in nature, but uses multiple cases rather than a single case. Because of this difference, comparative studies tend to be more nomothetic than idiographic. That is, comparative researchers will look for general characteristics that apply to all of the cases rather than the peculiarities of any one case. This approach is extremely old. In fact, Plutarch's *Parallel Lives*, which compares ancient Greeks and Romans, may be viewed as a classic example.

The most important modern instance using Picasso among the cases is undoubtedly Howard Gardner's *Creating Minds*. The book's subtitle provides a clue to its aims: *An Anatomy of Creativity Seen through the Lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. These seven individuals each represent one of Gardner's original intelligences. Despite that divergence, Gardner showed that they all share certain dispositional traits and developmental experiences.

For example, all seven were highly self-absorbed. This self-absorption ranged from disregarding others (Einstein and Eliot) to being difficult toward others (Gandhi, Stravinsky, Graham, and Freud) to being "frankly sadistic" (Picasso!). The artist could be extremely cruel to even his closest intimates.

Likewise, all seven displayed Gardner's version of the "ten-year rule," namely that some major breakthrough or creative shift takes place every decade or so. In Picasso's case, these are identified as *Les demoiselles d'Avignon* and the development of cubism, then the emergence of his Neoclassical style, and finally *Guernica*, which is seen as a 'comprehensive work' rather than a 'radical breakthrough' (as in *Les demoiselles*).

One very positive feature of this approach is that Picasso is put in the context of other highly creative individuals operating at roughly the same time. He was not only similar to the other great creators, but also strikingly different. For instance, of the seven subjects Picasso had the best claim to status as a child prodigy. Facilitated by the fact that his father was an art teacher, Picasso was able to acquire very precocious mastery of artistic techniques and expression.

Historiometric Methods

Like comparative studies, historiometric research uses multiple cases, only even more so. A typical investigation might consist

of dozens if not hundreds of cases. However, unlike either psychobiographical or comparative approaches, historiometry is strictly quantitative. Furthermore, although historiometric inquiries, like comparative studies, are inclined to nomothetic conclusions, that inclination is even more emphatic in historiometry, which engages in formal hypothesis testing using statistical techniques. Indeed, most often the cases that make up the sample are never completely identified by name. Instead, the names are only mentioned to illustrate how a variable might be defined or to prove a specific illustration of some nomothetic result. Accordingly, Picasso might be one of the cases in the investigation without ever being explicitly mentioned.

A case in point is a historiometric study that Dean Simonton conducted of 772 Western artists who were born between 1042 and 1918. This study was designed to test the hypothesis that artistic creativity is contingent on the artist being enmeshed in a complex social network of fellow artists, including older and younger creators as well as those who more properly count as contemporaries. This hypothesis was amply confirmed. Yet, despite the fact that Picasso was counted among the 772 cases, that inclusion was never made explicit. Only a handful of cases, such as Michelangelo and Leonardo da Vinci, are ever identified, and then only to make some narrow methodological or substantive point (e.g., that Michelangelo was the most eminent of the 772).

Nonetheless, it is worthwhile noting that Picasso exemplified the central finding of this historiometric investigation. More specifically, given that he was probably the most eminent artist of the twentieth century, we would expect that he would have been richly linked with other artists. That was in fact the case, those artists including such fellow (even if sometimes lesser) luminaries as Jean Arp, George Braque, André Derain, Juan Gris, Paul Klee, Fernand Léger, Henri Matisse, Amedeo Modigliani, Henri Rousseau, Gino Severini, and Maurice de Vlaminck. Naturally, some of these artistic linkages were more substantial than others were. The Braque and Matisse connections were especially critical, the former as a collaborator in the advent of Cubism, the latter as a key competitor and influence.

Although psychobiographical, comparative, and historiometric approaches are quite distinct, all three converge on one crucial fact: Picasso was certainly not a lone genius. His relationships with others, both artistic and personal, exerted a powerful impact on his creativity. In that respect he is typical not only of other artistic geniuses but also of creative geniuses in general.

His Work: Empirical Studies

Rather than concentrate on Picasso's entire life or work – or the relation between the two, some researchers have turned their attention to single creative products. For example, Robert Kastenbaum used Picasso's 1903 *The Old Guitarist* (in conjunction with Alfred Tennyson's poem *Ulysses*) to examine how young artists – Picasso was in his early 20s at the time – envision old age, with the idea that such time-transcendence would shed light on creativity. Other psychologists have used other Picasso creations to fathom other aspects of artistic creativity.

By far, the product that has received the most scrutiny is Picasso's 1937 *Guernica*. As noted earlier, this painting cannot be considered one of his key artistic breakthroughs. That distinctive status is reserved for his 1907 *Les Femmes d'Alger (O. J. Version O)*. Even so, it can still be viewed as his most iconic creation in the sense that it likely constitutes the work most strongly connected with his name. The painting is also one of the few of Picasso's works that deals with an actual historical event, namely the brutal bombing of the Basque town Guernica by Italian and German warplanes during the Spanish Civil War. This event clearly affected Picasso deeply, for the painting displays far more dramatic and dynamic power than his other major works, which are often austere and static. Yet from a research perspective, the most significant reason why this painting has attracted so much attention is that Picasso left 45 sketches. Because these sketches are numbered and sometimes even dated, they provide clues to the work's development.

These sketches fall into two categories. First are the various sketches that treat the entire composition, or at least the relationships among two or more figures. Second are the sketches that are devoted to the central figures in the final painting. These principal figures (with their approximate location) are as follows: (a) the menacing bull (in the upper left hand corner); (b) the weeping mother with her dead child (just below the bull); (c) the fallen and dismembered warrior with his outstretched hand and arm (bottom left corner), his head (to the right of former), and his arm holding the broken sword (bottom center); (d) the wounded and screaming horse (dominating the center); (e) the frightened woman looking out an upper-story window holding a lamp (to the right of the horse's head); (f) the wounded but still walking woman laboriously dragging her leg (lower right corner); and (g) the woman apparently falling in a burning building with arms thrust upward (in the upper right corner). Interestingly, the sketches include some figures that never ended up in the completed work, such as a winged horse.

Rudolf Arnheim, the Gestalt psychologist, conducted the first scientific study of artistic creativity based solely on these sketches. The resulting 1962 book *Picasso's Guernica: The Genesis of a Painting* has become a classic on this subject. Upon careful examination, Arnheim concluded that the sketches do not exhibit a progressive advance toward the final version. In particular, "the work of art cannot unfold straightforwardly from its seed, like an organism, but must grow in what looks like erratic leaps, forward and backward, from the whole to the part and vice versa" (pp. 131–132). Indeed, some of the sketches seem well wide of the mark, hardly seeming to belong to the same painting even when they concerned the same figure. Most conspicuous are the dramatically different versions of the horse and the weeping woman.

Dean Keith Simonton, in his 1999 book *Origins of Genius*, argued that these abundant "false starts and wild experiments" (p. 197) provided evidence for a Darwinian theory of creativity – a theory assuming that creative thought depends on blind variation and selective attention. Simonton's assertion then kindled an empirical and theoretical debate on what the *Guernica* sketches actually revealed about the creative process. This debate began with Robert Weisberg, who in 1995 had argued that the sketches reveal straightforward 'reproductive'

thinking in which graphic ideas already found in Picasso's 1935 etching *Minotauromachy* were simply extended and developed into those found in *Guernica*. As a consequence, Weisberg published a book review of *Origins* that was highly critical of Simonton's position. Later in 2004, Weisberg published an empirical study of the sketches that showed how the figural developments were highly structured. In the same year, Subrata Dasgupta published an article criticizing Simonton's interpretation on theoretical grounds. After responding to Dasgupta's critique, Simonton decided to conduct a comprehensive empirical study of the sketches. This investigation was published as a target article in a 2007 issue of the *Creativity Research Journal*, with comments by Weisberg and others, plus a reply by Simonton. A year later, Charlotte Doyle published her own independent criticisms of Simonton's interpretations. Because Simonton has yet to respond to the last article, the best conclusion to draw is that the jury is still out about whether the sketches illustrate Darwinian creativity. At this point, it is probably best to stick to the empirical facts. These facts represent something of a paradox.

On the one hand, it is manifest that the sketches are by no means utterly random. In the first place, the imagery in *Guernica* has undeniable antecedents in Picasso's prior work. It did not emerge de novo but rather most of the images have recognizable versions in previous products, especially the aforementioned *Minotauromachy*. In a limited sense, *Guernica* is nothing more than a recombination of previous visual ideas, even if an unusually successful recombination. To be sure, these earlier ideas did undergo considerable development. Thus, the naive and passive little girl holding the lamp in *Minotauromachy* is far removed from the fully aware and emotionally wrought adult holding the lamp in *Guernica*. Moreover, it is also quite clear that the succession of sketches did not randomly jump around from one graphic subject to another. Rather, Picasso would often pursue one line of thought for a few sketches before turning to another – trying out the range of possibilities in one figure before trying out a complementary range of possibilities in another figure. This sequential exploration was especially important in getting adjacent figures to become compatible in the overall compositional representation.

On the other hand, it is equally obvious that the sketches are far from being systematic. Their haphazard quality is especially impressive given the tremendous amount of artistic expertise the artist had acquired by this time – almost 40 years worth. With that amount of accumulated skill and knowledge, Picasso could have begun with a rough sketch of the composition with all the figures roughly in place, and then gradually refined each figure in conjunction with the others until the final composition emerged with the parts congruent with the whole. In fact, with lesser works Picasso could conceive a satisfactory product in precisely this way. Yet in a masterpiece like *Guernica* his procedure was extremely messy and inefficient.

The latter statement was demonstrated in Simonton's 2007 empirical investigation. Here five independent raters were asked to rate all of the sketches according to how similar they were to the final painting. Significantly, two of the raters – Subrata Dasgupta and Robert Weisberg – were already on record as claiming that the sketches displayed a highly systematic progression. Even so, all five raters exhibited a strong

consensus on their ratings so that they could be consolidated to produce a highly reliable 'progress score' for the sketches. These scores were then plotted as a function of the sketch's order. **Figure 1** shows the outcome. It should be apparent that after the initial sketches, the progress scores become chaotic, sometimes moving forward and other times moving backwards. Picasso was definitely not engaged in honing his initial sketches toward the final product. On the contrary, he was clearly engaged in exploring diverse possibilities. As Picasso himself put it, "I do not seek, I find."

It can be argued that the "false starts and wild experiments" seen in **Figure 1** merely reflect the fact that most of the sketches focused on single figures. As a result, Picasso might advance one graphic component (e.g., the horse) to a certain stage and then return to another graphic component (e.g., the bull) to bring it up to the same stage of development. However, if this argument is correct, then the backtracking will vanish when we look at each graphic component separately. This separation is accomplished in **Figure 2**.

The sketches for the bull, mother with dead child, warrior, horse, and weeping woman all exhibit significant zig-zag patterns indicative of backtracking. Often the final image in the painting is closest to one of the earlier sketches in the corresponding series. For instance, the second sketch in the mother with child series turned out to be the most proximate to the final product. The same was true for the weeping woman. The only sketch that shows a roughly positive monotonic function is the woman with the lamp. Yet even in this case the penultimate sketch in the series is the one that comes closest to the final image.

It is essential to emphasize that Picasso's exploratory experiments did not stop with these sketches. Even after he transferred his graphic ideas to the large canvas that was to become the final product, he continued to make major alterations. This fact is apparent in the series of photographs that were taken of the painting in progress. For instance, the photograph of the earliest version of the canvas depicts the fallen warrior with his arm thrust up with a clenched fist. Because this arm and fist dominated the center of the painting, it made the warrior one of the most dominant figures in the composition. Yet this

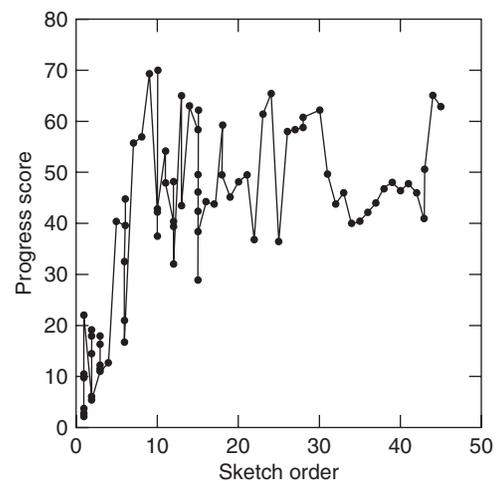


Figure 1 Estimated progress scores for the *Guernica* sketches plotted as a function of actual sketch order.

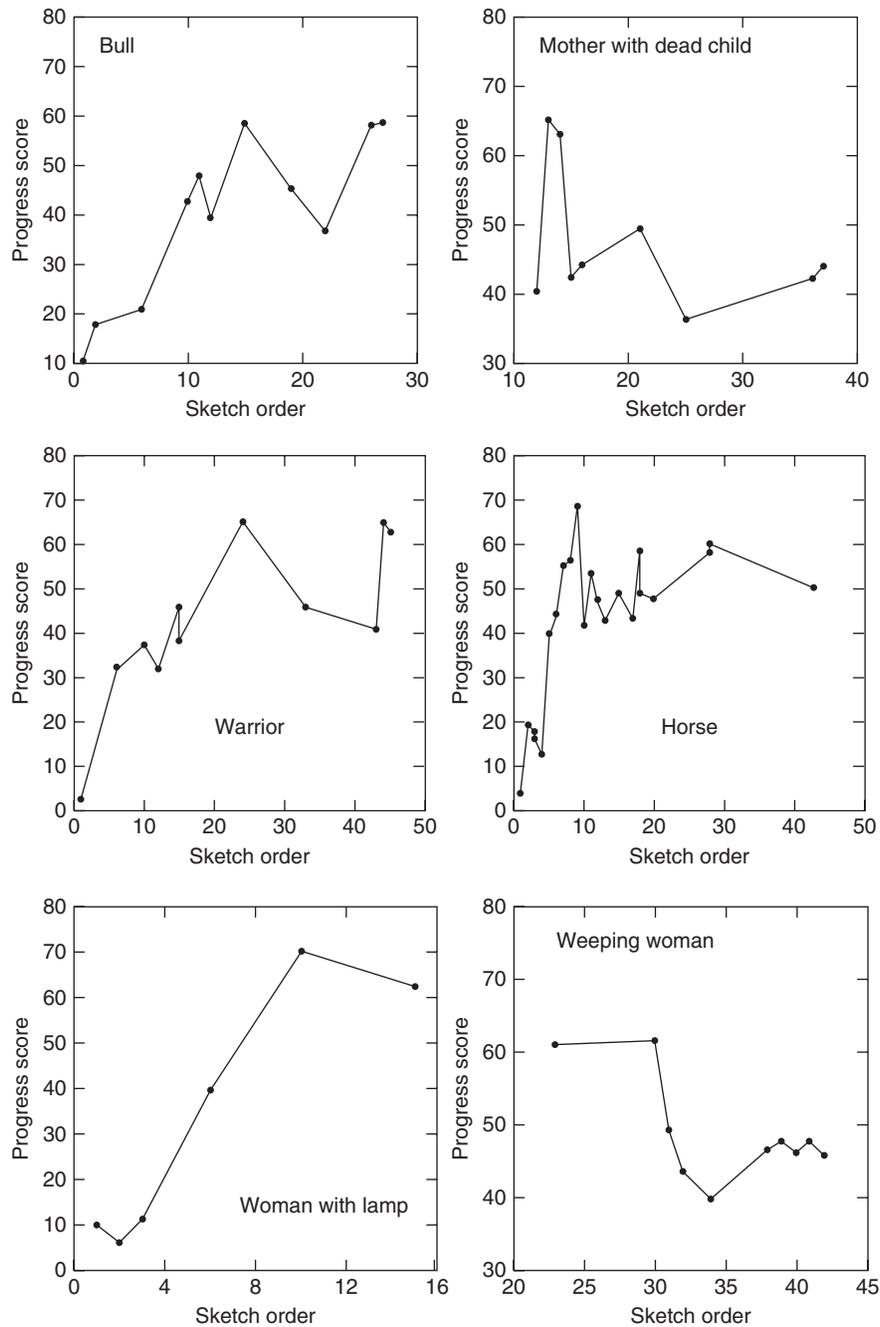


Figure 2 Estimated progress scores plotted as a function of actual sketch order separated by specific figure.

dramatic gesture was transformed until it totally disappeared. Its only remnants are some vestigial elements that now have no connection whatsoever with the fallen warrior. For example, the light in the top center of the finished painting was indirectly derived from the warrior’s fist.

These photographs show another curiosity: Picasso would sometimes attach wallpaper collages directly to the canvas. Not only would these come and go, but they would also appear in different places in the composition. The artist was visibly playing around with the possibility of completing the painting in the manner of Synthetic Cubism, but he changed his mind.

The final painting ended up largely linear and monochromatic, in contrast to many of his earlier sketches. Furthermore, the sketches often exhibited far more intense emotions than those displayed in the completed work. This emotional intensity is especially apparent in the sketches for the weeping woman, some of which images verged on the hysterical. This divergence is apparent in the bottom right-side graph of Figure 2.

All told, the sketches and the canvas photographs illustrate the extremely chaotic nature of Picasso’s creative process. This feature is especially striking given the phenomenal magnitude of the artist’s expertise. He had been painting for at least 4

decades when *Guernica* came into the world. Even so, he still needed to depend heavily on trial and error.

Conclusion

Picasso's stature as a creative artist has if anything increased since his death in 1973. Such contemporaries as Matisse and Braque seem to have lost ground in comparison. Picasso's elevated status was confirmed by a recent quantitative study that measured the amount of space devoted to various artists in standard reference works. Although Michelangelo ranked first, Picasso came in second, followed by Raphael, Leonardo, Titian, Dürer, and Rembrandt. The only other modern artists in the top 20 were Cézanne, Monet, Van Gogh, and Gauguin. Furthermore, Picasso produced a range of work in a diversity of styles and media that is probably unrivalled by any artist in any time or place. At the same time, he lived a fascinating and sometimes turbulent life. Not only is this life well documented, but so is the creativity corresponding to those life events. This wealth of data invites creativity researchers to delve more deeply into someone who can be viewed as the prototypical artistic genius.

See also: Historiometry; Michelangelo 1475–1564; Multiple Intelligences.

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Sylvia Plath 1932–1963

Novelist and poet

Author of *The Colossus and Other Poems*, *Ariel*, *The Bell Jar*, *Crossing the Water*, *Winter Trees*, and *The Collected Poems*

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SYLVIA PLATH (Victoria Lucas) was a creative American poet who died at the age of 30 in 1963 in England by putting her head in a gas oven. She wrote several volumes of poetry and a novel. Her work was based on her life experiences and had a confessional quality common also to the poets Robert Lowell and Anne Sexton. Plath had a severe depression when she was an undergraduate student, during which she attempted suicide. She was treated with electroconvulsive therapy and psychotherapy. Her life provides an opportunity to explore how creativity and psychiatric disorder interact throughout the course of a life history.



Sylvia Plath seated in front of a bookshelf. (Copyright CORBIS/Bettmann.)

Background

Plath's father, Otto Plath, was born in 1885 in the German town of Grabow. He emigrated to the United States when he was 15 years old and earned a doctorate in 1928, specializing in the study of bees. He began teaching at Boston University where he met a student named Aurelia Schober who was 21 years his junior. After divorcing his first wife, he married Aurelia in 1932. Sylvia Plath was born on October 27, 1932, three weeks ahead of schedule. She was somewhat frail because of a sinus condition that plagued her for the rest of her life. Two and a half years later, her brother Warren was born.

Plath's early years were uneventful. She apparently was quite bright and used her intelligence to please her father, as many firstborns do. She learned the Latin names for insects, and Otto would show off her skill to visitors. From the beginning, she earned straight As in school, impressing teachers with her intelligence and dedication. Aurelia read a lot to the

children as they grew, and Plath's verbal skills were so advanced that she went to school at age 4 and excelled right away. By age 5, she was writing short poems.

Otto fell ill in 1935, and he deteriorated over the next 4 years. He decided that he had lung cancer and chose not to seek treatment so that he would die quickly. He, therefore, initially refused to consult with doctors. In 1940, he noticed weird symptoms and finally sought medical advice. He found out that he had diabetes, which was treatable at that time, but he had waited too long before seeking treatment. In October 1940 his leg was amputated, and he died of an embolism on November 5, 1940, 8 days after Sylvia's birthday. Early loss is common among those who later commit suicide, and it may make them less able to cope with loss later in life.

Aurelia moved to Wellesley where she could raise her children in an educated and middle-class community and give them high-achievement experiences. Plath's first poem appeared in the *Boston Sunday Herald* in August 1941, when she was 8½ years old, and she won a prize for a drawing in another contest. As she progressed through school, her work continued to be outstanding, and she received many awards. She quickly developed an interest in literature and in writing. In junior high school she received straight As and a perfect record of punctuality. Her poems and drawings continued to win prizes. Her IQ was about 160. High school continued in the same vein. Plath took the advanced literature courses and edited the school magazine in her senior year. Her stories and poems appeared in magazines such as *Seventeen* and the *Christian Science Monitor*. She was also active in the local Unitarian church and in the community. She ranked first among the 158 graduates and was admitted to Smith College on a scholarship. Her biographers do not mention psychological problems at this time in Plath's life, though she tended to suffer from depression whenever her sinuses or menstrual cramps bothered her. However, the frequency and severity of the depressions is unclear. Plath's career at Smith was outstanding. From the first, she obtained mainly As, and her literary achievements steadily grew. Throughout her stay at Smith, she worked hard, often ending up fatigued and depressed. She continued to write and submit her work for publication. Despite frequent rejections, she built up an incredible body of published works. Indeed, a \$500 prize from *Mademoiselle* in the summer of 1952 led to an offer by Knopf and Dodd Mead asking her to consider writing a novel. However, not surprisingly, a run of rejection slips led Plath to question her ability and to fall into a depression.

Her junior year led to her most severe depression. She confided to her mother thoughts of suicide, and she saw a

psychiatrist in December of that year. But she continued to study hard and work toward winning a guest editorship at *Mademoiselle* in the summer of 1953, which she indeed won.

The summer of 1953 is the focus of Plath's novel *The Bell Jar*, written mostly during 1961 and 1962. At *Mademoiselle* Plath worked for Cyril Abels, reading and judging manuscripts and participating in all of the social activities planned for the group of guest editors. Abels noticed Plath's distancing manner and tried to break through and relate to the real Sylvia, but she failed to penetrate Plath's social mask. Although the guest editorship was exciting, Plath came home depressed by the experience.

Back in Wellesley, Plath was rejected for a course on creative writing at Harvard summer school, which left her with two months to fill. She could not write, and her depression worsened. After she cut her legs in a suicidal gesture, her mother began locking up the sleeping pills in the bedroom that they shared and took Plath to a local psychiatrist who diagnosed a depressive disorder and recommended electroconvulsive therapy. (In the 1950s, effective antidepressant medications had not yet been developed.) The electroconvulsive shock therapy seemed to make Plath's condition worse, and she developed chronic insomnia.

Plath contemplated using a razor blade to kill herself and she tried to drown herself in the sea. Eventually, on a Monday morning in August 1953, she took 40 sleeping pills from where her mother had locked them up, went into the basement of the house (after leaving a note saying that she was going for a hike and would be back the next day), and crawled behind some wood that was stacked there. (It appears that she threw up some of the pills, which possibly saved her life.) Her mother called the police that evening, and search parties were organized. Plath was not found until Wednesday afternoon when her grandmother went into the basement to do the laundry and heard Plath moaning. After a week in the hospital, Plath was transferred to the locked psychiatric ward at Massachusetts general Hospital where Erich Lindemann examined her. He diagnosed an adolescent nervous illness, whereas another psychiatrist diagnosed an acute schizophrenic episode. Her depression did not lift, and so she was transferred to McLean Hospital where she received insulin shock therapy, then chlorpromazine, and finally electroshock therapy again. This treatment was supplemented by psychotherapy from a female psychiatrist, Ruth Barnhouse. Barnhouse observed that Plath first refused to talk much and was angry at her mother. Barnhouse saw Plath as an intuitive-feeling type in Jung's schema, and Plath said that she felt she had been forced into using thinking to the neglect of feeling. Surprisingly, this time the electroconvulsive therapy helped and during the Christmas holidays Plath's depression disappeared. Plath was released in January 1953. She told a friend that she had tried to kill herself because she feared she had lost her talent to write. She also told him that she had tried to slit her throat when she was 10 years old, and she did have a scar on her throat. Barnhouse had encouraged Plath to no longer suppress her sexual impulses, so Plath had sex for the first time. When she returned to college, Plath confided to another friend that she had both loved and despised her father and probably wished many times that he was dead. When he died, she imagined that she had killed him (a theme that later appeared in one of her poems).

Aurelia heard from one of Otto's sisters that Otto's mother, a sister, and a niece had all suffered from depression, raising the possibility that an inherited predisposition to depression ran in the family. Plath spent another 1½ years at Smith and graduated in June 1955. Although Smith took away the scholarship for her first semester back, the college restored it for her final year. Graduation resulted in many prizes and awards, including Phi Beta Kappa and summa cum laude (one of only four students in her class so honored), and she was awarded a Fulbright scholarship to Cambridge University in England.

Plath had written at least 200 poems, short stories, newspaper articles, and magazine pieces, some of which had been published in national periodicals. Of course, she also received numerous rejection slips, but although the rejections often damaged her self-confidence they did not deter her from writing and submitting her work for publication.

Cambridge University and Ted Hughes

Plath spent 2 years at Newnham College of Cambridge University, where she eventually obtained her second BA. She hated the cold and rainy weather and the poor heating of the rooms. She fell ill frequently with sinusitis, colds, and the flu. She realized how much better prepared the British students were, and she abandoned plans to obtain a doctorate. She kept busy with course work, writing, and dating. Plath determined that she would be, at best, a minor writer and decided to settle down as a wife and mother who would write only in her spare time. Her depression worsened, and she saw a psychiatrist at the university. Then in February 1956, she met Ted Hughes. Hughes, an aspiring poet and writer like Plath, had graduated from Cambridge in 1954 and had worked in various odd jobs. Plath met him at a party in Cambridge and was attracted "at first sight." They married in June 1956.

Plath began to work with dedication on their literary careers, typing up and sending off submissions of both Hughes's work and her own. Their publications grew more and more numerous, and Hughes's first collection of poems was accepted for publication in 1957. They came to the United States, and Plath taught at Smith College for a year.

At this time, Hughes was the more successful poet. He had soon completed a second book of poems and a book of children's stories. His poems appeared in *The New Yorker*. The couple decided to return to England, especially as Hughes was not happy in the United States. But first they spent a year in Boston, and they supported themselves with the money Plath earned working at odd jobs along with their income from writing. Plath audited a course at Boston University from Robert Lowell, during which she met Anne Sexton, and her poems were eventually accepted by *The New Yorker*. Plath went back into therapy with Ruth Barnhouse and dealt with some of the feelings she had toward her mother and, with Barnhouse's encouragement, visited her father's grave.

Hughes was awarded a Guggenheim fellowship, which eased the couple's financial worries, and they were invited for three months to Yaddo, an artists' colony near Saratoga Springs in New York. They spent 3 months touring the United States during the summer of 1959, and during this trip Plath found

out that she was pregnant. They left for England in December 1959. Plath was twenty-seven, pregnant, and headed for permanent residence in a foreign country.

England and Suicide

The couple first rented an apartment in London. Plath gave birth to Frieda in April 1960. Visits to Hughes's family did not go well, as Plath and Hughes's sister Olwyn had severe conflicts. Later that year, Plath and Hughes looked for and found a house in Croton, Devon, with the help of loans from both of their families. Before moving, Plath found out that she was pregnant again. They rented their apartment in London to a Canadian poet, David Wevill, and his German-Russian wife, Assia Gutmann, and moved to Devon. Their literary careers continued to progress, and Plath's first book of poems was published in 1960. They each won prize after prize and by 1961 were successful enough as writers that their finances were thereafter in good shape. In 1961, Plath was awarded a Saxton Foundation grant to work on *The Bell Jar*. Plath gave birth to a son, Nicholas, in January 1962, but Hughes seemed unhappy to have a son and kept distant from the baby. He later admitted that he had not wanted any children. The cold winter made Plath ill and depressed, but life was full and busy with writing, the children, and a new house to fix up. By the summer of 1962, another woman had entered Hughes's life. Hughes and Plath had invited poet David Wevill and his wife Assia Gutman to visit, and soon Hughes and Gutman were in love and having an affair. Hughes left Plath in July, but Plath maintained hope that he would return to her.

Her work did not go well at this time. Plath's *Colossus and Other Poems* had received poor reviews, and the poems written in her new style were being rejected. She was also finding it hard to write. On her 30th birthday in October 1962, she was in Devon with two children, deserted by her husband, and now writing poems furiously every morning. By December Plath had moved to an apartment in London and had rented the house in Devon to others. The last few weeks of Plath's life were difficult. She corrected the galley proofs for *The Bell Jar* and was awaiting publication and comment. She was working feverishly, smoking heavily, hardly sleeping, and eating little. She had lost 20 lb. since the summer and developed influenza, after which the children came down with it. The winter was one of the worst ever, with frozen plumbing, strikes by the electrical workers, and snow and ice everywhere. The weather did not break until the end of January.

The reviews of Plath's book appeared at the end of January, and they were lukewarm. (She had published it under a pseudonym, which meant that reviewers would be less likely to give the work close attention that a work by Sylvia Plath would merit.) Her recent poems were being rejected, and her publishers could not sell *The Bell Jar* to an American publisher. In the last week of her life, from February 4, 1963 to February 11, Plath had a fever and wildly fluctuating moods. She lost her au pair on February 7 after arguing with her, and the weather was still bad. Plath kept in close contact with her physician, John Horder, and after February 4 she saw him daily. He treated her depression on his own, but also tried to refer her to a regular psychiatrist. Horder put Plath on antidepressants

(a monoamine oxidase inhibitor), and then, on February 7, searched for a bed in a suitable hospital so that Plath could be admitted. Two he approached were full, and one he deemed unsuitable. Friends invited Plath and the children to come and stay that day. On the evening of Friday, February 8, she met Hughes briefly and then came back to her friends' home. However, on Sunday she decided to take the children home, despite the protestations of her friends. Horder called her that night. That night she put the kids to sleep, opened their windows, placed milk and bread and butter by their beds, left a note on her downstairs neighbor's door to call Horder, sealed herself in the kitchen, and put her head in the oven and turned the gas on. Horder had arranged for a nurse to come on Monday morning, February 11. The nurse arrived at 9 a.m., but could not get in. She went to a public telephone to check on the address she was supposed to visit, and came back to see two children crying at the bedroom window. She found a workman who helped her break in, and they found Plath. The workman began artificial respiration, and the nurse took over. A police officer rescued the children, but when Horder arrived he pronounced Plath dead at 10:30 a.m. The gas had asphyxiated the downstairs neighbor too, and he did not regain consciousness until the late afternoon.

Discussion

The loss of her father when she was 8 years old looms large in Plath's life, especially because of the way she wrote about him. Plath seemed to be filled with anger over his rejection of her, both while he was alive (neglecting her for his research) and upon his death. Her poem written in the months prior to her suicide casts him as a devil, a concentration camp guard with her as a victim. She viewed Hughes as a father substitute. Yet she loved her father too and casts her suicide attempt years earlier as an effort to be reunited with him. (Interestingly, Plath eventually kept bees, as did her father, and she studied German, the language of her father. Her identification with him was strong.) Plath was depressed throughout her life, and it is likely that she had an affective disorder. Her first major breakdown occurred when she was an undergraduate, and her suicide has partly been attributed to her fear of becoming psychotic again. On top of this, she lost her husband, whom she loved, and who provided her with the environment to flourish as a mother and author. He not only left her, but he rejected her for another. In her novel about her psychiatric breakdown in 1953, Plath shows a distrust of her ability. She had worked hard to get good grades and to publish, but she feared that the success was temporary. However, Plath seemed to be quite persistent in her writing career and sent off poems and stories despite rejections.

Was Plath's Writing Helpful or Harmful?

Is writing therapeutic for creative writers or is it a stressor that can contribute to their psychological disturbance? Martin Silverman and Norman Will have argued that, although Plath tried to control her suicidal impulses by means of her poetry, she failed in this endeavor. Successful poetry, they suggested, must communicate between the inner worlds of the creative

person and the audience. (Presumably they mean *critically* successful, for even poor poetry can serve a useful psychological function for the writer, even if it is merely cathartic.) To be successful, poetry must first achieve a balance between the writer's use of the audience to serve his or her own narcissistic needs (a type of exhibitionism) and the desire to give others a way of structuring the terrors and anxieties that afflict us all. The writer must also achieve a balance between the potentially destructive conscious and unconscious forces motivating the writing and the constructive desires to harness these forces for the purpose of writing creatively. In terms of psychoanalysis, the writer must balance primary and secondary process mechanisms. The writer must also compromise between the fantasy permissible in writing and the acceptance of reality necessary for successful living.

When they applied their ideas to Sylvia Plath, Silverman and Will asserted that the successful creative process is successful only when the unconscious forces in the writer operate silently and remain hidden from view. This assertion represents a rather traditional view of creative writing. It would seem to express a preference on the part of Silverman and Will for a particular type of literature rather than expressing a universal truth. For example, the unconscious forces motivating Ernest Hemingway may be under control in his writing, but they are certainly not hidden, and the confessional style of poetry developed by W. D. Snodgrass and Robert Lowell and pursued by Anne Sexton and Sylvia Plath is in direct opposition to Silverman and Will's view. In Plath's later poems she revealed her deepest feelings, using her experiences to create the poem rather than to simply transform it. Silverman and Will noted that she described her early poems as "proper in shape and number and every part" but not alive. Her poems moved from being a reordering and reshaping of experience with a poetic purpose to becoming expressions of herself. She identified with her poems, which made their rejection even more painful, and Silverman and Will labeled this change as a "narcissistic regression." The causal sequence that Silverman and Will propose for Plath is simply one reading of Plath's life. Other equally plausible alternative paths can be proposed. For example, it is quite likely that Plath's participation—along with Anne Sexton, with whom she became very close—in a poetry workshop run by Robert Lowell had a major impact on her writing style. Several members of his workshop adopted a more self-revealing content for their poems, and two received Pulitzer prizes for their work (Lowell and Sexton). Furthermore, Plath, as she herself clearly recognized, was prone to recurring depressions. In all probability, Plath had an affective disorder, possibly bipolar, and her depressions were likely to reoccur periodically. It is evident from the severity of her

depression in 1953, which led to a very serious suicide attempt, that she would likely become suicidal again with each new depression (much as Virginia Woolf had).

It is interesting to note that although her writing may not have helped her cope with the stressors, external and intrapsychic, with which she was confronted during the early 1950s, in the later 1950s her switch to a more revealing and personalized style of writing may have helped her survive. Silverman and Will claimed that her writing failed to prevent her suicide. Perhaps it may have postponed her suicide? In the months prior to her suicide, Plath wrote feverishly, sometimes producing several poems in one day. (This feverish activity in the months prior to a suicide was apparent also in Anne Sexton's life.) What would Silverman and Will suggest as a more appropriate strategy for a person confronting intrapsychic turmoil who is not under professional care? It is very likely that the writing helped Plath control her inner turmoil, and some commentators think that the poems she produced were among her finest.

David Lester and Rina Terry have argued that writing poetry can be useful with suicidal clients. They saw the construction and revision of poems as serving a similar function for clients as the journal assignments devised by cognitive therapists by giving the clients intellectual control over their emotions and distance from the traumatic memories. Both Plath and Sexton showed manic trends prior to their suicides, writing poems furiously, poems with more emotional expression and less poetic crafting. Rather than arguing that writing poetry contributed in part to their suicides, it makes much more sense to say that, in their final breakdowns, poetry was no longer able to help them deal with the intrapsychic forces driving them as it had in the past. As their inner turmoil increased, both wrote feverishly, almost like a safety valve letting out the steam under pressure in a boiler, but to no avail because the pressure was building up faster than they could release it.

This final failure of the craft of poetry to keep Sylvia Plath alive may not signify total failure. She was an outstanding poet and functioned quite well given her psychiatric disorder. Perhaps the craft of poetry kept her alive for many years after her self-destructive impulses first manifested themselves.

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Play

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Glossary

Affect themes in play Emotion-laden content in the play narrative that reflects memories, thoughts, fantasies, and representations of events.

Divergent thinking The ability to generate a variety of associations, ideas, and problem solutions.

Play facilitation Improving the processes that occur in play such as imagination or affect theme expression.

Playfulness Cognitive spontaneity, social spontaneity, joy, and a sense of humor in approach.

Pretend play Play involving make-believe, an 'as if' stance, fantasy, and symbol substitution.

Pretend Play

Play is a universal phenomenon of childhood that comes in many forms. Pretend play which involves the use of fantasy and make-believe and the use of symbolism is the form most relevant to creativity. Pretend play also involves affect and expression of emotions. Greta Fein has conceptualized pretend play as symbolic behavior where one thing is treated as if it were something else. A lego becomes a milk bottle or a block becomes a telephone. Fein also stressed that pretend play is charged with feelings, so that affect is intertwined with pretend play. She viewed pretend play as a natural form of creativity.

Much of what has been written about the development of creativity in children has focused on the development of play. Keith Sawyer conceptualized pretend play in young children as being improvisational in that it is unscripted yet has loose outlines to be followed. Much of creative performance involves improvisation. Lev Vygotsky theorized that imagination developed out of children's play. He stated:

The child's play activity is not simply a recollection of past experience but a creative reworking that combines impressions and constructs from them new realities addressing the needs of the child. (1930/1967, p. 7)

Through play, children develop combinatory imagination—the ability to combine elements of experience into new situations and behaviors. Combinatory imagination is important in both artistic and scientific creativity.

Play follows a developmental process. Before two years of age, children play with objects similarly no matter what their actual functions are. Around two years of age, children discover that objects have specific functions. They recognize that a telephone is used to talk to someone and a plate is used to hold food. Also around the age of two, children begin to discover pretend play. They are able to pretend that a circular block is a wheel. Children continue to develop pretend play abilities throughout their childhood until about ten years of age. There are individual differences in how frequently children engage in pretend play and over what period of time during their childhood. In pretend play, children are able to think symbolically and not be confined to a single use of an object. The child is able to transform the object to represent many things but is also aware of the primary use of the object.

As children develop, their play becomes more complex. Jeffery Dansky (1999) pointed out that in high level play, children display all seven dimensions of original thinking described by Roberta Milgram: associative fluency; imagery; curiosity; fantasy; problem finding; metaphoric production; and selective attention deployment. He concluded that individual differences in play have implications for individual differences in creativity. Dansky also theorized that adopting the 'as if' frame in play may open the door to a mode of problem solving where one can play with ideas and possibilities, which is so important in creativity.

Fein studied the pretend play of 15 preschool children who were master players. From her observations, she concluded that good pretend play consisted of five characteristics:

1. Referential freedom. The 'as if' quality in play where one object is treated as if it were another, one person functions as if they were another, and time and place is as if they were different.
2. Denotative license. Pretend events occur and there is a divergent stance with respect to actual experience.
3. Affective relations. Symbolic units represent affective relationships such as fear of, love of, or anger at. Information about affective events are stored and manipulated in ways that make affective sense for the player.
4. Sequential uncertainty. There is a nonlinear quality to the sequence of events.
5. Self-mirroring. The self is observed through a distance. Children are aware of the pretend quality.

Play and Creativity

In 1983, Nathan Kogan stated that the research on the play and creativity link was the most promising set of findings in the children's creativity literature in the previous decade. The promise of that early research has continued to be realized. Edward Fisher in 1992 conducted a meta-analysis in the play and child development area. He found that the strongest relationships were between play and divergent thinking and play and perspective-taking criteria. He concluded that play does result in improvement in children's development. The strongest relationships were with cognitive abilities important in creative thinking.

It makes theoretical sense that pretend play would relate to creativity because many of the processes involved in the creative act occur in pretend play. In order to study play and creativity, one must be specific about the underlying processes involved. Sandra Russ in 2004 reviewed the literature and developed a model of cognitive and affective processes that occur in both play and creativity. Through pretend play, children practice cognitive processes such as divergent thinking, organizing thoughts into a narrative, flexible thinking, and the use of symbolism and fantasy. Pretend play also is a medium for affective processes to be expressed. Children use play to express emotions and affect-laden fantasy, to regulate emotion, and to experience the joy of the play experience itself. Interpersonal processes can also be observed in pretend play. Characters communicate and interact with one another and role play different perspectives.

Pretend Play and Creative Cognitive Processes

Dorothy and Jerome Singer suggested that areas of cognitive development are facilitated by pretend play abilities. Play helps the child to expand vocabulary and link objects with actions. For example, a child can learn words and actions by labeling objects and their functions through play – “I drink from a cup” or “I go in a car.” Play also helps the child develop object constancy and form event schemas and scripts. Playing peek-a-boo is very exciting for a young child who learns that even though mother is hiding, she will return. Pretending to play house or doctor is another way children learn about their world. Pretend play also helps children learn strategies for problem solving, develop divergent thinking ability, and develop a flexibility in shifting between different types of thought (narrative and logical). Singer and Singer thought that the last two categories were especially important in creative thinking.

Cognitive processes thought to be important in creative thinking are divergent thinking, transformation abilities, and insight. Divergent thinking is the ability to generate a variety of ideas. J. P. Guilford identified divergent thinking as important in and unique to creative problem solving. A typical item on a divergent thinking test would be “How many uses for a newspaper can you think of?” Divergent thinking involves free association, broad scanning ability, and fluidity of thinking.

Guilford also proposed that transformation abilities were involved in creative thinking. Transformation abilities involve a flexibility of thought that enables breaking out of an old problem solving set and seeing a new way to solve a problem.

Insight into the solution of a problem is important in creativity. Early research on play and creative problem solving investigated play and insight ability. Studies found that play in children three to five years of age facilitated insight in a problem solving task. Brian Vandenberg concluded that all the studies had the consistent finding that play facilitated insightful tool use and enhanced motivational activity. Variables of task type and difficulty and age were mediating factors. He discussed the similarity between play and creativity in that both involve creating novelty and disregarding the familiar.

Much of the creativity and play research has focused on divergent thinking. Singer and Singer thought of play as practice with divergent thinking, so there should be a strong

relationship between play and measures of divergent thinking ability. Many researchers found significant relationships between play and divergent thinking, usually independent of intelligence. For example, Russ and her colleagues found consistent relationships between fantasy in play and divergent thinking in preschool children as well as elementary school children. In one longitudinal study, play in first and second grade children was related to divergent thinking ability when they were in the fifth and sixth grades. Children who could use fantasy and imagination on a pretend play puppet task could generate more uses for objects (fluency) on a divergent thinking task. The relationship between pretend play and divergent thinking remained stable over time.

Much of the research in this area has been correlational in nature, but there are some well-carried out experimental studies that found that play facilitates divergent thinking. Dansky completed several studies which indicated that play enhanced divergent thinking in preschool children. In one of his studies, he found that free play facilitated divergent thinking, but only for children who engaged in make-believe. It was the pretend element that was important. Some critics of this research raised the issue of unconscious experimenter bias because the same experimenter gave the play and divergent thinking tasks. Peter Smith and Sue Whitney, in a carefully executed study, failed to confirm the hypothesis that play would enhance divergent thinking in preschool children. However, it is also possible that introducing a new examiner between the play and the divergent thinking task broke the set that was being induced by the play. Thus, there would be no experimental effect of play on problem solving. Another important point is that there have been a number of correlational studies that did use different examiners for the play and divergent thinking tasks and did find significant relationships between the variables.

Although there is much evidence suggesting that similar processes are involved in play and divergent thinking, we must speculate as to the actual cognitive processes that account for the link. Dansky’s theoretical explanation was that the process of free combination of objects and ideas involved in play is similar to the elements involved in creative thinking. He thought that the free symbolic transformations inherent in pretend play created a temporary cognitive set toward a loosening of old associations. Others stressed the role of play in the development of flexibility in problem solving. Play provides the opportunity to explore new combinations of ideas and to develop new associations for old objects. The capacity to see old objects and ideas in new ways should aid in developing transformation abilities; that is, the ability to break out of an old set and see a new solution to a problem. Also, children’s play behavior involves a search for alternate modes of relating to the object, a process similar to searching for alternate uses for objects in divergent thinking tasks. Anthony Pelligrini conceptualized that in play children recombine behaviors and develop flexible strategies. His research with rough and tumble play supports that concept.

In summary, much of the explanations about why play relates to creativity, and especially divergent thinking, have focused on cognitive variables such as cognitive flexibility, loosening of old cognitive sets, practice with associations, recombination of old objects and ideas and symbolic transformations.

Pretend Play and Creative Affective Processes

Pretend play is infused with affect for many children. Children use play to process emotions. J. Singer has discussed how play helps children organize their emotional experience. Affective processes also play a role in creative thinking.

Fein, Russ, and J. and D. Singer are all theorists who have stressed the importance of affect in play in the link to creativity. Fein proposed an affect symbol system that gets activated in pretend play and is important in creativity. An affective symbol stores information about emotional events and is manipulated and worked with in pretend play. Russ, from a psychodynamic framework, stressed the importance of pretend play in helping children access emotional memories and fantasies and associations. Children who are comfortable letting their thoughts roam a broad spectrum of associations and memories that are affect-laden should be more creative. Singer and Singer thought that a cognitive-affective framework was central to exploring imaginative play.

Just as it is important in creativity to play with ideas and images, it is also important to play with affective content. Affect expression in play occurs from a very young age. Interestingly, when we compare affect expression in the play narrative in children from six to ten years of age, we do not find developmental differences in the amount of affect expression over these years. In terms of stability of affect expression, Russ, Robins, and Christiano found significant relations between affect expression in children in play when they were first and second graders, and affect expression in play narratives when they were sixth and seventh graders. This finding suggests some stability in the tendency to express emotion and emotional themes in narratives across time.

Fein viewed affect as being intertwined with pretend play. She suggested that pretend play is symbolic behavior organized around emotional and motivational issues. The proposed affective symbol system manipulated and elaborated in play represents a child's affective relationships. This system could be activated by pretend play or drawing and is important for creative thinking.

Russ, after reviewing the literature, proposed categories of affect that are important to creativity and also occur in play. These include:

1. Access to affect-laden thoughts and ideas. This is the ability to think about emotional content. Affective symbols would be in this category as would primary process thinking, a key psychoanalytic concept.
2. Openness to affect states and feelings. Experiencing the emotion is also important to creativity and children use play to express positive and negative emotions.
3. Affective pleasure in challenge and problem solving. This is the ability to experience pleasure and joy in play and to 'get lost' in the play experience.
4. Cognitive integration, emotion regulation and modulation of affect. This blend of affect and cognition that is important in creative thinking and occurs in play. Emotion is in the context of a narrative.

Russ in 1987 developed the Affect in Play Scale (APS) to meet the need for a standardized measure of affect in pretend play. Until then, measures focused on cognitive aspects of play.

The APS uses puppets and blocks with standardized instructions in individual five minutes play sessions. The play is videotaped and coded for amount of affect expression in the play. Frequency and variety of affect themes is scored with a frequency count. Enjoyment of and comfort in playing is rated on a five point Likert scale, as is imagination and quality of the fantasy narrative. There is also a preschool version of the scale that uses a variety of toys with more structured instructions. Recently, Russ developed a brief rating version that rates the child's play in vivo and does not require videotaping.

Research using the APS with a variety of child populations and researchers found significant relationships between affect in play and creativity. In general, children who express more affect in play are more creative. Affect expression in play has related to fluency and originality in divergent thinking, to teachers' ratings of fantasy ability, and to emotion in memory narratives. In most samples, these relationships were independent of verbal intelligence.

It is important to note that both positive and negative affect in pretend play relates to creativity. Happy themes like having fun and aggressive themes of wrestling or bickering are examples of positive and negative themes in play. Because play is pretend, there may be positive affect accompanying even the negative affect themes. Or the negative affect themes may be modulated in intensity by the child so that they are not too negative.

There is some evidence that the expression of affect in fantasy is cross-situational. Affect in play has related to expression of affect in memory descriptions and expression of affect themes on the Rorschach. The relation to affect themes in memory descriptions could have implications for creative writing. Children who develop the ability to think about emotion-laden memories and express affect in narratives would have an advantage in areas of creative writing where emotions and understanding the emotions of others is important.

Playfulness and Creativity

Playfulness is another general characteristic of play that is important in creativity. It is generally accepted that a playful individual has an internal predisposition to interact within their environment in a playful way regardless of their exposure to tasks, contexts, or materials that may yield behaviors that are related to play. Lynn Barnett defined playful individuals as those who naturally possess the ability to frame or reframe their experiences in a way to provide oneself with "amusement, humor, and/or entertainment."

A pioneer in the research of playfulness, Nina Lieberman attempted to distinguish differences between play behaviors and playfulness as a trait in children. From her research she was able to delineate five components to describe this playfulness quality: physical spontaneity, cognitive spontaneity, social spontaneity, manifest joy, and sense of humor. Physical spontaneity referred to the level of movement and coordination during play. Cognitive spontaneity described the imaginative qualities of play and a child's willingness to assume different character roles and unconventional uses of objects. Social spontaneity emphasized flexibility in interactions with other children and a child's willingness to initiate play and interact with others. Manifest joy described a child's ability to express

enjoyment and enthusiasm while playing. Sense of humor referred to a child's ability to clown around, tease, and joke with other children. Lieberman found that playful kindergarten children did better on divergent thinking tasks than nonplayful children.

Building on Lieberman's work, Barnett developed a more reliable measure of playfulness which also supported that playfulness is a single characteristic that describes an individual's predisposition to play. Barnett and others explored relationships between playfulness and other personality traits. Barnett found that playfulness related to several personality descriptions, such as bright, active, aggressiveness, cheerful, self-confident, imaginative, impulsive, mischievous, and responsible. Other researchers found a strong relationship between playfulness and several adaptive personality traits like creativity, humorousness, emotional expressiveness, curiosity, openness, novelty-seeking, and communicativeness. In addition, children who were considered playful also demonstrate greater levels of positive affect, physical activity, communication, and imaginative and social behaviors in play than less playful children. Other researchers found a relationship between play and personality factors of positive mood, persistence, approachability, and adaptability.

Converging evidence suggests that children who are playful tend to be more flexible in their understanding of the world, more approachable, tend to initiate contact with others, and have an assertive style that may contribute to their ability to act adaptively when distressed. It may be that children who are naturally playful are more effective and efficient at dealing with their problems in their environment. Nonetheless, more research is needed to better understand the relationships between playfulness and positive adaptive behaviors.

Lieberman also discussed the importance of joy in playfulness. Children experience joy in play. Passion and the tendency to become absorbed in the task has been identified as crucial by many creativity researchers. To let passion and joy of learning develop in children is becoming increasingly difficult in our culture. Yet love of the task is necessary to help the individual tolerate all of the negative and frustrating components of the creative process necessary to make a major contribution. In play, children are beginning to experience the joy of getting lost in the task and doing something for the love of it.

Interpersonal Functioning

Developmental theorists, Vygotsky and Jean Piaget, believed that interaction through peers fosters problem solving and play development. Vygotsky identified a zone of proximal development, which includes tasks that are too difficult for the child individually, but are possible with guidance by adults or more skilled peers when the child is playing. Piaget also emphasized the importance of peers in the development of problem solving skills, but suggested the peers need not be more advanced. Through interactions with others at a similar developmental stage, children learn different perspectives, discuss possible resolutions, and decide on the best solution. Children develop problem solving skills, as well as advance their play skills, through this resolution process.

Pretend play is also related to understanding emotions of others, perspective-taking, and empathy with other children.

Paul Harris proposed that imaginative understanding may enable children to understand others' mental states and affective experiences. The research supports this proposition. Understanding the emotions and perspectives of others is important in a variety of domains such as fiction writing, poetry, screenwriting, play-writing, and song writing.

There is also a growing literature on the importance of having imaginary friends in childhood. Marjorie Taylor has done much of the research on the creation of imaginary companions during the preschool years.

Russ in 2004 summarized the play and creativity research and concluded that play is related to many of the cognitive and affective processes important in creativity. Much of the research is correlational but there are some well-designed experimental studies as well. Russ speculated that pretend play helps the child become more creative by:

1. Practice with free flow of associations that is involved in divergent thinking.
2. Practice with symbol substitution, recombining of images, and manipulation of object representations.
3. Expression of positive affect, which is so important in creative work. Playfulness and the love of the experience of getting lost in a task and experiencing joy.
4. Expression of positive and negative affect themes in fantasy. The child develops access to a variety of memories and associations and manipulates affective symbols.
5. Developing narratives that integrates and regulates the emotions.
6. Expanding understanding of the emotions and perspectives of the other.

There is definitely a need for more research that investigates the underlying processes and mechanisms that account for the well-established relationship between play and creativity in children.

Facilitating Pretend Play and Creativity

One way to foster creativity in children is through facilitation of pretend play ability. There have been efforts to improve children's play skills. Many of these play training studies have been in an academic context rather than a therapeutic context. Smilansky's study in 1968 was one of the first to demonstrate that teachers could teach play skills. She worked with kindergarten children from low SES backgrounds in Israel for 90 minutes a day, five days a week, for nine weeks. The children who engaged in sociodramatic play, with help from their teachers, showed significant cognitive improvement when compared with other groups. Teachers helped the children develop their play by commenting, making suggestions, and giving demonstrations. Play training has been found to be effective with mentally retarded populations. Additionally, in Austria, when compared with a control group, low-SES elementary school children who were instructed in play four hours per week had better divergent thinking skills and were happier in school.

One of the methodological problems with many studies in the play facilitation area is the lack of adequate control groups. Smith stressed that adequate research design requires the

inclusion of a control group that involves experimenter-child interaction of a form other than pretend play. He concluded that when this kind of control group is included, usually both the play group and the control group improve. Dansky reached a different conclusion after reviewing the play training literature. He found that many studies did have adequate control groups that controlled for involvement of the experimenter. Dansky concluded that there were consistently positive results in studies with adequate control groups that demonstrated that play tutoring, over a period of time, did result in increased imaginativeness in play and increased creativity.

Russ and colleagues investigated the effects of play intervention techniques on children's play skills and associations with creativity, coping, and life satisfaction. Participants were 50 first and second grade children in an inner city school (99% African-American). Children were randomly assigned to either the imagination play group, the affect play group, or the puzzles/coloring control group. Each participant met five times with a play trainer in individual sessions. A standardized play intervention was used for each play group.

The major result of this study was that the play interventions were effective in improving play skills. The affect play condition was most effective in that, after baseline play was controlled for, the affect play group had significantly higher play scores on all play and cognitive processes. These children had more affect in their play (both positive affect and negative affect), a greater variety of affect content, and better imagination and organization of the story than did the control group. The imagination play group also had significantly more positive affect and variety of affect than the control group. Another major finding was that, on outcome measure of divergent thinking, there were significant effects for group. When we did a follow-up study of these children four to eight months later, only the imagination group had improved play skills over time. Results for the affect group did not hold over this period. Also, the increase in divergent thinking did not hold. The longer lasting effect of the imagination intervention on play skills is interesting and warrants more research. In general, the results are promising that a brief standardized play intervention can improve children's play skills, which may, in turn, enhance creativity, coping, and feelings of life-satisfaction.

Kasari and colleagues in a randomized controlled study with autistic children, found that a play intervention resulted in increased symbolic play. This was a very rigorous study that began the intervention at the child's current developmental level of play. The training involved modeling and prompting. Children in the play group, compared with the joint attention and control groups, showed increased symbolic play that generalized to play with the mothers. This study is relevant to creativity because children with autism have deficient pretend play skills. Techniques that facilitate play in these children should be effective with other groups as well.

Erin Barton and Mark Wolery, in a review of the literature on play with children with disabilities, concluded that there is a consistent relation between pretend behaviors in the child and adult prompting and modeling. However, there were many methodological problems with the studies. The authors did think that teachers could prompt pretend play in the classroom, but for generalization to occur, multiple exemplars of materials and multiple trainers should be used.

There is some research that guides parents in helping children to develop their play skills. Singer and Singer, in 1999, developed a video-based program for parents and other caregivers of preschool children that uses make-believe play to enhance literacy. This is a comprehensive program called 'My Magic Story Car.' Children watch pretend play games on the video and then play the games. In a nationally tested study, they found that key literacy skills improved after the program was utilized. In addition, the majority of children continued to play the make-believe games on their own without adult intervention and teach the games to other children.

The building of empirical research on specific play interventions is encouraging and needs to continue. Future research should continue to identify the specific prompts and techniques that facilitate play. More randomized controlled studies with rigorous methodology are needed. Hopefully, these prompts and techniques could be adapted to a variety of settings and child populations. Dissemination of the scripts to parents and teachers for everyday use is an important next step.

Changes in the Culture of Play

Over the past few decades, time for free-play has decreased. Children are heavily scheduled for structured activities and the computer and videogames have taken over much of childrens' free time. Children throughout the world do not have enough opportunities to be involved in unstructured activities. However, even considering the shift in focus, David Elkind suggests that children maintain the same desire to play. Although there are fewer spaces and less designated areas of play, children continue to play games and create learning experiences. They reinvent outdoor areas for make-believe games and change routine activities into games of finishing first or lasting the longest. Although it is difficult to generalize, it seems that many children continue to foster their creativity and problem solving through play.

Recent findings by Russ and Dillon are consistent with Elkind's view. They reviewed play studies from 1986 to 2008 with different school-based populations that used the same standardized play task, instructions, and scoring system (Affect in Play Scale). They found that the organization of the play narrative and amount of affect expression has remained stable over this 20-year period. Imagination in the play narrative has significantly increased in recent years. These findings suggest that children are finding ways to develop abilities to express imagination and affective expression even though there is less unstructured time available to them.

Conclusion

Research continues to support the relationship between pretend play and creativity. Both cognitive and affective processes that are important in creativity occur in play and, we think, are developed in play. The studies that are developing play interventions that facilitate play skills and creativity are crucial in expanding our understanding of how play helps child development. Increasing sophistication of research design, measurement tools, and play facilitation techniques are necessary to

move the field ahead. The study of the individual child is also important to include in our research repertoire. Fein's study of master players continues to be a rich source of information and research ideas. If we can continue to build research evidence that play facilitates creativity and child development in general, then we will have strong arguments about the importance of play in order to influence social policy. In the meantime, children will continue to find ways to develop their imagination and find time to play.

See also: Divergent Thinking; Emotion/Affect; Improvisation; Insight.

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Relevant Websites

- www.zerotothree.org – Zero to three - National Center for Infants, Toddlers, and Families.
- www.playengland.org.uk – Play England.
- <http://www.ncb.org.uk/cpis/home.aspx> – Children's play information service.

Poetry

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Glossary

Canon A body of literary works said to define the tradition.

Foot A group of syllables serving as a unit of meter, in verse: for example, *spondee* (two accented syllables); *iamb* (one unaccented syllable preceding one accented syllable); *trochee* (one accented syllable preceding one unaccented syllable); *anapest* (two unaccented syllables preceding one accented syllable); *dactyl* (one accented syllable preceding two unaccented syllables).

Free verse Rhymed or unrhymed poetry composed without attention to conventional rules of meter.

Image and imagery A figure of speech, especially metaphor or simile; a representation of a thing.

Line Phrase or words that make up a theoretical pattern of verse: for example, *dimeter* (two feet), *trimeter* (three feet), *tetrameter* (four feet), *pentameter* (five feet), *hexameter* (six feet).

Meter Measured, patterned arrangement of syllables in lines of poetry according to stress and length.

Mimesis Imitation or representation.

Muse One of the nine goddesses who presided in Greek mythology, over art, literature, and the sciences. The spirit that inspires a poet.

Poem An arrangement of words in verse, always rhythmical, sometimes rhymed, expressing facts, ideas, or emotions in a style more concentrated, imaginative, and powerful than that of ordinary speech, sometimes in meter, sometimes in free verse.

Poesis Making or invention.

Rhyme Correspondence of end sounds in lines of verse or in words.

Rhythm Regular recurrence of grouped strong and weak, stressed and unstressed, long and short, high-pitched and low-pitched syllables arranged in feet or cadences, in alternation.

Stanza A group of lines of verse forming one of the units of a poem.

Symbol A sign that refers to or stands for another thing, usually abstract.

Verse A sequence of words arranged metrically in accordance with some rule or design.

Definition

A poem is an arrangement of words in verse, always rhythmical, sometimes rhymed, expressing facts, ideas, or emotions in a style more concentrated, imaginative, and powerful. Poetry is of poems.

Introduction

Poetry is the oldest form of literature. It is characterized by meter, rhythm, rhyme, and/or verse. Called by many the highest of the linguistic arts, it is written by poets. (The obsolete term 'poetess' is no longer in use, as both male and female practitioners prefer to be called poets.) Both poetry and the other form of literature, prose, are distinguished in that they are written from the imagination. Poetry, however, is metrical or at least cadenced. Poetry is an art form in which every word, punctuation mark, capital letter, line break, rhyme, rhythm, and stanza have meaning. Poetry is an art form in which things always mean more.

Kinds of Poetry

Lyric Poetry

Lyric poetry has a strong emotional component, using imagery, especially of nature. The emotion is compressed with attention to sensuality. Lyric poetry has its origins in musical singing,

chanting, and reciting to accompaniment. By the Renaissance, however, the bard (singing and strumming poet) gave way to the lyric poet who wrote to be read and not for a musical presentation.

The lyric poem came to have its own rules:

1. Edgar Allan Poe (1809–49) said it must be brief;
2. Samuel Taylor Coleridge (1772–1834) said it must be unified and metrical;
3. William Wordsworth (1770–1850) said it must be "the spontaneous overflow of powerful feelings";
4. Friedrich Hegel (1770–1831) said it should be subjective, personal, and intense;
5. Arthur Schopenhauer (1788–1860) said it should be "an inverted action of mind upon will";
6. John Stuart Mill (1806–73) said it should be concrete, like a brief overheard conversation;
7. Northrup Frye (1912–91) said it is "an internal mimesis of sound and imagery";
8. Herbert Read (1893–1968) said it is "the imaginative prehension of emotional states";
9. James Joyce (1882–1941) said it is where the poet "presents his image in immediate relation to himself."

The relation of the form to music is apparent in that the words of songs are still called 'lyrics.'

Lyric poetry includes not only popular and folk songs, drinking songs, hymns, lullabies, and love songs, but

philosophical poetry, dream visions, satire, odes, epigrams, sonnets, and elegies. Lyric poetry has its traditions in all cultures and geographical regions. In recent years, it has taken digital form, using hyperlinks to visual and kinetic elements and even texts generated by machine.

Narrative Poetry

Narrative poetry includes the epic poem, the romance, the ballad, the verse tale. The narrative usually tells a story of historical import. Narrative poems are difficult to categorize metrically, as sometimes they look like prose, and sometimes they use strict meter and verse. An example of the former is John Clare's *The Badger*; an example of the latter is Byron's *Don Juan*.

Dramatic Poetry

Dramatic poetry imitates speech, and is exemplified by the Greek tragedies, Shakespeare's plays, Molière's work, Goethe's *Faustus*, Pushkin's *Boris Gudonov*, Ibsen's *Peer Gynt*, Eliot's *Murder in the Cathedral*, and Shange's *For colored girls who have considered suicide/when the rainbow is enuf*.

History of Western Poetry

Each national and ethnic group has its own revered and special poetic heritage. Because this encyclopedia is written in English and published in the United States, within the sphere of the roots of that language, this brief history will concentrate on the history of western poetry.

The first poet of the Western canon was Homer, who wrote the *Odyssey* and the *Iliad* circa 2000 BCE, yet poetry is much older than Homer, who wrote from oral traditions dating from as far back as the eighth century BCE. Poetry is older than writing. In the Judeo-Christian canon, much oral poetry was captured in the Old Testament, especially in such books as the Psalms. One of the most common forms of poetry was the hymn, an ancient Greek liturgical genre. Hymns have been found in all cultures, including aboriginal, Oriental, and African. Hymns were religious verses which praised the gods, heroes, or patriotic or religious abstractions.

Poetry was the spoken form of hymns and songs. By the fifth century BCE, Socrates (470?–399? BCE), Plato (c. 428–347 BCE), and Aristotle (384–322 BCE) were functioning as critics of poetry, and their works formed the first literary criticism. Poetry was described as being about heroes, gods, and common people; poetry was of concern to the public; poetry was itself a form of entertainment and delight to the people; poetry was touched with the divine, inspired by gods or Muses; poetry was both an art and a craft; the poet was secular, not a priest, prophet, or god. In Socrates' dialogue with Ion, Plato defined poetry's themes:

Is not war his [Homer's] great argument? And does he not speak of human society and of intercourse of men, good and bad, skilled and unskilled, and of the gods conversing with one another and with mankind, and about what happens in heaven and in the world below, and the generations of gods and heroes?

In his dialogues, Plato viewed poetry as both inspiration and imitation. Poetry was a gift possessed by poets, and Socrates said it was not an art but "an inspiration; there is a divinity moving you." The divinity was like a stone magnet that attracted iron which in turn attracted other iron. The Muse inspires the poet who inspires others.

All good poets, epic as well as lyric, compose their beautiful poems not by art, but because they are inspired and possessed. (*Ion*)

Poets fall under the spell of music and meter.

For the poet is a light and winged and holy thing, and there is no invention in him until he has been inspired and is out of his senses, and the mind is no longer in him; when he has not attained this state, he is powerless and is unable to utter his oracles. (*Ion*)

Yet Plato also thought that the poet was an imitator. That is, the poet committed these inspirations to written language which is imitative, a *mimesis*. The language is referential, that is, representative of the emotion and captures the emotion through certain linguistic conventions such as metaphor, simile, and other figures of speech – as well as through imagery, rhyme, rhythm, and sound. Poetry as *mimesis* was inferior, as it was but an imitation, a copy, of the real form which existed in the ideal, nonmaterial world. Thus poetry was not truly creative, as it was written or oral representation and not original. This idea lasted until the time of the romantics in the eighteenth century, when poetry became *poesis*, or making. In Plato's *Republic*, the poet was to be relegated to a lesser height than the politician because of this imitative representation.

To Aristotle, however, poetry was more true than history because the poet could fabricate truth from the elements of history rather than exhaustively tell the facts. The poet is able to tell the truth on a deep level, being able to see the patterns, and the overarching themes. Aristotle said:

The distinction between historian and poet . . . consists really in this, that the one describes the thing that has been, and the other a kind of thing that might be. Hence poetry is something more philosophic and of graver import than history, since its statements are of the nature rather of universals, whereas those of history are singulars. (*Poetics*)

Though Aristotle spoke of the forms of poetry called drama (tragedy and comedy) and the epic poem, subsequent critics and thinkers have credited Aristotle with denoting the true nature of poetry. Poetry can capture the inner essence of a situation whereas history cannot. This idea about poetry was not to resurface in any major way until the late seventeenth century. Until then, poetry was often viewed as a branch of logic.

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The fact that poetry spoke of universal truth was the aspect of poetry that attracted the romantics in the eighteenth century and up to the present. Unlike the classicists of the Middle Ages and the neoclassicists of the seventeenth century, who produced poems in strict Platonic imitation, *mimesis*,

the romantics and later poets did not focus so much on the prescribed forms with their prescriptive line lengths in certain kinds of syllabic meter (i.e., iambic, trochaic, anapestic, and the like), but instead focused on the Aristotelian idea that the poem speaks more truly of a situation than a historical text could. The poem defined the inner reality. It was constituted of inner truth and not outer conformity to verse standards.

The poet thus was thought of as a seer, someone who could probe to the inner depths. However, the poem was not mere psychological essay, but a form of art evoking the Aristotelian fear and pity, a sense of beauty and of awe in both the poet and in the audience with its wedding of words and the elements of rhythm, rhyme, and stanza. The purpose of the poem was not to persuade, for that is the purpose of rhetoric and not poetry. The very form of the poem combined with the elements of poetic syntax, and put together with the denotative 'meaning' created something beyond meaning, inseparable from the form. The words of the poem form sound, a pure, nonintellectual substance heard by the ear and resounding within the throat or the breast. Mimesis was thus combined with poesis.

Nineteenth century romantic philosophers debated the meaning of the sense of beauty (fear and pity) evoked by the poem (imagination), the form of the poem (sense), and the moral influence of the poem (intellect). In Germany, Kant (1724–1804), Schlegel (1772–1829), von Schiller (1759–1805), Hegel (1770–1831), Schopenhauer (1788–1860), and Nietzsche (1844–1900) thought about and debated the aesthetics of poetics.

In England William Wordsworth wrote a preface that became classic, to the second edition of his *Lyrical Ballads*. The poems were written in common language and not in neoclassical diction. Meter alone distinguished poetry. Although meter is also present in prose, poetic meter has regularity detectable in the line. Followed by poetic reflections by Samuel Coleridge (*Biographia Literaria*), John Keats (1795–1821), Percy Bysshe Shelley (1792–1822), and George Gordon Lord Byron (1788–1824) these English romantic poets asserted their own philosophy. They revered the noble poet standing alone against the vagaries of the world and sentimentalized the peasant and the savage. The solipsism of self-reference in some romantic poetry led to a backlash by postromantics such as Victorian critic John Ruskin (1819–1900) and poet Matthew Arnold (1822–88).

In France, romanticism was personified in Jean-Jacques Rousseau (1712–78), a prose writer who had great influence on poetic thought with his visions of oneness with nature. Lamartine (1790–1869), Vigny (1797–1863), and Hugo (1802–85), among others such as Baudelaire (1821–67) continued with pantheistic and magical realistic views of nature as the source of feeling and a guide to spiritual wholeness. They also advocated a return to common language and disavowed classical form. By the end of the century, the poet was regarded as having a special magical relationship with the unknown and poetry were regarded as prophecy. The works of Arthur Rimbaud (1854–91) and Stéphane Mallarmé (1842–98) expressed this.

At the end of the nineteenth century the French symbolists such as Jules Laforgue (1860–1887) along with Mallarmé, Rimbaud, Paul Valéry (1871–1945) and Verlaine (1844–1896) asserted that poetry was overwhelmingly music and should capture from music the elements that belong to poetry.

Poetic symbol shows a relationship between the thing and the readers. Prosody, or the ancient forms of verse, should be utilized in this attempt. Symbols expressed truth through suggestion rather than narration. Symbolist poetry also uses experimental grammar, many allusions that may make the poetry rather obscure. Paul Claudel (1868–1955) asserted that the symbol is metaphoric, that is, a relationship between two subjects. Each object is named and compared with another object, perhaps a divine object. For Claudel, the syllogistic nature of the old poetry should be replaced by the logic of the metaphoric and the symbolic.

In the dialectic of poetic history, Apollinaire (1880–1918) asserted a return to the lyric sensibility. His work and thought paralleled the rise of cubism, Fauvism, and the modern in the visual arts. Apollinaire coined the word 'surrealism' which signaled that the world of poetry was on the threshold, just outside the world of realism. The surreal deals with the ordinary and with the everyday and does not try to comprehend the divine or the spiritual. The poetry of the surrealists, especially Bréton (1896–1966) and Eluard (1895–1952) dealt with love of the woman, seeing her as equal to man.

French poetry of midcentury was called *engagée* by Jean Paul Sartre. Dealing with the Second World War, the Resistance, and the meaning of devastation, it tried to make sense of existence (*existentialism*). Poets separated from poetic movements, isolated themselves from current chic thought, and wrote as receptors of events around them.

T. S. Eliot (1888–1965) brought French symbolism to England. The romantic metaphysical way of looking at poetic subject matter and the symbolist way were similar, he thought. The comparison of poetry to music was essential. The subject matter was difficult, evoking religious symbols and obscure texts. American imagist Ezra Pound (1885–1972) was another influence on symbolist poetry, and on Eliot, who dedicated his poem *The Wasteland* to Pound. Pound defined the image as "an intellectual and emotional complex in an instant of time." The pentameter was to be broken and straightforward line similar to the sequence of the musical phrase was to ensue.

Irish poet William Butler Yeats (1865–1939) spanned the romantic and modernist era. His *A Vision* (1925) is a prose explanation of how he used symbolism, mythology, and symbolism in dealing with opposites: objectivity and subjectivity, art and life, soul and body. Postwar poets with competing theories – the Georgians – Walter de la Mare (1873–1956), Robert Graves – who advocated a return to nature and myth; the soldiers who died (Rupert Brooke (1887–1915), Wilfred Owen (1893–1918) who argued a pacifist or patriotic vision of their experiences in the First World War; the colonialists – Rudyard Kipling (1865–1936) – who wrote of England's glory overseas; dominated the poetry of the early twentieth century. By the 1930s, English poetry had become concerned with leftist causes such as the Spanish Civil War – Stephen Spender, W. H. Auden (1907–73). In the postwar Dylan Thomas (1914–53) wrote on personal themes in formal and experimental verses. The Movement of the 1950s was short-lived, and no theoretical schools of poetry have dominated British poetry since.

US poetry was derivative or simultaneous with the movements in British and French poetry until the liveliness of post-Second World War signaled an ascendancy. For example, Walt

Whitman (1819–92) acclaimed a romantic vision of poetry derived from Ralph Waldo Emerson (1803–1882) (who called for a transcendental vision whereby there is an association between the word, the thing, and absolute truth) and Edgar Allan Poe (1809–49) (who argued for the importance of the imagination). Whitman's *Leaves of Grass* (1855) proclaimed the importance of the body as much as the soul. While Whitman was representative of Emerson's call for a poetry of the democratic person in nature, Emily Dickinson (1830–56) represented Emerson's call for a poetry hermetic and private. She became the most well known woman among romantic poets on all continents. Other American romantic poets such as Henry Wadsworth Longfellow (1807–82) and James Russell Lowell (1819–91) were very popular but their works have not stood the test of time. Dialect poets such as James Whitcomb Riley (1849–1916) and son of former slaves Paul Laurence Dunbar (1872–1906) and the late romantic poetry of southern Sidney Lanier (1842–81) signaled a regionalism and ethnic emphasis that was to continue in American poetry.

Premodernist poets such as Robert Frost (1874–1963) continued to write pastorals with the subject matter of nature. Frost began to use the speaking voice within poetic form, responding to the call of the romantics. He eschewed free verse, which was advocated by the symbolists and which contains lines of irregular length that evoke the cadence of music.

Modernism advocated that there is a connection between art and life. The construction of the verse was irretrievably linked to the meaning of the words. Verse did not serve to convey words, but was itself an irrevocable structure intrinsic to the meaning. Symbolism and imagism were two different ways to achieve this unity. Symbolism (Poe, Baudelaire, Rimbaud, Mallarmé, Valéry) advocated a turning in to the subjective with impressions of the external world expressed in implied emotions and sensations. Imagism (Pound) called for a visual flash which stood for both the emotion and the thing. William Carlos Williams (1883–1963) sought to use the American idiom (a romantic precept) in a variable foot (the line as a musical bar) in an imagistic way (the word as thing). Hilda Doolittle, known as H. D. (1886–1961) incorporated psychoanalytic concepts into her images. Eliot declared himself a British citizen, but his deep influences were from his childhood in St. Louis, Missouri. Wallace Stevens (1879–1955) wrote with affinity to the symbolism of Mallarmé and Valéry. If poetry is connected to nature, it is connected through figures of speech and relationship to music. Hart Crane (1899–1932) tried to take in modern industrialization with the symbol of the Brooklyn Bridge and a hearkening back to Whitman's romantic optimism.

Regional and ethnic Black writers also hearkened back to romantic visions in structuring their poems around spirituals – Langston Hughes (1902–67) and Countee Cullen (1903–46); and images of small towns and large cities in the Midwest – Carl Sandburg (1878–1967) and Edgar Lee Masters (1868–1950). Women also followed romantic principles – Edna St. Vincent Millay (1892–1950) and Elinor Wylie (1885–1928) – in their lyrics and formal sonnets.

The influence of imagism, surrealism, and symbolism continued with poets such as Robert Bly (b. 1927), who talked of the 'deep image' which would psychologically take the reader into a formerly unconscious place; with Allen Ginsberg (1926–96), who with the Beats looked to Whitman as well as

to Pound in advocating a counter-cultural lifestyle with a poetic line that resembled jazz. The so-called 'Black Mountain' poets – Robert Creeley (1926–2005) and Denise Levertov (1923–97) were allied with the abstract expressionists of the mid-century art world and they called for open form poetry with stresses more gestural than formal. The 'confessional' poets – Anne Sexton (1928–75) and Sylvia Plath (1932–63) – took after Robert Lowell (1917–77) in their frank autobiographical work. The New Critics called for an 'objective' look at the work, apart from autobiography, as the work stood by itself, apart from personal history, geography, or culture. Among other poetry movements have been Acmeism, Beat, Concrete, Cowboy, Futurism, Feminist, Harlem Renaissance, Jazz, Language, Metaphysical, New Formalism, New York School, Objectivism, Slam, Fugitive, Post postmodern, and the like. Each of these has propounded a series of principles and has been a reaction to or response to another movement of poetry (see American Academy of Poets.)

Formal verse gave way to the ironic lyric. Modernism gave way to postmodernism. Constructivism gave way to deconstruction. By the end of the twentieth century poetry was looked at as sign, for it had a dualism. Poetry was physical words on a page; the medium was ink on pulp. However, while prose was also physical words on the page, the medium was in the background. In poetry, the physical words are the foreground as well. This led poetic philosophers to contemplate the difference between signification and content. The experimenting of early and mid-twentieth century poets who aligned their work with movements in music and art shook the very Platonic and Aristotelian foundations of what poetry is. At the millennium we were left with these questions. Can poetry stand up to the creative imperatives of the other arts or is it merely a fundamentally poor imitation? Can poetry show truths through art that philosophy and religion cannot show? Can poetry continue to be a political force with a critique of bourgeois values? Can poetry align itself not with an obscure elite but with the common people? These questions continue to plague poets. Post postmodern poets have wrestled with morphing recent scientific discoveries with the language and lines of poems.

Creativity and Poetry

Poetry is inherently creative in that the creative process whereby poetry is made utilizes the Seven I's of inspiration, imagination, imagery, intuition, insight, incubation, and improvisation.

All creators talk about inspiration. Literally, inspiration is a taking in of breath. In terms of creativity, inspiration provides the motivation to write. When one takes in breath, one fills the lungs with air, with environment, with the stuff of life, and after the intake comes the necessary release. For poets this release is in the writing of the poem. Various kinds of inspiration have been recorded: the visitation of the muse, or the inspiration of love and desire; the inspiration of nature; inspiration through substances; inspiration by others' works of art and music; inspiration from dreams; inspiration from social injustice; inspiration of novel surroundings. The topics of poems range throughout these, and many other situations of inspiration.

In order to be inspired, the poet must experience insight. Insight in the creative process is the ability to see and

understand clearly the inner nature of things, especially by intuition. Insight involves restructuring the problem so that it can be seen in a different way. The creator experiences a feeling of delight in what is called an 'Aha.' It could be argued that poetry is one of the most regular providers of ahas for its readers, who are moved to fear and pity by the writing of the poet, whose insight provides insight to the apprehender, the reader or hearer of the poem.

All creators experience, during the creative process, a period of incubation, of fallowness where the inspirations that provide the insights are resting. Poetry is a solitary art, for the most part, as the poet meditates, walks, reads, and thinks about the meanings, images, and puts things together into the whole that is the finished poem.

Imagination is a faculty much discussed in creativity literature. Imagination in the creative process refers to a mental faculty whereby one can create concepts or representations of objects not immediately present or seen. The Romantic era of the eighteenth and nineteenth century began to view imagination as the primary criterion for the writing of poetry. Coleridge said imagination was the main power used in writing poetry: a "synthetic and magical power." Any writer can string images together but the poet infuses the images with imaginative power and with passion and makes not an account of imagery but of emotional truth. The poet must have an innate sense of music:

But the sense of musical delight, with the power of producing it, is a gift of imagination; and this, together with the power of reducing multitude into unity of effect, and modifying a series of thoughts by some one predominant thought or feeling, may be cultivated and improved, but can never be learned. (*Biographia Literaria*)

Even the intellectual deconstructionists and postmodernists say that imagination is necessary in uniting poetry with philosophy. In their discussions, imagination remains the creative force behind poetry.

Imagery is also part of the creative process. The term *imagery* is psychological, the ability to mentally represent imagined or previously perceived objects accurately and vividly. Imagery is an attribute of imagination. Imagery is not only visual, but also auditory, tactile, olfactory, and gustatory. While imagery is to be infused with the poet's imagination and sense of music in order to produce the truly creative poem (as opposed to the nonpoem, the 'fancy'), the *image* is the organic heart of the poem to twentieth-century modernists. The image is the concrete metaphor for inner reality. The poem itself becomes the image, an energy field made corporeal. Pound said, "The image is not an idea. It is a radiant node or cluster; it is a . . . VORTEX, from which ideas are constantly rushing." The image is then both a description and a metaphor for the creative energy of a field surrounding the image. The image is a reference to a visual, aural, or kinesthetic semblance named to subdue or elaborate the unnamable.

To postmodernist deconstructionist Jacques Derrida, the image fills out the words. The reader, with imagination, completes the poem's empty spaces with the image. Thus figurative images – onomatopoeia, irony, metaphor, simile, and the like – the rhythmic conventions of poetry – function as rivers to complete the effervescent meaning of the poem. The poet as creator is at the mercy of the image created, for the references

evoked by the images are uncontrollable. The reader in the physical act of reading, the eyes moving across the page, taking in the letters in type upon paper combined into words and an evocative language, enters into a dark room which is only illumined by images evoked by the words put into patterns created by the poet.

Images become symbols, icons, imagery. These also are creative, both in the spiritual sense of having been infused with import and meaning by centuries of thought, but in the individual sense of resonance with an interior truth to which the reader (or hearer) gains access through the associations evoked by the aesthetic creation of the poet. Consider the imagery in this line from Whitman's 'Song of Myself.'

I hear the bravura of birds, bustle of growing wheat, gossip of flames, clack of sticks cooking my meals.

The reader is thrown to the auditory by the first two words, and the image of swaggering, bragging birds, chests puffed up, sitting in trees loudly chirping comes upon the ear. To hear growing wheat 'bustle' evokes the humming sounds of fussing, moving females, scuffling and scurrying, who more often 'bustle' than men. With 'bustle' comes a transition to 'rustle,' which is a sound evoked by the word, and perhaps to the taffeta dresses women wore at that time, which had appendages called 'bustles.' All these and many more images associate to the ear from the juxtaposition of 'bustle' with wheat growing.

Whitman adds the 'gossip of flames' to his auditory images. Gossip has a sound that is quiet, as it is usually passed from one person to a trusted other in a hallway, a doorway, before a meeting. Gossip is hearsay, rumor, not truth. To associate 'gossip' with fire makes the flame seem friendly, for gossip is usually exchanged between friends about other friends or acquaintances, and the person who gossips usually trusts the person to whom she is gossiping. Thus the auditory image is homey, friendly, but a little cruel and dangerous as well.

The 'clack of sticks' also creates astonishing auditory imagery, as 'clack' seems too loud for what sticks do when they hit each other. 'Clack' is a sound word, but in the increment of sounds, sticks would not 'clack' but would perhaps 'click' or make a dull 'thwack.' That they 'clack' enhances their flame-readiness, for they must be quite brittle and quite large. Yet they are 'sticks' and not 'logs' and so the imagery presented by the juxtaposition of the two words 'clack' and 'sticks' tells the reader in her dark recess that creates imagery, exactly how big the sticks are. Big enough to cook a meal, quite dry, but not logs. Thus the reader must be creative also, in trying to understand the imagery created by the poet.

Another aspect of the creative process that poets use is in the connection to intuition. Poetry has recently (in the twentieth century) been called a form of intuition. Though ideas can be deduced from a poem, the poem itself is the idea, and that is intuition. Phenomenological theories of poetry assert that the reader grasps the poem through a kind of 'inseeing' – according to Henri Bergson (1859–1914) – who advocated the importance of intuition over intellect, expounding the idea that there are two opposing forces: he promoted the idea of two opposing currents: lifeless matter in conflict with organic life as the vital urge (*élan vital*) strives toward the freedom inherent in the poet's and poem's intuitive creative action.

Finally, while poetry is formally structured, metrical, and musical, many poets have used the regular practice of improvisation by which to write. The accidents that come from regular practice, from trying out new words, new ideas, new syllabic formations, often come through improvisation. Although improvisation is a key skill in the domains of music, poets also use it, especially poets who write free verse, but formalist poets also improvise. The poet James Merrill, who wrote much free verse, used automatic writing as an improvisational technique: William Butler Yeats, who wrote much formal verse, also used automatic writing as inspiration for work.

Conclusion

Poetry is one of the oldest domains of creativity, practiced instinctually by humans throughout evolutionary time. Because of this, the future for poetry is assured; whether new forms will evolve through technology is immaterial, for the human creative instinct to produce poetry has always existed and will continue to exist.

See also: Domains of Creativity; Metaphors; Sara Teasdale 1884–1933; Writing and Creativity.

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Problem Finding

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Glossary

Ill-Defined problem Problems that have multiple possible goals and no consensus on what the best solution may be.

Problem construction The process by which individuals structure ill-defined problems and identify the goals and other elements needed to plan the problem solving effort.

Problem definition Altering a previously identified problem, before solutions are attempted, to make it workable.

Problem finding The umbrella term for activity that occurs before problem solving. Includes problem identification, problem definition, problem construction, and so on.

Problem identification Recognizing that a problem exists before defining or solving the problem.

Problem representation Schemas that capture the central features of prior problem solving and guides future problem solving efforts such as goals, restrictions, procedures, and information.

What is Problem Finding?

One major approach to the study of creativity is the examination of cognitive processes involved in creative problem solving and creative thinking. Most of the cognitive process models include problem finding or an associated construct as the first step. J. P. Guilford was the first to recognize the importance of problem finding, coining the term 'sensitivity to problems.' Other models used terms such as problem definition, problem identification, problem formulation, problem generation, problem discovery, and problem construction. While specific definitions of each term vary somewhat, all have a common thread and to prevent confusion, the term problem finding will be used throughout this article. Problem finding is an umbrella term that includes the multiple aspects delineated in the literature. Two major aspects of problem finding have been identified. One includes problem anticipation and identifying problems or opportunities in the environment when they are not presented to the problem solver. The second aspect includes structuring and defining the problem in a way that provides a starting point to formulate a solution.

Other work has differentiated problem finding tasks by the degree to which the problem is given to the problem solver. This ranges from problems that are well structured and given to the problem solver (presented problems), to ill-defined problems where the problem solver identifies the problem (discovered problem), to problems that are found or generated by the problem solver where none existed before (created or generated problem). The role of problem finding is particularly important when problems are ill defined for two reasons. One aspect of problem finding calls for identifying possible problems in the environment, many times when problems are not clearly identified, or even known. These types of problems are ill-defined by definition, as no problem is presented to the problem solver. The second aspect requires the structuring and defining of the problem. If the problem is well-defined or structured, there is no need for problem finding.

It is important to note that while problem finding is seen as the first step in creative problem solving, followed by other processes such as information search, idea generation, and idea

evaluation, the creative problem solving process is not as fixed. Many process models assume a more cyclical nature where individuals may cycle back to earlier processes. This likely will happen as a result of difficulties encountered in later processes. For example, finding new information that requires the individual to think about the situation or problem in a new way may result in reformulation of the problem. Similarly, if during idea evaluation, the individual identifies that no good ideas were developed, he or she may cycle back to earlier stages – either to the idea generation phase or the problem finding phase.

The Process of Problem Finding

While most creative problem solving models include problem finding as the first process, there are only a limited number of models of the problem finding process itself. Early models such as those by John Dewey and Guilford provided a separation between problem recognition followed by problem definition. Min Basadur suggested that both ideation and evaluation play a role in problem finding.

A more detailed process model of problem finding was suggested by Michael Mumford and his colleagues. This model starts with attention and perception. Individuals need to attend to and perceive a gap or a problem in the environment. It seems that when problems are well-defined, there is no such perception, and the process of problem finding either is bypassed or occurs quickly and automatically. This first step corresponds to what appears in theoretical models as one aspect of problem finding – problem anticipation or identifying opportunities in the environment. Attention and perception of environmental cues trigger problem representations. Problem representations are knowledge structures based on past problem solving efforts and include four types of information (a) the goals and outcomes associated with the problem solving effort, (b) information required to define and solve the problem, (c) procedures and operations performed on the information in order to solve the problem, and (d) constraints and restrictions on the problem solving effort.

Problem representations are activated through environmental cues. If the problem representation has been associated with a specific cue in the past, it will be activated. More ill-defined problems and situations are likely to have more diverse and complex set of cues. In addition, ill-defined problems will likely have cues that are associated with multiple problem representations resulting in more problem representations being activated. As the problem or situation is more well-defined, structured and less complex, it is more likely that a small number, or even one, problem representation will be activated. If the problem is identical or very similar to a problem solved in the past, the problem representation associated with that problem solving effort will be activated. When only one problem representation is activated, it is likely that the problem solver quickly and automatically completes the problem finding process moving immediately to problem solving. When multiple problem representations are activated, and a single problem representation cannot be used, the problem solver must find a way to create a new problem representation which includes a mix of the elements from the activated problem representations to guide problem solving. This will likely result in a more creative way to define the problem, and therefore more creative solution.

The process described above has several important implications. First, in most situations, problem finding will occur automatically. These situations include routine problems, problems that have been encountered before and solved successfully, or problems that are similar to previously encountered problems. Active engagement in problem finding will occur only when the problem is different enough from past experiences or includes diverse information that elicits multiple problem representations. A second implication is that the problem finding process, like the creative problem solving process as a whole, includes both divergent and convergent elements. The activation of multiple problem representations, multiple ways of perceiving the problem, is a divergent process. However, the integration of the various problem representations into a new single coherent (and original) representation is a convergent process. Finally, an important implication of this model is the role that knowledge plays in the problem finding process. Activation of problem representations occurs based on the similarity of cues perceived in the environment and existing problem representations. Therefore, some knowledge is necessary for effective problem finding to take place. Further, the availability of a pool of potentially useful problem representations would be beneficial.

Importance of Problem Finding

Problem finding has been linked to creativity in a wide range of domains. The seminal study by J. W. Getzels and Mihaly Csikszentmihalyi linked problem finding behaviors with originality and aesthetic value of paintings created by art students. More importantly, problem finding measures were also predictive of artist's success measured 7 and 18 years later.

Problem finding ability and effort (a) predicts creative accomplishments and creative problem solving in everyday problems and (b) predicts creativity above and beyond known predictors such as divergent thinking and intelligence.

Factors Affecting Problem Finding

Research found that active engagement in problem finding increases the creativity of the process itself and of the resulting solution. In some studies, participants were given instructions to think about the problem prior to solving it, to identify goals, or to rephrase the problem in different ways. Other research induced active engagement by training the problem finding process (alone or in combination with other creativity relevant processes). A recent meta-analysis on the effect of creativity training found that training in problem finding was one of the best interventions for improving creativity.

The effect of expertise on problem finding is not fully understood. Experts spend more time defining the problem relative to novices, and are likely to have more problem representations that can be used in defining the problem. Conversely, experts are more likely to evaluate new problems as similar to those that they have encountered in the past, resulting in the use of a dominant problem representation.

Recent work suggested that dialectical thinking, especially acceptance of contradictions, is related to problem finding. Other personality variables linked to effective problem finding traditionally have been related to creativity in general including openness, tolerance for ambiguity, and flexibility. It is not surprising that the variables related to effective problem finding are related to cognitive style or individual difference in processing information.

Other variables related to problem finding are related to motivation. Individuals who see themselves as creative, have creative self efficacy, and self esteem, are more likely to engage in effective problem finding. Active engagement in problem finding is an effortful and time consuming activity. It is therefore likely that only those individuals who are motivated to engage in the process will do so. While some research exists on the role of personality and motivational variables in problem finding, the literature is limited, and more work is needed.

Situational variables also influence problem finding. Ill-defined problems posed by the problem solver generates more solutions than a presented problem (even when it is ill-defined). This finding may also speak to the motivational aspects of problem finding and creativity. When problems are generated, they may reflect the interests and concerns of the problem solver and therefore are more likely to be more involving and interesting.

Other task characteristics include the degree of consistency of information presented in the problem. More ill-defined problems tend to include more diverse cues, some of which may be inconsistent or in conflict with one another. Diverse cues or contradictory information in the problem has been linked to increased originality and creativity of the solutions, presumably based on the effect these cues and contradictions have on the diversity of the problem representations activated and the need to integrate diverse problem representations. This finding mirrors findings regarding individual differences, where dialectical thinking, or the ability to work with and accept contradictions has been linked to increased problem finding and creativity.

Problems and situations also may vary in the degree to which they elicit affect and the type of affect they elicit. Affect is an important variable that has not been studied in the

context of problem finding. Affect has been found to influence creativity, specifically, positive affect seems to improve creative performance, whereas the effects of negative affect are mixed, and depend on the task and more specifically on the type of negative affect (e.g., anger or sadness). It is expected that problem finding would be influenced by affect, however; how it will be influenced is not yet clear. Further, it is possible that affect resulting from the problem itself may have a stronger effect on problem finding, as it is more closely tied to this process.

Finally, available time and time pressure affect the problem finding process. Problem finding takes time and effort, and past research consistently found that individuals who spend more time on this process, develop more alternatives for how the problem is viewed, and also develop more creative ideas that are more effective. Because the process tends to be automatic most of the time, it is likely that time pressure will result in an automatic application of the process instead of active engagement.

Measurement of Problem Finding

Problem finding is typically automatic and does not have an outcome that can be evaluated therefore probing is necessary to observe the outcome. A typical approach of evaluating problem finding involves asking participants to define the problem in multiple different ways. However, this probing is a direct manipulation of problem finding, one that is also used to induce active engagement in problem finding. It is therefore difficult; if not impossible, to study problem finding directly without also manipulating it. In order to further our understanding of the problem finding process, it would be helpful to identify a way to measure problem finding without manipulating it or creating active engagement.

The fact that measuring problem finding requires the manipulation of problem finding also raises another important issue. How we manipulate problem finding may affect the results of the process. One popular method uses a variation of John Baer's approach, in which an ill-defined problem is presented, and participants are asked to restate the problem in as many different ways as possible. This sort of manipulation induces active engagement and forces participants to think in an effortful manner about how to define the problem. In addition, this specific approach seems to be geared toward a focus on goals, which are only one element of the problem representation. It is possible that different approaches for inducing active problem finding, with a focus on other elements, such as constraints or information needed, may result in somewhat different outcomes.

Finally, the approach discussed above for eliciting information about the problem finding process presents the problem solver with an ill-defined problem. Providing the problem to be solved allows for control in the study of problem finding, as all problem solvers react to the same stimulus. However, by providing a problem, the focus is on one aspect of the problem finding process, that of structuring the problem. However, as previously stated, problem finding includes both the process of identifying opportunities and problems as well as defining the problem. When the same ill-defined problem is presented to all participants, by definition, we are focusing on presented

problems and the process of defining the problem. We are not able to investigate generated problems and the process of identifying problems and opportunities. Only a handful of studies have evaluated the latter, finding increased creativity for generated problems compared to presented problems.

Teams and Problem Finding

Teams are faced with many opportunities to engage in creative problem solving. Organizations use teams to address the need for having multiple stakeholders (such as members of different departments) involved in decision making, or when problems are too complex for one individual to solve. Research on cognitive processes at the team level, whether they relate to creativity or more routine problem solving efforts, is sparse. The only area that has received much attention is that of brainstorming. Earlier processes to idea generation such as problem finding, and later processes such as idea evaluation have received minimal attention.

When individuals work in a team to solve problems, problem finding must be evaluated from two perspectives. Each individual within the team will engage in problem finding and the problem may be defined differently by each individual. Problem finding and defining of the problem is a result of the problem representations elicited by cues in the environment. Both attention to these cues as well as the problem representations available to the individual will be based on past experiences which differ from one person to another. Therefore when problems are ill-defined, individuals within a team will view the problems in different ways. Past research on team problem solving and decision making suggests that teams that are heterogeneous (based on gender, expertise, and the like) are more likely to experience difficulty reaching a consensus on a solution and difficulty communicating effectively.

The availability of multiple problem representations at the team level, just like at the individual level, may lead to integration of these problem representations in new and creative ways, leading to a new problem representation and more creative solutions. However, as individuals typically engage in the problem finding process automatically, they may not be aware that other members of the team may define the problem in a different way. This can lead to misunderstanding and difficulty in communication in heterogeneous teams. Further, it is less likely that individuals will discuss the problem finding process or how each one defines the problem. Teams typically focus on the solution that is needed, and team members assume that other team members view the problem in a similar fashion. Disagreements about solutions may often be traced back to lack of agreement on how the problem is defined or the elements of the problem, such as differences in goals, restrictions, or information available or needed.

Conclusions

Problem finding has been identified in theory and in research as the first step in the creative process, and therefore influences later processes and has a significant role in creative production. While the last decade has seen an increase in empirical work on

this topic and more is known today about problem finding, there are still many unknowns. Empirical research is needed in areas of the different types of problems and problem finding (such as problem identification vs. problem definition), measurement of problem finding, individual differences and situational variables that influence problem finding, and the process of problem finding in teams.

See also: Cognitive Style and Creativity; Divergent Thinking; Janusian, Homospatial and Sepconic Articulation Processes; Problem Solving; Socio-Economic Status and Performance on Creativity Tests; Teams.

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Problem Solving

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Glossary

Algorithm An operator that is a precise rule, which if followed, will guarantee a solution.

Goal state The desired end in a problem.

Heuristic A rule of thumb that may narrow the set of possible moves and increase the likelihood of success but which does not guarantee a solution.

Operator Means of transforming or moving from one state to another in a problem.

Problem A discrepancy between one's start state and goal state in which there are generally obstacles

that prevent movement to the goal state in a single step.

Problem solving General term applied to the process whereby the person overcomes obstacles and moves from a start state to a goal state.

Problem space A person's internal representation of a problem, including knowledge states and operators.

Start state The beginning point in a problem.

State General term referring to the representation of knowledge at a particular point in a problem.

Introduction

Problem solving is a topic that is difficult to delimit. Much of what people do on a day-to-day basis could be called problem solving, but without making some distinctions among types of problem solving, it is difficult for researchers to make progress in differentiating the processes involved and how they operate. To help narrow the focus, different ways of defining problem solving can be considered, but to begin to understand problem solving it is necessary to step back and consider a definition of the term *problem*. Without a clear sense of what constitutes a problem it is not possible to specify exactly what might be involved in solving it.

A traditional way to describe a problem, based on early work by Allen Newell, Herbert Simon, and colleagues, is in terms of *start states* and *goal states*. Using this terminology, a problem is a discrepancy between a start state and a goal state. Put differently, if there is a gap between where a person is now and where that person wants to be, then a problem exists. Describing problems this way leads to the definition of problem solving as the process whereby people eliminate the discrepancy or move from the start state to the goal state. As noted below, the process has traditionally been characterized as a search through problem states.

Notice that this definition puts the emphasis squarely on the processes involved. In some ways, the particulars of the problem are not vital; all problems and all problem solving has something in common. It does not matter exactly what specific starting situation a person wants to move from or what specific goal state is desired. What matters is the processes used in generating the steps that move the person from the beginning to the end, and those steps are usually mental operations that work on the person's existing knowledge or seek new knowledge.

To use a simple example from everyday life, if your car has run out of gas and you are on the side of the road about to be late for a meeting, you have a problem. The start state is that you are out of gas and have a meeting to get to, and the goal state is being filled up so you can drive to the meeting.

(There are also other ways to think about the goal state, which we will consider later in this article.) Problem solving in this case would be whatever steps you take to acquire the gas so that you can continue progress to your destination. Even though there are physical steps involved in this example (e.g., acquiring a container to bring gas to your vehicle), the emphasis in the study of problem solving, of course, is on the mental steps, the thought process you use as you try to figure out a solution; that is, how you reason about getting from the start to the goal.

A difficulty in thinking about problem solving as the process of eliminating the discrepancy between a start and goal state, however, is that this characterization is exceedingly broad, potentially encompassing virtually everything humans do. It can and does include everyday situations such as running out of gas, but also more life-threatening situations, such as that confronted by the Apollo 13 astronauts and NASA ground crew in 1970 when an oxygen tank ruptured causing significant damage and disruption to systems on the spacecraft while it was nearly 200 000 miles from Earth. It can also encompass short-term situation such as those already noted, or longer-term issues, such as a company not having as much profit in a quarter as it would like or having poorly rated customer relations. Start and goal state discrepancies can be on a local scale, such as a string of unsolved burglaries in a particular town, or on a global scale, such as disease, poverty, famine and other human conditions.

Beyond the variations in significance, scope and time-scale, we are almost always in some state and about to transition to another (unless unconscious or asleep or otherwise not using our minds or bodies). To continue with the out-of-gas example, if your car stopped right next to a gas pump and you only have to put the nozzle in and fill up, it would not make sense to call that a problem in the same sense as if you were in the desert, miles from any gas station with no container to transport gas even after you walked or got a ride to one of those distant stations. To continue with the Apollo 13 example, if the crew had back-up oxygen canisters, and could have easily changed one out for another, the incident would probably not be well remembered and would not have been a problem

in the same sense. To differentiate these situations, we can narrow the definition of a problem somewhat by including the idea that there ought to be some obstacles or impediments that prevent immediate movement from the start to the goal state in a single move.

A Common Language

Even with some attendant difficulties, characterizing problem solving as the processes involved in removing a discrepancy or making your way from a start state to a goal state is helpful because it can reveal the commonalities across otherwise very different situations. It also provides a language for describing the important elements of those situations. Again returning to the Newell and Simon characterization, which still has a dominant influence on our understanding of problem solving, the problem solver's internal representation of the problem can be referred to as the *problem space*. It contains states of knowledge, referred to as *problem states*, as well as the means of moving from one state to another, called *operators*. The states included in the problem space are the start state, along with any of its givens, the goal state and any of its specific requirements, and all possible states in between. In this way, problem solving is thought of as a search through the problem space, finding the path from the start state to the goal state. To return to the out-of-gas example, for instance, the internal representation of the start state might include the knowledge of the fact that you are out of gas, the current location and time, the meeting location and time, and any other factors known to you as the problem solver. The goal state might include you being physically at the meeting along with any materials you need for your role in the meeting.

The construct of a *subgoal* is also useful in describing problem solving in that progress toward the goal state can be understood in terms of accomplishing subgoals along the way. Determining whether or not you own a gas can and have it with you might be a subgoal along the way toward your overall goal of getting to the meeting, for example.

Operators are legitimate and helpful procedures for transforming one state into another. They are the cognitive processes of most interest in psychological approaches to understanding problem solving. They generally fall into two classes, called algorithms and heuristics. The distinction is that algorithms are rule-like procedures that, if followed correctly, will bring you to the correct solution, either the overall goal or a sub-goal, whereas heuristics are rules of thumb that may guide us in the direction of a solution, or narrow the number of possibilities we consider, but do not guarantee we will find a correct solution.

Algorithms play a vital role in achieving problem solutions, but a rich literature in creative problem solving also documents how slavish adherence to them can block people from seeing even very simple solutions. An example is the classic water jar problems used by Abraham Luchins and Edith Luchins. Consider that you have three containers A, B and C. A can hold 21 cups of water, B 127 cups and C 3 cups, and your task is to measure out 100 cups of water. The solution is to fill B completely, empty 21 cups into A, and then 6 more cups using the 3 cup capacity of C twice. After getting a series of such problems, all of which can be solved with the same

B-A-2C approach (e.g., A=5, B=20, C=2, Goal=11), people develop and apply that algorithm to such an extent that they do not readily see simpler solutions to subsequent problems for which the algorithm will not work (e.g., A=28, B=76, C=3, Goal=25). This inhibition due to adherence to an old established approach is typically viewed as analogous to the blocked thinking that prevents people from seeing new creative solutions to a situation. As discussed in the section on 'Problem Types,' heuristics can sometimes help where algorithms would either fail or be impractical.

Although real world problems, such as poverty, are vast in scope and critically in need of solutions, research observing the mental operations at work when people attempt to solve them is not typical. Instead, researchers who study problem solving tend to use much simpler tasks that can be handled, most often by individuals, in a relatively short time-frame, such as the water jar problem just described. Another example of such a task is a cryptarithmic problem, such as the classic DONALD + GERALD = ROBERT problem. It is easier to see when written as a standard addition problem:

$$\begin{array}{r} \text{DONALD} \\ + \text{GERALD} \\ \hline \text{ROBERT} \end{array}$$

In this problem, each letter corresponds to one and only one digit, and the task is to find the correct mapping between letters and digits so that the sum is correct. In addition to the knowledge of the overall goal, the start state given to problem solvers includes the additional piece of information that D=5. The rules of addition certainly qualify as algorithms and are relevant to this task. Adding 5 and 5 (D and D) and getting the sum of 10 leads to the conclusion, with certainty, that T=0. Thus, a subgoal of determining the mapping for one of the letter-digit pairs is accomplished by applying that algorithm. Using that operator transformed the starting knowledge state to a new one that includes not only D=5, but also T=0 (and possibly that 1 is carried to the next column, if the solver realizes that). We can also see the role of heuristics, such as "start with what you know" or "begin with the rightmost column (because you may need to know about carry bits)." The heuristics alone will not guarantee solutions, but they may help to narrow the steps to be considered.

Algorithms can also be thought of as brute force procedures for ensuring a solution. When thought about this way, it is clear that they may have a special role in simpler problems with few possible states, but need to be supplemented with heuristics in more complex problems. Chess is the prototypic example of a complex problem. The limits on working memory preclude one from considering all possible next moves and their ramifications for all possible responses by one's opponent and so on. To help narrow the possibilities, heuristics are needed. Certain principles, such as "control the center of the board" and "attempt moves that threaten an opponent's pieces with more than one of yours" might increase the probability of a win and narrow the set of moves you will consider. They alone however, cannot guarantee achieving the goal state of checkmating your opponent's king.

The emphasis on using legitimate operators, whether algorithms or heuristics, is because you actually have to reach the goal. One cannot just decide that $5+5=7$ or that a 'white

diagonal' bishop can move to black squares. For the gas example, a teleportation booth might be nice and, if it worked properly, might get you where you are going, but as far as we know, teleportation is not currently feasible. This is not to say that wildly impossible ideas are useless. In some circumstances they help to suggest a new way to represent the problem, and might be especially valuable when we are stuck.

In considering the movement from start states to goal states, we can also think about procedures for determining the next move. One such procedure is *hill climbing*. A way to think about hill climbing is that the goal is the highest point in the problem space. One wants to get to the top of the hill, the highest possible point in a landscape. In using this procedure, the next move would always be one that gets you to a higher point, never to a lower point. This would work fine in a simple situation where there is just a single hill and one has started at its base. However, if the landscape is really one with several hills and a single one that is higher than the others, and one has started at the base of one of the lesser hills, there is a difficulty. Using the hill climbing heuristic will get you to the top of that hill, but all possible next moves will lead you lower and you will stop. Since moving lower violates the hill climbing principle, it fails, and succumbs to the problem of a local maximum. You reach a local high point, not the global high point that is your goal.

The problem with hill climbing can be seen concretely in another classic situation used to study problem solving, namely the Hobbits and Orcs problem. In that problem, the start state is that there are three Hobbits and three Orcs on one side of a river that must be transported to the other side of the river, subject to some constraints. There is a boat that can carry two individuals at a time across the river. It is important however that the Hobbits never be outnumbered on either side of the river; if they are, they will be eaten by the Orcs. If you have not already tried to solve this problem, you may wish to do so now, but if you want to solve it on your own, temporarily skip the next paragraph and just consider the take-home message in the one that follows it.

To begin one can send a Hobbit and an Orc to the goal side, with the Hobbit returning in the boat so that others can be transported. Note that if the Orc brings the boat back, the two Hobbits still on the starting side will be outnumbered, so it has to be the Hobbit who brings it back. Next, two Orcs can be sent over to the goal side, with one returning the boat to pick up more individuals. At this point, there are three Hobbits and an Orc on the starting side and two Orcs on the goal side. Now, two Hobbits must go over in the boat, because if a Hobbit and an Orc go over, that one Hobbit will be outnumbered three to one on the goal side. Likewise, once to the goal side, neither of the Hobbits can bring the boat back to the starting side alone because the one that remains on the goal side would be outnumbered. At this point, there seems to be an impasse until you realize that two individuals can bring the boat back to the start side instead of just one, and that one should be an Orc and one a Hobbit. That way, when the boat gets back to the start side, there are two Hobbits and two Orcs there as well as one Hobbit and one Orc on the goal side. The idea of two rather than one going back in the boat seems to go against the goal of getting them all to the other side, yet is necessary for a solution. Once this impasse is resolved, the remaining steps are

straightforward. Two Hobbits go to the goal side, sending an Orc back with the boat. With all three Hobbits now on the goal side, the Orcs can be transported and never outnumber them.

The solution to the Hobbits and Orcs problem illustrates an important aspect of creative problem solving, namely that people sometimes operate according to implicit assumptions or constraints and those constraints can prevent them from achieving problem solutions. To solve the Hobbits and Orcs problem the implicit assumption that only one individual brings the boat back must be dropped to achieve the goal state. That specific problem is a well-defined one with a clearly identified goal state, but relaxing constraints is also applicable to less clearly defined problems. Consider for example a problem of limited parking on campus, a situation that plagues many universities. One can think in terms of building more parking decks or implementing shuttle service from remote sites, but a potentially creative alternative might occur by dropping the assumption that classes need to be taught during a limited set of ordinary daytime hours. Perhaps there are enough spots for all who need them if not everyone is coming to campus in the day time as opposed to some coming for classes at 3:00 AM. Whether that is a viable solution or not is debatable, but it would not occur as a possibility without relaxing the class time constraint.

An alternative procedure for determining the next step in a problem is *means-ends analysis*. Means-ends analysis compares the current state to the goal and chooses operators that remove the greatest difference between them, but it can allow for moving toward a subgoal that might actually be away from the overall goal. To return to the out-of-gas example, after determining that you do not have a suitable container, you might choose to walk to a hardware store in a direction opposite the nearest filling station to acquire one before moving in the direction of that station, because doing so satisfies a necessary subgoal.

Problem Types

Although there may be some utility to having a common way to characterize otherwise different situations, it is also vital to a rich understanding of problem solving to recognize that there are distinct types of problems, each with its own special features. One common distinction is between problems that are classified as well-defined versus those that are classified as ill-defined. This distinction is especially relevant to the field of creativity research. Well-defined problems are those that have a clearly specified start and goal state. An example might be the type of arithmetic problem noted previously. There is clear information about what is currently known, the values of two numbers that are to be added together, and the relevant procedures, such as the rules of addition, are readily determined. Likewise, the goal state, the sum of the two numbers, is unambiguous. Another example, though a bit more complex, is the cryptarithmic problem discussed in the previous section. The start state is well specified in terms of what is known, what is to be determined and what the relevant procedures are for getting there.

At the other extreme are problems with little in the way of definition for start and goal states, such as, do something meaningful with your life, start a successful business, or

produce a work of art that will be lasting in its effect on culture. It is difficult to identify the start state, other than perhaps noting that one has not yet done something meaningful, successful or lasting in that regard. Likewise the ways in which a life can be meaningful, a business successful or a work of art lasting are endless and completely open. Nor does one need to consider such complex tasks to capture the notion of ill-defined problems. Simply painting a painting, writing a poem or short story, or designing an experiment can be thought of as ill-defined problems. These ill-defined problems are the ones that sometimes are held up as the stuff of which creativity is made, though there is no question that creativity can be applied to much better defined problems than these. They are the types of problems that lead to the view that perseverance, tolerance for ambiguity, a willingness to risk failure, and other such traits are critical to being creative.

Because well-defined problems have clearly defined start and goal states, and because they have a single correct answer, creativity is sometimes considered to not be applicable to them. Sometimes divergent thought, or the seeking of many possible answers rather than the single correct one is considered integral to creativity. Ill-defined problems, with their many potential avenues for solution, fit better with the notion of requiring or even encouraging divergent thought. However, this perceived limitation on the link between creativity and well-defined problems is partly a matter of description. Sometimes the creative work on a problem is rethinking it or defining it clearly, as discussed in the article on 'Problem Finding.' That is, creative effort may help a person change an ill-defined problem into a well-defined one.

Well-defined problems, whether well-defined as originally presented to the solver or as constructed through problem finding, fit readily into the search framework described in the previous section. Problem solving is a matter of finding the right path in the problem space between the start and goal states. Other than noting that their start and goal states are not clear, however, ill-defined problems may need different constructs such as finding a different way to represent the problem.

There are some classic problems that are used to illustrate the importance of problem representation. How we represent a problem often determines our likelihood of solving it. For instance, consider the monk who begins a journey up a narrow mountain path at dawn, stopping along the way to eat and rest, reaching the temple at the top by nightfall, where he stays overnight to fast and meditate. At dawn the next day he begins his descent along the same path, again stopping along the way, reaching his original starting point sometime that afternoon. Not surprisingly, his journey down takes less time than his journey up. Your problem is to this: is there some point along that path that he occupies at exactly the same time on each of the two days, and can you prove it? Your initial thoughts might lead you to the idea that the answer has to be 'no.' Since the journeys take different amounts of time, you might first think it unlikely because there could be many specific times when he is on the path on the way up but not on the way down, on toward evening, for instance. And anyway you might reason, when he is on the way down he will be near the upper part of the mountain early in the morning, but on the way up, he will be near those points in the evening.

Not possible you might reason, but without any way to prove your conclusion. However, the correct answer is that there is such a point, and showing it reveals the importance of problem representation. As long as we represent the problem in terms of a single monk going up and down, it is extremely difficult to think out how there could be such a spot and time. But if instead we change our way of thinking, and represent it as two monks, one starting at the bottom and one starting at the top, then the solution becomes clear. If they walk along the same mountain path, at some point they have to pass one another, so they are then at the same point at the same time of day. Note that this is true even if they make their journeys at different rates. Even after hearing this solution, some problem solvers balk, in part because this type of rerepresentation is difficult to construct, and there is a suspicion that it may be flawed. "What if the one is eating or resting when the other passes by," might be an objection, but note that the objection contains the phrase "passes by." Of course at that exact moment, they are at the same place on the path.

Let's return to our out-of-gas scenario. We initially said that the goal state was to fill the car to be able to drive to the meeting, but we could characterize the goal state quite differently, that is, we could rerepresent the problem. If the goal state is simply being at the meeting, then a variety of other possibilities come into play, including hitchhiking, calling a friend for a ride, renting a car, taking a bus or other form of mass transit, borrowing a pair of roller skates or any of a huge number of potentially relevant steps. Which of those might be feasible, of course, depends on the particulars of the situation, but none would come to mind if we narrowly focus on the goal state as acquiring gas. We might even radically alter the goal as being one of having some sort of presence at the meeting, even if it is only virtual. So, a web application on a cell phone might get us there, including all of our electronic data and slides relevant to the meeting. Again, problem representation is the key to the types of solutions considered, and consequently to successful problem solving. Importantly, something like a web application would not be part of the problem space if the way of representing the goal state was limited to a physical presence at the meeting.

An approach to problem solving that directly embraces the notion of determining the best way to represent problems before actually attempting to generate solutions, has come to be known as Creative Problem Solving (CPS). CPS was developed initially by Alex Osborn and Sidney Parnes, and subsequently refined by others. It includes an initial stage, comprised of three substages, during which people are supposed to identify, clarify and otherwise clearly define the problem to be confronted. The substages are variously called (a) objective finding, mess finding, or constructing opportunities, during which people identify a broad goal, (b) fact finding or exploring data, during which they determine what is known and what still needs to be known, and (c) problem finding or framing during which the exact nature of the problem is defined and specified. It is during the first stage that an ill-defined problem may become better defined. The next stage is idea finding or idea generation during which people generate ideas for possible solutions to the problem as defined. In the last stage, preparing for action, which is comprised of two substages, people choose and refine a solution from the

many possibilities (solution finding or developing solutions), and implement the solution including finding ways to increase acceptance of the chosen solution (acceptance finding or building acceptance).

Beyond the well-defined versus ill-defined distinction, an alternative way of characterizing problems, proposed by psychologist Jim Greeno, is to classify them into one of three types: *arrangement problems*, *inducing structure problems*, and *transformation problems*. Let us consider each of these types in turn.

In arrangement problems, the solver must arrange objects or elements in a way that satisfies some criterion. One simple example of such a problem is an anagram. In an anagram one starts with a string of letters that do not form a word and must arrange them to form a word. For example, given the letters grutohoh one can arrange them to form the legitimate word 'thorough.' Unless there is more than one word that can be formed, as in the case of eanoc, there is a single correct answer to each such problem.

Anagram problems are also helpful in illustrating the differences between a brute force algorithmic approach and the use of heuristics as discussed previously. One could apply an algorithm of beginning with each of the letters in the given string and constructing all possible variations on arrangements for the other letters until one happens upon a word. This type of non-creative algorithmic approach would be easy enough with short strings, such as dre (dre, der, red, rde, edr, erd). However, for longer strings, such as grutohoh, the procedure is more tedious. Ultimately one would achieve a solution, but it might be extremely time consuming to get there. In such a case, heuristics, such as using typical orthographic patterns might help. One would not need to consider arrangements with long strings of vowels or consonants, such as uoo, grth, and hrgt.

Inducing structure problems require the problem solver to induce or discover the structure present in a set of elements they are given. A classic example would be series extrapolation. Consider the sequence 2, 4, 6, 8. What is the next element in the sequence? The correct answer is 10. The structure in the set of elements is that they are increasing by 2. A slightly more complex series might be 9, 2, 7, 4, 5, 6. What is the next element? The correct answer is 3, with the structure being an interleaving of odd numbers decreasing by 2 and even numbers increasing by 2.

A potentially more interesting version of inducing structure is an analogy problem. Consider the type of problem that might be seen on an abilities test, such as cat:lion::dog:?. The key to solving such a problem is discovering the relation between the first two items and producing something that is related to the third item in the same way. One characterization of the relation between cat and lion is that they are felines, with the one being a domesticated pet and the other more generally found in the wild. Possible answers, therefore, might be wolf or fox, that share a similar relation with dog, being canines, and differ from it in the same way along the dimension of domesticity. Note that either fox or wolf would be better answers than elephant, for example, that also differs in domesticity but does not share the canine relation. Put differently, the quality of a solution to an analogy problem depends on the match between the relations involved. Analogy plays a major role in creative endeavors, and more detail about analogical thought is available in the article on Analogies.

Transformation problems involve executing a set of operations to transform one state or situation into another. The Hobbits and Orcs problem described earlier is a good example of such a problem. One must transform the situation of three Hobbits and three Orcs on one side of the river into all six on the other side of the river according to a set of constraints. Another classic example of a transformation problem is the Tower of Hanoi. In a simple form there are three pegs, a, b, and c. At the start there are three disks of decreasing size on one of the pegs, say a, with the largest on the bottom and the smallest on the top. The goal is to recreate the stack of disks on one of the other pegs, say c. The rules specify that only one disk may be moved at a time and that a larger disk cannot be put on top of a smaller disk. As in the Hobbits and Orcs problem, the Tower of Hanoi also requires temporary movement away from the goal. After moving the smallest disk to c, the peg where we want it to be, and moving the medium disk to b, one has to move the smallest to b to make room for the largest on c. You have to be willing to move away from the goal temporarily in service of achieving it eventually.

Still another way of characterizing problems is to distinguish between *insight problems* and *noninsight* or analytic problems (see articles on 'Insight' and 'Incubation' for more detailed information). Generally, insight problems are those that seem to involve a restructuring of information or a key realization to achieve their solution. Consider the woman in a particular town who married 20 men from that town, without divorcing any of them or any of them dying, yet broke no laws even though bigamy is illegal in that town. How can this be? As long as one conceptualizes the information as specifying that she is married to 20 men, the answer seems to elude us. If one realizes, however, that she is of the clergy or a justice of the peace and that she performed the marriage ceremonies for the men, there is no problem with her marrying 20 or more. In this way, insight problems do require a rerepresentation.

Consider also the coin dealer who immediately called authorities when offered a supposedly ancient coin that appeared to be old, with an emperor's head on one side and the date 544 BC on the other. How did the dealer know it was a fake? Of course, BC would not have been used as a designation on coins or anything else at that point. Again, a realization seems to be required.

Insight problems need not be merely verbal. A classic, more perceptual example is the task of using six matchsticks to create four equilateral triangles all with a side length equivalent to the length of a match. Readers can struggle with this problem on their own, but a stumbling block is representing the problem in two dimensions. While the solution appears easier if one realizes the triangles can be put together in three dimensions, those type of clues do not always help problem solvers.

Insight problems are seen as different in some respects from noninsight problems, such as algebra or logic problems, where steady plodding progress to a solution is required. They do seem to differ in that ratings of warmth, how close one is to a solution go up suddenly at the point of solution for insight problems and more gradually for noninsight problems. One interpretation of that difference is that insight problem solving does not involve a search through a problem space as in the Newell and Simon view, but an alternative

view is that people could be making incremental progress on both types of problems but not be consciously aware of it in insight problems. However, the phenomenon itself does seem to differentiate the types of problems. It also appears that asking people to think out loud as they solve problems (see next section) can interfere with solving insight problems, but tends not to interfere with solving noninsight problems. So, the insight–noninsight distinction does appear to be a useful one.

Insight problems are also closely related to another topic that has been of interest in the field of creativity, namely functional fixedness. One of the most noted examples of functional fixedness is the two-string problem in which the solver is confronted with the situation of two strings hanging down, some distance apart. The person must tie the two strings together, but they are far enough apart that he or she cannot simply hold one and walk over and grab the other. There also happens to be a pair of pliers on the floor. People often do not think to use the pliers in the problem, because their ordinary function, tightening or loosening bolts, does not seem to apply. Yet, one solution to the problem is to use the pliers as a weight, tie them to one of the strings and set it in motion like a pendulum. Then the swinging string can be grabbed while holding the other. To achieve that solution, one must overcome functional fixedness and realize an alternate use for the pliers.

The insight problems used in laboratory studies of problem solving are highly simplistic and often seem to involve a trick. In addition, they tend to have one right answer, leading some to question their usefulness for understanding creativity, since creativity often involves more open-ended situations. The fact that these problems have a single well defined answer or goal state yet require a kind of reconceptualization, makes them similar to both well-defined and ill-defined problems at the same time.

Many of the often-cited real world cases of insight are much more complex than simple tasks used in research. For example, Archimedes' realization of how to measure the volume of Heiro's crown, or August Kekulé's insight that the structure of benzene must involve a ring of carbon atoms seem to capture much richer knowledge than alternate interpretations of the word 'marry.' Yet they also share with these more simplistic problems a key feature; there is one correct answer and the new idea is compelling largely because it came with the conviction that the problem solver found the answer.

So far, this article has focused on problem solving by individuals, but much problem solving in real world settings takes place in groups. Special issues come up when considering group problem solving, such as the dynamics of group behavior and the advantages or disadvantages of working on a problem individually versus in a group. A particular topic that comes into play is brainstorming, in which problem solvers are requested to hold off judgment on ideas, produce a large quantity of ideas, especially unusual ones, and to piggyback on the ideas of others. Brainstorming and other aspects of group problem solving are discussed in the article on 'Group Dynamics.'

Methods of Inquiry

Because the focus on understanding problem solving has been on the processes involved, procedures that reveal those

processes are of most interest. Although it matters whether or not people achieve the correct answer, it is more important to understand how they got there, or why they did not get there if they failed to solve the problem. In laboratory studies of problem solving there are two standard ways of obtaining such information: preserving or in some way capturing intermediate products that people develop along the way, and collecting verbal, think-aloud protocols.

Intermediate products could be formulas or calculations used in math problems, sketches in preparation for a more complete drawing or design, tentative guesses or hypotheses written down or any of a wide range of thoughts embodied in the materials created by the problem solver on the way to a solution. They can provide a window into the person's thought processes.

Verbal protocols are collected when an investigator asks a participant in a study of problem solving to talk out loud while solving the problem. Protocols can contain evidence of knowledge states and the application of operators in transforming those states. To return to the DONALD + GERALD = ROBERT problem, an initial statement might, for example, look like, "Let's see, I know D is 5, so if I add the two Ds I get 10, so T must be 0, and I'll be carrying 1 to the next column. I better make a note of that." Collecting verbal protocols as the person is solving the problem can have drawbacks. It is possible, for example that solvers may not always know how they moved from one point to another in a problem. But, collecting protocols during the problem is needed for getting a look at the process and it yields better information than retrospective accounts. In addition, the evidence seems to show that it does not interfere with the basic nature of the process, with the possible exception of disrupting insight problem solving.

An alternative means of coming to understand problem solving is developing computational models designed to simulate it. Verbal protocols can be used to identify key changes in states of knowledge and the operators that bring them about. They can capture the use of algorithms and heuristics. That information can then be used to develop computer programs with the goal of matching what humans do on the same and other related problems.

Summary

Problem solving is best thought of as eliminating the discrepancy between the current, less desirable situation and some more desirable goal state. This definition leaves room for many types of problems, from those that are well defined and easy to confront to those that are ill defined and more difficult to approach. Some problems can be solved readily as stated, and others require reconceptualization, a different way of representing them in order to make progress. Some are difficult because of unnecessary limiting assumptions or fixation, and some require an insight if they are to be solved. Although creativity is applicable to most situations, it is typically thought of as being more relevant to ill-defined problems or those that require restructuring, overcoming fixation, or achieving insights.

See also: Group Creativity; Incubation; Insight; Problem Finding.

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Prodigies

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Glossary

Child prodigy A child who performs at an accomplished professional level in a highly demanding domain.

Collaborative creativity Recognition that most transformative efforts take place as a result of more than one person.

Common creativity The form of creativity that enlivens and enriches daily life, is clever and refreshing, but only known to those close to its creation.

Domain specific creativity Recognition that creativity varies in relation to the domain in which it takes place.

Extreme creativity Of the several forms of creativity, extreme creativity represents the pinnacle of achievement; Mozart, Madame Curie, Judith Jamieson, and Einstein are examples.

Moderate creativity Innovative or original work that transforms a domain but does not achieve the highest level of impact.

Introduction: Prodigy Research and Creativity Research

In this article we will discuss the relationship between creativity and child prodigies, particularly in light of recent research and theory in both areas. In the past few decades the study of child prodigies has been revived after nearly half a century of neglect, while the domain of creativity studies has taken some important turns that bear directly on how to understand the prodigy's astonishing achievements.

We will begin with a discussion of the prodigy, defining the phenomenon and summarizing what is currently known about it. Next, we will discuss recent work in creativity studies that may be relevant to the study of prodigies. Finally, we will turn to the ways that creativity studies may inform efforts to better understand the prodigy and how the prodigy may help sharpen our understanding of the variety of ways that creativity can be expressed.

Child Prodigies

The child prodigy is an ancient phenomenon, described in venerable texts like the Old Testament (David and Goliath) and the New Testament (Jesus in the Temple). There have been famous prodigies in history (Joan of Arc), in sports (Tiger Woods), and in entertainment (Shirley Temple). What distinguishes each of these cases and all other child prodigies is that they have achieved seemingly impossible heights in their areas of endeavor while still mere children.

Although child prodigies have been known through history, systematic research is a relatively recent phenomenon. Essentially, studies began in the early part of the last century, languished between about 1930 and 1980, and then re-emerged in the mid-1980s through a small set of studies that continues to grow. Traditionally, the child prodigy was seen as a sign or portent, something out of the usual course of nature

that often meant that major changes were in the air. Prodigies for most of history were not just children, but could be any anomalous event or occurrence (a hurricane or unusually long drought) that gave rise to concern about the future.

The earliest research on prodigies tended to focus on single or small numbers of cases in the domains of music, chess, mathematics, and a few other areas of achievement. The studies were mostly descriptive, although a few also provided some data on IQ and other early psychometric and personality tests. The most detailed study was of a Hungarian piano prodigy of nine named Ervin Nyiregyhazi, a boy who disappeared from public view for nearly 50 years, was 'rediscovered' in 1973 and died about 14 years later in 1987. Other than occasionally in the popular literature (Ruth Szeminska, Yehudi Menuhin), little was written about prodigies by scholars.

In 1986 a study of six boy prodigies launched contemporary research; there were two chess players, a science/mathematics prodigy, a musician/composer, a writer, and a child whose gifts seemed to be protean and who was given the label 'omnibus prodigy.' There was a brief discussion of creativity in this group of children, but creativity was not the main focus of the research.

For the purposes of this and future research, a prodigy was defined as a child younger than 10 years of age who has reached the level of a highly trained professional in a demanding area of endeavor. Each of the participants in the study probably reached this criterion, even the 'omnibus prodigy' who had composed several orchestral works before his tenth birthday. The writing prodigy may not have quite reached the criterion because of the childish themes of his writing. On technical grounds, his writing was sophisticated and well constructed.

This research helped organize subsequent work in several ways: it provided a relatively clear definition of the child prodigy; it offered a broad framework within which to interpret the extreme behavior of a prodigy as compared with other children; and, it helped differentiate the specific nature of

the child prodigy from general high intelligence, the previously most common explanation for the prodigy's great accomplishments.

Subsequent research and theory has tended to confirm earlier findings, although not without controversy. Some scholars have disputed the definition of a prodigy as always needing to be younger than 10 years old, others have questioned the use of the term prodigy at all, preferring 'precocious' to prodigious, and still others have questioned whether the prodigy must possess uncanny natural gifts and talents to achieve the highest levels of performance in his or her domain. Systematic study of the relationship between the child prodigy phenomenon and creativity has not occurred to date, although examples of great creators like Mozart have tended to link the prodigy with creativity.

Mozart is of course a near mythic figure who produced compositions that have not only withstood the test of time, but that have become ever more revered within the Western canon. And Mozart was without doubt a prodigy. The problems with interpreting Mozart's case as emblematic of child prodigies in general, however, are twofold: first, very little solid evidence concerning Mozart's earliest years is available, leaving us with mostly anecdotal, unreliable information; and, Mozart was very unusual, even among child prodigies.

Most prodigies are masters of existing forms and are not noted for their record of major changes in the domains from which they derive their notoriety. In other words, unlike Mozart, most child prodigies in most areas in which prodigies have been found, have excelled in how well they are able to perform known and recognized marks of great achievement in their domains. For a musician it might be to perform a challenging piece of music (a Rachmaninoff piano concerto, for example), for a chess player it might be to win against world-class competition, for a mathematician to solve a major set of problems that only master mathematicians can solve.

This does not mean that child prodigies cannot be creative in other ways in their chosen domain, but the usual benchmarks for great creative contribution tend to be outside the areas of expertise for all but a select few prodigies. Even a famous performer like Yehudi Menuhin, the remarkable child prodigy violinist, produced no new works for the violin in his venerable lifetime. Yo Yo Ma, one of the greatest cellists of all time, has produced no compositions of note. Advances in the domain of creativity studies have given us tools by which to interpret qualities of child prodigies' performance that may be appropriately labeled creative, although not in the usual sense of contributing major new works for the domain that others may perform.

A possible exception to what has just been proposed may occur in the domain of visual art. Prior to the appearance in the West of a book about the amazing Chinese painting prodigy Wang Yani, it was believed by most scholars that visual art was a domain in which prodigies do not occur. Since there are only a relatively few domains in which prodigies do occur, this was not in and of itself a surprising situation (e.g., there have been no child prodigies in physics, philosophy, engineering, genetics). Once Wang Yani's work was available, however, the domain of prodigy study began to discover more cases, including some in the West.

Given that visual art requires originality as well as technical mastery, at least in Western contexts, the increasing number of child prodigy visual artists (including more girls, also unusual prior to 1986), implies that the link between child prodigy and creativity may be stronger than previously believed, at least for the domain of visual art. Or it may be that most child prodigy artists to date have actually mostly produced variations on canonical works using existing techniques and themes as some critics have maintained. It is a reasonable prediction that in future studies, child prodigies and creativity will be studied together, certainly among child prodigy artists and perhaps in other domains as well. In any case, it is a major shift to have prodigies in the visual arts to study.

Creativity Research Relevant to Prodigies

Several shifts and advances in creativity studies have made that area better equipped to shed light on the nature of prodigies. Among the more relevant areas of creativity research for prodigy studies are the following:

1. creativity is increasingly seen as specific to the domain in area it is expressed;
2. creativity is considered to be a developmental process at least as much as it is seen as a set of distinctive traits or personal qualities, occurring as a confluence of a number of forces sustained over a period of time;
3. creativity is understood to be a matter of judgment (subject to change) by those given authority to make these judgments;
4. creativity is increasingly understood to include a number of different forms, ranging from humble and relatively common innovations, to unusual but not truly exceptional contributions, to fundamental and transformational revolutionary changes; finally,
5. creativity is now seen as typically collaborative, social and cultural as much as it is the unique expression of an individual's potential, especially in those forms of creativity that emphasize innovation, improvisation, and performance.

For each of these qualities, there are implications for how child prodigies are defined and understood.

Creativity as Domain Specific

For much of its history, creativity has been conceptualized as a set of traits and qualities existing independently of the specific domain in which they are expressed. Although there may be some traits of this sort, it is increasingly clear that there must also be domain specific talents and proclivities that are distinctive to each area of creative activity. The qualities that make a creative architect are not altogether the same as those that make a creative dancer, mathematician, or novelist. For the study of prodigies, the more that is known about the qualities that mark creative efforts in various domains in which prodigies are found, the more likely we will be able to understand the prodigy's abilities, including possible limitations in those abilities. By recognizing that each domain has its own set of distinctive qualities, in addition to whatever general ones may be applied, we may better comprehend the nature of the

prodigy's accomplishments, at the same time as we may be able to better distinguish between astonishing technical mastery and innovative, adventurous, or transformational efforts.

Creativity as a Developmental Process

The qualities that contribute to a creative process, both the general as well as the specific ones, are seen as subject to change over time; creativity traits may in some instances increase or decrease in strength, while domain specific talents and abilities are seen to become organized, disorganized, reorganized, and occasionally transformed during an individual's lifetime. In addition to the individual developmental process, domains in which creative contributions are made also develop and change. Knowing the developmental history of a domain may be helpful in understanding why one contribution is seen as creative at a particular point in time, another less so.

For the study of prodigies, both areas of developmental change are relevant. Prodigies are better understood as examples of extremely rapid development through a challenging domain that, typically, requires much longer to master. By knowing the developmental markers that distinguish levels of mastery from novice through master performer, we can locate and compare the prodigy's accomplishments with those of others who seek to master the domain.

Also, if it is understood that a domain is currently focused on a particular set of challenges (e.g., mapping the genome, integrating electronic music with more traditional forms), the work done by individuals or groups of individuals can be seen in the context of an evolving domain. Some historians of science who study the domain of physics have remarked that were Albert Einstein a young physicist today, the likelihood of his revolutionizing the domain would be small. The unique talents, preoccupations, and sensibilities that equipped Einstein admirably to attack the problem of relativity would not serve him as well in conceptualizing string theory or alternative universes.

For the study of prodigies, an understanding of the history of a domain provides a context for what the prodigy does. It appears to be the case that prodigies appear in domains that have certain features in common; for example, where the knowledge structures of the domain are either transparent or readily accessible such as in music or chess. It also appears to be the case that prodigies tend to master existing forms rapidly more often than they create new forms (even Mozart may be so described), so by having a sense of how a domain has evolved, what its current and past demands have been, and knowing what distinctive technologies and techniques have been available for practicing that domain over time, we can place the prodigy's accomplishments within a meaningful cultural, historical and evolutionary context. That context may include information on the qualities that would mark a creative contribution to a domain as compared with a contribution that is marked more by remarkable technical proficiency, the hallmark of the prodigy.

Creativity as Changing Judgment

When they were both active composers, the works of Antonio Salieri were generally judged to be superior to those of his younger rival Wolfgang Mozart. Two centuries later, Mozart's

works are precious and revered icons of Western music, Salieri's relegated to oddities only known to the public by virtue of their place in Peter Shaffer's play about Mozart life and death. Galileo Galilei was condemned for heresy by the Catholic Church for supporting Copernicus' theory that the earth rotates around the sun; 350 years later the Church admitted that errors had been made, but did not apologize for its condemnation of Galileo. What may be recognized as a prodigy's achievement may also change with time; some gymnastics and figure skating moves that were amazing 30 years ago are routine today. Doing these things would have meant world-wide recognition only a few decades ago, while they are considered journeyman accomplishments in contemporary competitions.

Forms of Creativity

Perhaps the most significant shift in the domain of creativity studies for the work on prodigies has been growing recognition that creativity is many things, not a single thing. For most of its history, the study of creativity revolved around efforts to assess a single trait of creative potential using one or another form of test. Alternatively, research on the 'creative personality' attempted to define a profile of the kind of person who would most likely be a creative thinker. Only recently have scholars begun to conceptualize a variety of ways to be creative, ranging from relatively modest changes involving everyday events, such as a fresh approach to flower arrangement to a revolutionary and fundamental shift in the very principles upon which a body of knowledge rests (e.g., a theory of evolution by random variation and natural selection).

Several schemes for representing variation in creative activities and processes have been proposed; although they vary in several ways, they have in common recognition that the qualities that are necessary and sufficient for one form of creativity may or may not be those that give rise to another form. It may be a different set of circumstances and processes that account for an innovative marketing campaign as compared with a new approach to music composition or a solution to a centuries-old mathematics problem as was achieved in the 1990s by Andrew Wiles for Fermat's Last Theorem.

Along with the increasing consensus that creativity is best conceptualized as domain specific, the ideas that creativity varies (within domains) in its strength, its range, its reverberations through that domain, the degree to which it transcends existing constraints have also gained credibility. It becomes a more complex but more proximal task to describe and explain the particulars of a certain kind of creative accomplishment and the specific qualities and circumstances that may have given rise to its appearance. It seems likely that in future studies we will more likely see more modest claims for the key features and key elements that are involved in a particular form of creativity of a given strength during a particular period of that domain's history. Claims that are intended to apply to all forms of creativity of all degrees of power and at all times in all places will most likely be abandoned.

Creativity and Collaboration

Several major studies have appeared in the creativity literature in recent years attempting to document the pervasive influence

of collaborative processes as critical to virtually all creative achievements. Some well known cases of the 'lone creator' such as Einstein or writer J. D. Salinger did their work in much greater a social context than we tend to believe. In some of the more extreme cases of creative contribution, the person known for making the contribution spent several years in intense collaboration before going on to construct and communicate a work that becomes recognized around the world. Such was the case with Einstein, Freud, Watson and Crick, and Andrew Wiles. Many others who hold esteemed places in various domains benefited from collaboration throughout their most productive periods; Mozart, Picasso, Martha Graham, and Darwin are cited as examples.

For more modest forms of creativity such as creation of a new software platform or a better weapons system, collaboration is essential. In most natural sciences, particularly physics, research is almost always done in large collaborative collectives of several hundred members. This is because the equipment needed to carry out experiments is scarce and astonishingly expensive, and the amount of data needed to add significantly to knowledge is huge.

For the prodigy, the relevance of the importance of collaboration for creative contribution may help differentiate the prodigy from others who demonstrate extreme talents and who perform at a very high level. Because prodigies in most of the domains in which they occur are young children, the term collaboration may not be an appropriate one. The process of preparing a prodigy to reach the highest levels of his or her domain is without a doubt one that involves sustained efforts by a number of people (parents, teachers, mentors, patrons, technicians, for example), at least during the child's early years the roles of others would likely be better described as preparation, support and enabling than true collaboration. Collaboration, after all, implies shared if not equal participation in a creative process.

Prodigies and Creativity

Having reviewed some of the contributions to knowledge about prodigies and about creativity in recent decades, it now remains to bring the two areas of study together to see what can be said about child prodigies and creativity. There are four ways to describe the relationship between the child prodigy's phenomenal achievements and what is known about creativity.

First, it is fair to say that child prodigies are creative in certain respects. The fact that a child is able to amaze a sophisticated audience with an astonishing display of technical virtuosity suggests that such a performance is both unusual and distinctively appropriate enough to be labeled 'creative.' The question is in just what sense is the child prodigy's performance creative.

Second, although it is reasonable to describe a child prodigy as creative, it is likely that this creativity is limited to the specific domain in which the prodigy is performing. That is, if the prodigy plays chess, it is unlikely that the creative aspect of that playing would extend to other domains. There are no recorded cases in which a child's achievements extended beyond the boundaries of a single domain. Even the 'omnibus prodigies' that rarely appear begin to focus their efforts and are known for their exceptional ability in a single area; the child so described in one study had focused his efforts in music composition by ten.

Third, there are few prodigies who transform the domain within which their prodigious achievements take place. A prodigy is defined by performance at the level of a highly trained adult professional in the same domain; as remarkable as that level of performance is, it does not necessarily mean that the child would be rated as among the very best performers in that domain. It means that the child's performance would meet whatever criteria are currently established to qualify as a professional in the domain. Among professionals, only a small number during any period will be recognized as one of the leading performers. The members of every symphony orchestra in every city in the country are professional performers; the soloist who travels around the world to perform with the leading orchestras has exceeded the criteria for being labeled a prodigy by a considerable margin.

Finally, knowing that the prodigy tends to master existing forms, where creativity is the transformation of forms, helps put the prodigy's achievement in perspective. What marks the prodigy's achievement as remarkable is not its tendency to bring a new form into a domain. The prodigy masters an existing domain to a level of proficiency so as to be considered good enough to do that activity as a professional. Among those who have reached the professional level, a very small number bring sufficient new meaning to a performance and/or transform existing techniques or technologies to a sufficient degree to be considered creative in the more exalted sense.

Making a distinction between prodigious and creative achievements in no way diminishes the feats of the remarkable children who amaze us with their seemingly uncanny ability to perform at the highest levels in domains that are very demanding and difficult, and do so in a relatively short period of time.

The prodigy's achievement affirms that culture has found a way to make a complex area of human achievement sufficiently accessible to children to allow the most talented of them to mount its heights in a very short time. Having done so leaves the domain essentially unchanged. Unless the very fact of this feat is to be labeled as 'creative,' the domain presents the same challenges to those who aspire to master it as it had before the prodigy did so.

There are cases where the distinction between prodigious and creative are less clear, and the recent efforts in creativity studies to differentiate among various forms of creativity may be helpful in modulating what may be too much of an either/or distinction. For example, although a great performance of a piece in the classical repertoire changes none of its notes, that performance may have qualities of interpretation, expression of emotion, and depth of meaning that have not been captured before. This form of creative interpretation may have a long term effect on other performers, on decisions to include the piece in concerts, in the buying public's purchase of recordings of that piece, and the like. Given that creativity represents a significant transformation of a challenging domain, interpretive efforts may be appropriately called creative. But few would confuse them with a singular contribution that leaves the domain changed in fundamental ways. Prodigies often do the former, rarely the latter.

Conclusion

To conclude this discussion of prodigies and creativity, we have seen that recent efforts in scholarship in both areas of study

have helped clarify and explain both topics. Advances in the study of creativity have taught us that prodigies are creative in certain respects: they are amazing in being able to perform at a very high level, thereby astounding us with their achievements. This in itself may be seen as creative. They also occasionally bring a new and fresh interpretation to an existing piece of music, chess opening, artistic style, or dance form, earning a claim to a form of creativity achieved by a small number of professional performers. Only the rarest of the rare among prodigies could lay claim to the most powerful creative achievements, those that transform a domain in an irreversible and enduring way. Of the many thousands of musical performers and composers, there are a tiny number – Mozart, Beethoven, and a few others – whose works have become established foundations of the domains to which these composers devoted their lives.

It should be emphasized in closing that this discussion is in no way intended to diminish the truly astonishing things that prodigies sometimes do. A prodigy represents one of the most rare and precious manifestations of harmony between cultural and biological evolution. To have found a way to give full expression to the natural human potential of its young is one of culture's highest aspirations. In the prodigy we see that effort in one of its most successful forms, a tribute to our civilization, and a gift from all previous generations to all future ones.

See also: Ludwig van Beethoven 1770–1827; Collaboration; Expertise; Genius and Greatness; Innovation; Mentors.

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- <http://www.cnn.com/2007/LIVING/worklife/12/10/mf.child.prodigies/index.html> – Article from *Mental Floss* magazine (<http://mentalfloss.com/magazine/>) "10 Child Prodigies who actually ended up doing something."
- <http://www.artsci.wustl.edu/~ksawyer/groupgenius/excerpt.html> – Nexus of links to sources about creativity, innovative ideas and a blog hosted by Dr. R. Keith Sawyer, professor of psychology and education at Washington University in St Louis, self-described "scientist who studies creativity," and author of the book *Group Genius: The Creative Power of Collaboration*.
- <http://www.davidsongifted.org/default.aspx> – Website for Davidson Institute for Talent Development, a resource focusing on serving the needs of gifted children. Includes links for articles on prodigies.

Programs and Courses in Creativity

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Glossary

Course A formal structure for offering instruction; in teaching environments, a course is the smallest single unit of coherent concepts and goals for learning that fit into a larger curricular program, usually with some kind of accumulating credit toward a degree or certificate in training environments, a course also contains a coherent set of goals and instructional activities, and is usually self-contained, as in a one day course in creative thinking, it may or may not lead to some kind of local certification.

Curriculum All the experiences that go into a coherent plan of learning that focus and guide the choice of activities and instruction. Curriculum relates to what should be in the complete learning plan and why it is present.

Discipline A coherent body of knowledge that is instructive; offers potential for teaching and learning.

Instruction Those elements that relate to the goals, activities, and selection of content designed to directly instruct learners in the concepts they need to know within the larger curricular framework. Instruction focuses on what specifics are needed and how material will be delivered.

Interdisciplinary programs or courses Starts with a discipline and uses activities or approaches which are

connected beyond mere series of integrated events or actions; focuses mainly on integrating the tools and approaches from several disciplines to discover the relationships among them.

Multidisciplinary programs and courses Those that can be added on to another discipline that already exists. Often short term; neither the initial system nor its structure has to change to accommodate unless teacher or learners make the connections. Content is domain specific.

Multifaceted Having more than one part or made up of multiple constructs.

Programs (a) Formal delivery structures used to deliver creativity; (b) content materials and activities used within the delivery structure.

Technique How a person chooses to apply a tool or combination of tools, processes, or approaches.

Transdisciplinary Beyond the parameters of traditional disciplinary views; transdisciplinary approaches connect, are present, and are at the core of other disciplines. Highest level of steady integration. Starts with issue or problem and uses problem solving to bring disciplinary knowledge together.

What is Contained in a Program or a Course: Some Guiding Definitions and Issues to Consider

Programs and courses are part of the foundation of any topic as it gains internal coherence and external credibility and grows toward the parameters of a discipline. Programs and courses are two of a number of elements that include such structures as the creation and on-going growth of research and applied journals, the development of professional organizations with guidelines for ethical behavior, and on-going national and international conferences. Each of these structures adds some formal pathway to encourage growth, thinking, research, and communication that will increase the body of knowledge of a topic and our understanding of the instructiveness of it. In creativity, courses and programs fit into this category because they are the bottom line formal structures for the teaching and training of its content.

[†]This article is dedicated to Dr. Mary C. Murdock (1947–2010), a leader in the design of creativity education curriculum. Mary spent her career teaching creativity at the university level, challenging over two decades of graduate students to find their creative passion. This, her final article, gives voice to her wisdom and perspective on creativity programs. Mary embodied the creative spirit, and is a continuing source of inspiration to her colleagues and students.

Certainly attempts to identify, categorize or classify programs and courses are a worthwhile venture, if for no other reason than to put a temporary bookmark in our progress in making creativity accessible. Numbers are one benchmark of health. These efforts, however, are not without challenges.

Challenges in Understanding the Meaning and Impact of Programs and Courses

In the creativity literature and practice, the term program or programs is used in several different ways, which has caused no small amount of confusion. Reviews of programs often contained a mixture of the longer, more formal curricular work and the shorter, more instructionally oriented activities, or even packaged materials of activities and skills, such as the Purdue Productive Thinking Program, that can be used by a variety of people in many contents to add creativity to their courses or workshops. By curriculum, we mean all experiences that go into a coherent plan of learning to focus and guide the choice of activities and instruction. Curriculum relates to what should be in the complete learning plan and why it is present.

Another option contains a variety of instructional approaches and philosophies that may be mixed. By instructional approaches, we mean those elements that relate to the goals, activities, and selection of content designed to specifically

instruct learners in the concepts they need to know in the larger curricular framework. Instruction focuses on what specifics are needed and how the material will be delivered.

It can be difficult for a reader or a reviewer to make sense of what to include and why to include it or to determine the status or development of programs and courses and their commensurate impact on the development of the field. Traditionally, surveys, questionnaires, and on-line investigation and personal inquiry have provided these kinds of data.

A second challenge in identifying creativity programs or courses lies in the difficulty in establishing longevity and in embedding them in the context of either teaching or training. This is necessary so that they can survive on their own merits. Otherwise, they may just have a champion who may sponsor them initially. Then this champion may lose interest or not be able to sustain the onslaught of possible criticism in order to gain acceptance for something new. By the time research is completed and an article written and published, the data are out of date, both in the creation of new programs and courses, and in the demise of them. The shelf life of a creativity course or program is short in comparison to more traditional content. English 101, Introduction to English, or Basics of English are going to be around, recognized, and accepted in programs of study in many colleges and universities consistently over time. No one will ask "What is this?" Creativity 101, however, will get no such pass.

A third challenge concerns where creativity programs come from. Although the variety of choices is dynamic, the range, expertise and peer review may be somewhat lacking. There are four traditional pathways for the development and presentation of creativity programs and courses:

1. academic institutions with formal degree granting curriculum such as the Master of Science Degree in Creativity at State University College at Buffalo, New York;
2. centers associated with academic institutions, such as the Center for Applied Learning at McMaster University in Hamilton, Ontario, and the Torrance Creativity Center at the University of Georgia, Athens;
3. centers either privately funded and run, such as the Center for Creative Leadership in Greensboro, North Carolina or those tied to an established institution either by location or some course access; and
4. internal creativity units or teams within organizations.

Well-established programs or courses are often located in academe where they have been through an extensive peer review process.

Programs can refer to either formal delivery structures, such as courses or training sessions, and the learning processes used to deliver them or to the content of materials and activities that are used within them. Thus, a program (as it appears in the creativity literature) could mean a formal program of study with curricular coherence and scope and sequence in courses that lead to an academic degree. A program might have a more instructional focus with more emphasis on a set of activities of some days or hours' duration sponsored by a Center, or by an independent contractor, often for some kind of local credit or local credential. As used here, programs may refer to either, though the prevailing literature tends to focus more on materials than on formal delivery structures.

A course is a formal structure for offering instruction. In teaching environments, a course is the smallest single unit of coherent concepts and goals for learning that fit into a larger curricular program where one may accumulate credit toward a degree or certificate. In training environments, a course may contain a coherent set of goals and instructional activities and is usually self-contained, as in a one day course in creative thinking or a week long course to introduce the Creative Problem Solving process.

Again, the term course has been loosely used, though it generally offers some kind of topic related to the broader phenomenon of creativity, such as a course in creative product or a course in habits and blocks to creativity. Academe courses in creativity are often easier to establish than longer-term curricular initiatives: (1) they can be more easily focused on some interdisciplinary aspect such as creativity in business or creativity in the arts; (2) they often only need a single sponsor or champion. Their time frame from initiation to implementation is reasonably short. In consulting, center, or other development outside of academe, courses are often simple and quick ways to make a point, particularly as it relates to the originator's goals, and to get information out.

These critical factors continue to influence both how others view creativity programs and courses and how they are crafted. One should be cautious to develop them with purpose, in accessing what they are intended to do, and in presenting them to others as accurate exemplars of what we know about the discipline.

Historical Context for Programs and Courses in Creativity

The development of programs and courses in creativity is historically embedded in three major questions that have consistently been asked: (1) What is creativity? (2) Is creativity teachable and how do we know? and (3) How is creativity teachable?

What Is Creativity?

In any domain or discipline the parameters of its content depend upon having coherent concepts that are clear and connected to each other in a logical, understandable way. In simple terms, domain or disciplinary content must make sense both to those who have expertise in the area and to those from other fields who look at it with outside eyes.

The parameters of the domain of creativity are connected by one over-arching characteristic that is often misinterpreted and misunderstood. There is general agreement by theorists and practitioners in the field that creativity is a multifaceted phenomenon. Mel Rhodes' work in the late 1950s and early 1960s to find the similarities and differences in definitions of creativity and imagination illustrated the early variety of views people were using, even from this limited perspective. His definitional work supported a framework to organize creativity for study into four categories that had distinct but overlapping elements: the creative person, creative process, creative product, and creative press (now generally referred to as climate or environment).

This broad definition has served as a standard framework in deliberate creativity for both organizing concepts and developing programs and courses as multifaceted. For example, in the early development of programs and courses, there was a strong research emphasis on obtaining information about creative people – who were the highly creative; what were their traits and qualities; were there particular qualities that were more general or some specific to creativity only? Thus, courses and programs (where they existed in early times) often had content related to personal creativity and how people might or might not enhance what they had. The Institute of Personality and Research (IPAR) work of McKinnon and colleagues at Berkeley added data to the person component of creativity. Much has been done to refine the person approach since those early days but the concept of the creative person was a starting point and programs and courses followed suit.

In the 1950s and 1960s, more attention began to be directed toward creative process. What steps, stages, or repeating aspects of how people could get more creative results to problems and challenges, either personally or professionally, were the focus. This led to an expansion not only of courses and programs in process such as Synectics, Creative Problem Solving (CPS), and Lateral Thinking, but also a stronger overlap in activities that involved person and process. The process approach was very popular because it moved the focus of programs and courses away from a more personal view of creativity and into the realm of results and outcomes of problem solving that involved people. In other words, it focused on what you get when you deliberately apply tools and techniques to a situation with no obvious answer. Although tools and techniques had been popular with person approaches as well (brainstorming, e.g., was well-known as early as the late 1940s and early 1950s) they came into their own during this time as well. Process required tools to deliver specific results and many tools became associated with divergent thinking and idea generation.

In the late 1970s and throughout the 1980s there was increased research interest and follow up in practice about creative press or environment. Researchers such as Teresa Amabile in the United States and Goran Ekvall in Sweden, began looking at a more social, interactive approach to creativity. Identification of basic creative climate concepts which could be explained and identified, instrumentation and applied work to support those concepts, and activities that could help people understand and practice them were developed.

Ironically, the concept of creative product as an element to be explored more specifically did not begin to receive attention until the 1990s and beyond. Much of the more direct line to product came earlier, through the demand in the workplace for innovation. Innovation is, in some ways, a similar concept for creative product. It is the new outcome that comes from market demand and push. Programs and courses in innovation have been widespread in the organizational workplace. They are also popular in the consulting business because people recognize the term and associate success and competitive edge with having new ideas that are ahead of the pack. In the programs arena, business curricula often have courses in innovation, as do MBA programs, and a variety of entrepreneurial studies have courses. In creativity, Susan Besemer has developed instrumentation and a theoretical framework to support basic concepts that identify the characteristics of creative products

in general and has applied this work in education and organizations. The innovation/creative product development is another example of how practice sometimes leads theory and then theory catches up.

Rather than any one particular definition or approach being the sole determinant of our views about what creativity is, we have, instead, all of the implications that go with the word multi. No matter what words are used to define creativity: multi, multiples, many, options, choices, the use of the term implies that to expect or, indeed, seek a unified theory of creativity with one definition, one angle, or one approach, is not authentic to the true nature of the phenomenon in question. That it is in the very nature of creativity to be multifaceted is not a problem but, rather, an opportunity. It is neither a simple nor simplistic construct. It is instead a constellation of skills, techniques, and processes that describe how people bring about something new.

This newness or novelty is the generally accepted hallmark theoretical characteristic of creativity and is most frequently accompanied by its partner in practice, usefulness. These two elements, the theoretical element of novelty and the practical element of usefulness, constitute a well-accepted definition of creativity that works in many different situations. In addition to this basic definition, Rhodes' analytic framework has served as the standard and useful organizer for both organizing concepts and developing programs and courses.

Is Creativity Teachable?

Once the multiple concepts and constructs of creativity began to be moved into the public eye by theorists and practitioners, they needed to pass the test of verity. (Who says this information is accurate or correct? What research exists to support the ideas that people are putting forth?) If theorists and practitioners were maintaining that teachers, trainers, consultants, and everyday people could deliberately learn, improve, or enhance the natural creativity they already have, how would the average person know that this was information on which he/she could rely? This teachability issue sparked a controversy that, for some outside the domain, is still not yet resolved. Within the discipline itself, however, the teachability issue has reasonably been put to rest. Here we find that, not only did research catch up with practice with both quantitative and qualitative support, but practice continued to develop with ongoing feedback and program evaluation, cases, examples, and behavioral indicators that people's creative thinking could be impacted and changed in more deliberate ways.

Early work in cognitive theory by such researchers as J. P. Guilford and E. P. Torrance, and the personality work of Frank Barron and Don MacKinnon at Berkeley, set the stage for further exploration into the nature of deliberate creativity. In more recent times the work of Robert Sternberg and his colleagues as well as the work of Howard Gardner and David Perkins have clarified and elaborated upon the cognitive concepts of deliberate creativity and how they operate.

On the applied side, in the late 1960s and early 1970s, a major research project was conducted (within this series of creativity courses developed by Osborn, Parnes, and Noller) to examine the efficacy of the undergraduate courses established at Buffalo State College. The Creative Studies Project

was one of the earliest pieces of applied research designed to explore the efficacy of creativity and creative problem-solving (CPS). Its results did indeed support the teachability of creativity and CPS. Evidence continued to accumulate for the teachability of deliberate creativity (as evidenced in reviews such as those of E. Paul Torrance, Laura Hall, John Feldhusen, and Ban Eng Goh). Inquiry supporting teachability has continued, on the applied side, in the organizational context as well, most notably with the ongoing work of Min Basadur.

How Is Creativity Teachable?

As theorists and practitioners refined their understanding and articulation of what deliberate creativity was and built support for how it was teachable, they came face to face with the question that is most pertinent to those in the field – how is creativity teachable? How can we best help others to learn about it? What are best practices? What have other people tried? How can we improve our practice to create better programs and courses? Without the constant burden of proving, justifying and explaining what creativity was and if it could be learned and taught (although the questions are still not resolved nor agreed upon universally), there is now more time for those who are serious about the discipline to concentrate on refined and improved practical approaches for instructiveness beyond the dependence on tools that has been prevalent. As one would expect in any other discipline, practice and application are the keys to learning about creativity deliberately – support, by the way, for the teachability of creativity that even early practitioners maintained.

In recent times there has been more work on the cognitive and affective elements of creativity, particularly in regard to higher-order thinking skills. Work from Project Zero at Harvard has begun to accumulate examples and research based support for how to identify and practice skills and dispositions that are a part of the larger picture of how people think creatively are being studied. How to look at more subtle and specific ways to explain what is happening in the field and to develop instructional materials and curricular frameworks that will deliver deliberate creativity to others in more effective ways are being identified as well.

How to Teach Creativity: Some General Issues to Consider

In addition to previously mentioned process pathways into teaching and training, courses and programs need a content home, a location or home base in terms of philosophy or approach to the material. This philosophy serves as a guide for how to design instruction and just where to put creativity in the mix. This content location comes from three traditional disciplinary approaches: interdisciplinary, multidisciplinary, or transdisciplinary.

If a program or course takes an interdisciplinary approach, the instructional approach starts in a discipline and focuses on integrating tools and techniques from several other disciplines, looking for relationships among them. Its activities and instruction should be more than a series of connected events strung together.

If a program or course has a multidisciplinary philosophy, the intent is to add on to an existing discipline. Often the

approach is short term and the initial discipline itself does not have to change unless the participants want to. It is content specific.

The final approach, transdisciplinary, takes the view that creativity is beyond the disciplines. This approach views creativity and its concepts as being at the core of what needs to be taught. Connections can then be made into other content areas but they come back to creativity as the core. This philosophy pushes back on the domain specific argument that one must be creative in something. The more productive approach would be to understand that the domain specific argument is rooted in practice and the transdisciplinary counterpart relates to the theoretical soundness and accurate identification of what creativity is. In order to be used effectively in a practice in a domain, one must have a knowledge base in the content of creativity, regardless of domains it might connect to. Therein lies the transdisciplinary connection, because concepts of creativity can be found in almost any discipline and form a powerful core beyond what the other disciplines have to offer. Take, for example, flexibility, one of Guilford's original elements of divergent thinking. In order to adapt, rethink, adjust or cope with complex thinking, one will need this skill. It is core and beyond the skill bases of most disciplines, yet without it, one is limited in how to approach or find anything new, different, or surprising. It may happen naturally on occasion, but the deliberate awareness that sets up understanding, practice, and decisions about when to apply and why will remain tacit.

Each of these approaches has unique strengths and drawbacks and each, in its own way, has had an influence on the development of creativity courses and programs. When deciding how to teach creativity, determining its philosophical position determines what you choose to instruct and why.

The Future of Programs and Courses in Creativity

Throughout its development, creativity has never lacked for dynamism or change – multifaceted concepts, infusion of new theory, new practice, and new approaches. Theory and practice are more balanced in programs and courses today than they have ever been. New ones emerge and either grow or die. Older ones survive, thrive, or fall by the wayside. Periodically there are attempts to locate, count, or otherwise determine the current status of programs and courses. There are also program reviews so that some degree of development can be determined, but a seriously accurate assessment would be nearly impossible to reach. By the time information gets back to the researcher and an article gets to print, some programs are on a downward spiral and new ones are being created. In spite of clear parameters, the exact nature of the program or course may have been misunderstood or changed to appeal to a different audience. Still, it is a worthwhile effort and we can say with confidence that the number of courses and programs continues to increase.

Currently there are several trends at work that impact programs and courses: (1) more creativity courses; (2) increased use of technology; (3) more transdisciplinary impact; and (4) continued effort to balance theory and practice.

Interest in creativity is sometimes strong and sometimes weak, often depending on external circumstances and the perceived need for change and new thinking. Economic pressures,

a host of complex social situations, fear of change and ambiguous situations tend to get people interested in learning about ways to overcome their problems or to find new challenges. Current times support these factors as influential. The market for creativity programs and courses seems to be expanding.

The impact and development of technology has increased throughout education and organizations. The tendency toward maximizing technology in the delivery of content, with on-line courses and multiple site delivery are increasing, making virtual options much more available. Creativity content has always been a potential money maker in a curriculum, particularly in a single course or series of core courses. As a stand-alone degree, the work is harder due to the basic premise that creativity must be applied in something. However, courses continue to flourish and so do programs, many with on-line options. Questions that remain are such ones as: Is one course enough? Is a full degree more credible? How much formal work is enough to establish credibility and expertise? Interdisciplinary and multidisciplinary offerings, such as degrees in other subjects with a concentration in creativity, are appearing.

Historically, creativity has had strong roots in practice and, indeed, its practice has often outstripped its theoretical development. Creativity programs and courses generally were not only often first situated in practice and then followed by conceptual support, their practice often led the way to further research. The relationship between theory and practice is not a race. Sometimes one moves ahead of the other but, eventually, the two have to find a pace that is productive and collaborative. Much of the early research (and some of the contemporary work as well) was rooted in the practical needs of consultants and other practitioners who saw, in their authentic practice, the power of finding options and having choices about how we might solve problems. The need for novelty, newness, differentness, or multiple perspectives or options is strong in almost all areas of endeavor – in our workplace, in organizations, in education, in the arts and in the sciences. It is also important in our everyday lives and in our individual problem-solving. In practice, when we see that something works, we explore how and why that may be without waiting for someone to conduct a study and tell us what we should think and do. In theory, when we look at practice, our task is to explain, to describe, and then support or refute practices and beliefs that might be spurious. Balancing theory and practice will always depend on funding, interest, creative

thought, and motivation, but, as more programs and courses develop, so does the field and domain. With more and more people interested in working over the long-term focusing on the domain of creativity itself, as well as more people taking creativity courses and programs within other domains, the confluence of information and support will continue.

See also: Creativity Training; Education and Creativity; Theories of Creativity.

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Psycholinguistics

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Glossary

Cognitive module A cognitive module is a hypothesized cognitive structure which is specialized to solve specific cognitive tasks. Various characteristics have been attributed to these structures, such as being informationally encapsulated (i.e., does its work without recourse or access to other cognitive processes). Some have argued that language in general has the properties of such a module, and within language, processing of syntax, for instance, proceeds initially independent of pragmatic or semantic factors.

Communication Accommodation Theory (CAT) This theory was developed to provide social and cognitive reasons for code-switching in language (the concurrent use of more than one language form in speech). For instance, it has been proposed that when speakers seek approval in a social situation they are likely to converge their speech to that of their interlocutor (such as by adopting the same accent or dialect); in contrast when one wishes to emphasize the social distance from the interlocutor one might engage in the use of divergent speech by emphasizing the use of the linguistic features of their own in-group.

Conceptual metaphor Sometimes referred to as 'root metaphors,' a conceptual metaphor is the understanding of one idea or conceptual domain (target domain) in terms of another (source domain). As such it provides linkages between sentences that differ semantically. As a basic concept in cognitive linguistics, this notion challenges some basic concepts in language and thought, such as by situating metaphor in conceptual and not merely linguistic terms and by eliminating a traditional basis for the distinction between literal and nonliteral language.

Descriptive grammar As contrasted with prescriptive grammar (cultural expectations of proper linguistic etiquette), a descriptive grammar provides the rules with which acceptable grammatical structures are produced and understood. A good descriptive grammar must describe the cognitive operations for all the basic forms used in a specific language group, such as the ability to embed one structure within another or the ability to recognize that two sentences mean the same thing despite syntactic differences.

Design features of language The features represent a list of 16 characteristics that are claimed to distinguish true language from communication devices employed by nonhuman animals. Among these characteristics are the following: Interchangeability (the ability by speaker-listeners to receive and also send the same message), semanticity (speech sounds can be linked to specific meanings), arbitrariness (there is no direct connection between the signal and its meaning), displacement

(the ability to talk about things that are not physically present), productivity or creativity (the ability to create new messages by combining already-existing signs), and prevarication (the ability to make false statements or to lie).

Linguistic creativity The open-endedness in natural language wherein new meanings can be given to existing words or phrases, that new words can be created as needed, and that novel word combinations can be generated (and understood by a naïve listener). It has been argued by Chomsky and others that humans can produce an infinite number of syntactically appropriate sentences, and must do so from a finite set of cognitive rules.

Nonliteral language A traditional approach assumes that there is plain and conventional mode of speaking, typically called literal language. Contrasted with this is nonliteral language, or embellishments that deviate from this norm. Despite the long history and acceptance of the distinction, there is no consensus on the definition or what constitutes literal language or where the boundary exists between the literal and nonliteral. Even if one were to consider it deviant, nonliteral language is not rare and encompasses a wide array of figures of speech, such as metaphor and simile, and rhetorical devices such as hyperbole and irony commonly found in creative text. Since the mid-1980s there have been movements both in cognitive psychology and in linguistics that have undercut the importance for this distinction, arguing that literal and nonliteral language alike are based on the same cognitive structures and found in both everyday and artistic language usage.

Protolanguage As used more traditionally, a protolanguage is a hypothesized root language for modern languages that one reconstructs based on the comparison of vocabularies and grammars. In this way, one can identify a language family that evolved from a common language. As used in a larger evolutionary perspective, a claim has been made that in the evolution of our species there was at least one of our hominid ancestors that exhibited a nonsyntactic form of language that limited how the world could be represented and in which communication of intent was highly dependent on perceptual and pragmatic factors. The argument is that evidence for this earlier form of language is still present in modern humans.

Universal grammar This linguistic theory is based on the notion that all human languages have a substantial commonality, and hence that one can describe these commonalities in a generalized descriptive grammar. This basic notion can be traced in one form or another back to the thirteenth century. In the twentieth century, this idea has been associated with various linguists, most notably Noam Chomsky who has advanced a 'principles and parameters'

approach predicated on the proposition that syntactic knowledge can be modeled on two mechanisms: first, a finite set of principles common to all languages (e.g., all sentences must have a subject) and, second, a finite set of

parameters that determines syntactic variability from language to language and which is set by experience with a given language (e.g., a parameter that determines whether the subject must be overtly expressed).

Psycholinguistics is the study of how linguistic knowledge is acquired, represented and used by the human mind. As such, it brings insights from both linguistics and psychology to bear on the cognitive aspects of language comprehension and language production. Because humans can create an infinite number of sentences that others can understand, the basic mechanisms involved are central to the understanding of everyday creativity. To some, the core issues should be limited to language production and comprehension in adult native speakers whereas others see a more expanded set of appropriate topics, such as children's acquisition of language, second language learning, language disabilities, neuro-linguistics, computational models or simulations of human language and artificial intelligence. Since the first edition of the *Encyclopedia of Creativity*, there have been notable changes in the field, though a central motif continues to be attempts at explaining linguistic creativity, the open-endedness found in all natural language which permits for the creation of new words, the creation of new meaning for existing words and the ability to understand and produce, in principle, an infinite number of utterances, many of which will be novel. In this review, the emphasis is on adult native language usage, with computational and neurological evidence brought in only in a secondary fashion. The structure of this review is to first describe what makes language unique, and speculations about the role(s) played by language in the evolution of human creativity, followed by a discussion of the seminal work of Noam Chomsky with an emphasis on the impact that he has had on molding how the debates on everyday linguistic creativity should be structured. Finally there will be a lengthier discussion of some of the more notable changes that have occurred in psycholinguistic research over the last decade and a more brief discussion of how creativity is created as a form of social linguistic interaction. In all instances the emphasis will be on psycholinguistic implications for our understanding of human linguistic creativity.

Introduction

The study of language is important to creativity because, arguably, language is the quintessential everyday human creative activity. Adult native speakers cannot only produce sentences they have never heard previously but other native speakers, for whom this also is novel, can understand them. It has been argued that all humans, regardless of culture and language community have the innate ability, in principle, to generate and comprehend an infinite number of utterances from their native language, even in the absence of explicit prior experience. Thus, it has been argued, the mechanism(s) responsible for linguistic creativity can provide insights into characteristics of the human mind necessary for creativity in general.

What Is Language and How Did It (and Creativity) Evolve?

The traditional approach holds that language is one of the unique defining characteristics of being human. As such, attempts have been made to identify characteristics of language that make it different from communication devices used by other animals, such as mating or alarm calls. Albert Katz (1999) listed the 'design features' of human language identified by Charles Hockett and the parallel of these features to aspects of both everyday and domain-specific expert levels of creativity. Notable characteristics include interchangeability (people both generate and comprehend language; people are capable of both generating and appreciating creative output), displacement and prevarication (linguistic messages and creative output alike can refer to objects and events that employ symbols that can be manipulated in ways that are not constrained by the here-and-now or other constraints of environmental 'reality'), and reflexivity (humans communicate about communication; critiquing or commenting on what has been said or written is not only a basic characteristic of language per se, but is also the basis for literary and critical analysis, and other aspects of scientific and artistic creativity). Katz noted that the parallels between the characteristics of language and creativity might indicate that (a) language is the underpinnings and basis for the increased creativity seen with humans relative to closely related primate species or (b) creative thought arises from a conceptual system that is reflected both in language and creative output.

In recent years, evolutionary psychology has attempted to disentangle the locus of the language and creativity parallels. Genetic mapping demonstrates that the divergence in the evolutionary lineage that led to the modern day chimpanzee (our closest living relative) and to the modern human took place somewhere about 5.5 million years ago and, despite that time span, the genomes of humans and chimps differ by only about 2%. There is evidence of nonlinguistic expert-level creative activity with some of our hominid ancestors: stone tool usage by *Homo habilis* and with the more sophisticated tool kit and evidence of long distance hunting by *Homo erectus*. Although the fossil evidence cannot definitively prove whether these creative jumps were associated with the evolution of language, some suggestive evidence is the presence of Broca's area (an important language brain center in modern humans) from the cast of a brain cavity of *Homo habilis*, and with changes to the vocal tract more compatible with speech in *Homo erectus*. Our species, *Homo sapiens*, first appeared in an archaic form about 500000 years ago, with more modern forms found in the fossil record about 200000 years ago. Starting about 45000 years ago, and especially from about 30000 years onward, there is an explosion in expert-level creative output, including many examples of symbolic expression (e.g., decorated tools, beads, ivory carvings and, of course, spectacular cave drawings).

The linguist, Derek Bickerton, and some anthropologists have taken this historical record as indicating that the evolution of language had two important phases, both with implications for creativity: an initial stage of protolanguage (evidenced in *Homo erectus*), namely the type of language seen in pidgin languages and in early stages of language development in children. This language is nonsyntactic, of the form ‘animal see, me run,’ in which context and direct perceptual experience would be needed to disambiguate what had been said (and would not be considered a ‘true’ language because it fails to meet several of the criteria described by Hockett, such as the criterion of displacement). The second stage, associated with *Homo sapiens*, would consist of true language, with a fully developed grammar. With grammar one can escape the here-and-now and exhibit all the design features of language. To Bickerton, language evolved primarily to serve a representational and not a communicative function. Thus with protolanguage one can only represent the world in a limited manner whereas with a true grammar one can represent the world in a rich varied way – one can talk, and think, counterfactually, about events not present (as in the past or future) or even about the fantastic and nonexistent. From this perspective the range of expert level creativity seen today in the arts, sciences, and other human activities would only be found in modern humans.

In contrast, some others, while not dismissing the importance of syntactic-based language to creativity, have argued that the evolution of creativity encompasses many cognitive and representational systems, such as mimicry, analogical thinking, and mental imagery each of which can be separable from language. Arguably animal homologues to these processes can be the basis for observed creative activity in animals, such as the productive thinking by chimpanzees described by Wolfgang Kohler in the early decades of the twentieth century. Moreover, more recent comparative studies have shown that many cognitive abilities initially attributed to language can also be found in some form in chimpanzees, including prevarication and behavioral evidence suggesting that these primates have the ability to recognize the mental states of other chimps, a prerequisite for many forms of expert-level creativity.

Psycholinguistics: Some Traditional Approaches

If indeed language is the prototypical form on everyday creativity then a central question turns to understanding the mechanisms whereby humans comprehend and produce language. The first half of the twentieth century was dominated by behaviorist theoretical approaches to language, exemplified by the linguist Leonard Bloomfield in the 1930s and the psychologist B. F. Skinner in the 1950s. This approach eschewed mental concepts and argued that language can be understood as stimulus-response patterns. Skinner, for instance, argued that syntax could be understood as a form of stimulus-response chains similar conceptually to the behavior chains one could train an animal to perform. The dominance of behaviorist approach led to almost half a century in which the representational and mental processes of concern to modern psycholinguistic inquiry were virtually nonexistent. One notable exception to the behaviorist trend during this time

span is found in the mentalist work of Edward Sapir and Benjamin Lee Whorf (the so-called Sapir-Whorf, or linguistic relativity, theory). The basic claim is that a person’s native language sets up a series of ‘lenses’ through which reality is understood and interpreted. A corollary of this approach is that the language used by a person (in a given cultural context) provides insights into the minds of a given linguistic community or culture. Initial psychological tests of the hypothesis did not support a strong version of the hypothesis, which claims that the structure of a language determines the contents of thought. However there is support that has emerged in recent years from the laboratory of the psychologist Lera Boroditsky and others for a weaker version, namely that different languages shape or predisposes one to think of space and time in different ways. The emphasis on the representational aspects of language, both as seen in the recent work on linguistic relativity and with Bickerton’s approach to the evolution of language, have direct implications for our understanding of creativity. For instance, a classic block to creativity is functional fixedness, that is, the difficulty or inability to conceptualize events or objects in other than canonical ways. Psycholinguistic experiments have demonstrated that how one labels the objects presented for use in a productive problem-solving situation influences whether or not the problem is solved. Labeling objects as ‘box and tacks’ permits invites thinking of these as two objects, each of which can be used to solve the problem whereas labeling the same objects as ‘box of tacks’ invites participants to represent the objects as unified (and hence that the box cannot be used as an aid to creative problem solving). The theory on the one hand makes contact with the geneplore model of creativity and empirically-based computational models of problem solving in which the representation of a problem determines the likelihood that a solution will be found (and that creative leaps involve restructuring how one represents a problem) and the theoretical extension, not proven, that because different languages (of which there are about 5000 in use world-wide today) represent reality differently, some languages are better equipped to perform certain type of creative activities.

By the 1950s there was a paradigm shift away from behaviorism toward mentalist approaches in psychology and language alike. Prominent in this movement was the work of the linguist Noam Chomsky, who, in the late 1950s, influenced psychologists initially with a critique of Skinner’s approach to language, especially with regard to Skinner’s attempt at explaining syntax as a chaining mechanism. Although Chomsky’s specific theoretical arguments have undergone many changes since the publication in 1957 of his book *Syntactic Structures*, he has maintained an emphasis on grammar and on everyday linguistic creativity. Any model of language he argued must be capable of predicting which combination of words is felt to be acceptable and which unacceptable to an adult native speaker (labeled a ‘descriptive grammar’). Language is a paradigmatic case of human creativity given our ability to produce and understand novelty on a daily basis. Because natural languages are infinitely large, Chomsky argued that any acceptable descriptive grammar must be generative in the sense that from a finite set of rules one can describe the structure of the infinite set of sentences that are grammatically acceptable. In essence the goodness of a descriptive grammar is its ability to generate

the sentences of a language and to associate each sentence with an appropriate grammatical description, a fatal flaw with the chaining mechanism proposed by Skinner (which Chomsky argued was a variant of a finite state grammar). An important evolution in his theorizing was the development of transformational-generative grammar, based on the insight that one cannot understand linguistic creativity or language competence by merely describing the structure of the utterances we produce or sentences we read (the surface or s-level); rather we have to consider also the thematic relations being described (a more abstract deep or d-structure). Given these two levels of representation we would then need some transformational process between these structures (thus, for instance, conserving the intuition that the same meaning can be expressed in multiple ways).

Although many aspects of Chomsky's approach has been modified or rejected by others over the years, the influence that he has had on the field has been monumental and many of his approaches to the nature of the human mind have direct relevance for discussions about human creativity. One such claim is for the biological basis for language in humans. Because humans become proficient in the comprehension and use of their native language surprisingly rapidly, Chomsky (and others) argue that linguistic competence is biologically based, and as such there must be universal grammar – the innate schema of initial assumptions which all humans bring to language learning, and on the basis of which they construct the grammar of their linguistic community (from among all the possible grammars that one could have learned). One possibility for this that Chomsky proposed in some of his later writings is that humans are born with a common set of principles each of which can be set to one or another parameters. The specific parameter settings are based on exposure to a given language, even the impoverished experiences that one faces in early development. To the extent that creativity is dependent on the presence of grammar, then creativity too is biologically based.

A second important claim made by Chomsky is for the modularity of the mind, in the sense that it consists of a set of autonomous processing units, each one with its own set of rules specialized for domain-specific information. Processing within a module is informationally encapsulated such that the workings of the module precede independent of activity in other units; the output of a module is usually available to general intellectual capacities. With respect to language, the argument would be that the processing of language occur independent of other intellectual activities and, within language itself, the processing of syntax proceeds independent of pragmatics or semantics. Employing the standard Chomskyan methodology of logically considering the intuitions about the acceptability of sentences, often those artificially constructed to make a point salient, one can easily show that a sentence such as "colorless green ideas sleep furiously" is intuitively understood as syntactically acceptable yet meaningless. Thus, one can conclude that the processes that lead to acceptable syntax is not based on whether or not the sentence is semantically interpretable, and, by extension, that syntax and semantics are separable.

An implication of a modular approach for our understanding of creativity is that, if correct, much of creative processing

would reside in specialized processing units separable from language and, more generally, general intellect. Moreover, this position leads to the position that different facets of creative activity are each served by their own modules, with their own set of mental operations. Along these lines, the linguist Ray Jackendoff has suggested separate modules exist for music, language, and dance-related activities. There is some evidence as well that different domains of creative activity are mediated by different brain structures, a position consistent but not necessary for modularity. As extended further, a strict modular approach would be in line with multifactorial approaches to understanding creativity, such as the structure model proposed by Guilford, and inconsistent with theoretical models that posit a more general approach to creativity, such as through a generalized associate network (and implemented in such tests as the Remote Associate Test).

Psycholinguistics After (or in Opposition to) Chomsky

The post-Chomskyan era has seen notable changes to many of the questions about language and creativity, from both linguists and psychologists. Moreover, especially in the last two decades, moment-to-moment (on-line) measures of language processing, and the use of large-scale language corpora have become importance tools, displacing for many, the artificial, single sentences employed as test stimuli and the dependence on the intuitions of native speakers characteristic of the Chomskyan era. Theoretical approaches now are more integrated with ideas arising in cognitive science and in neuroscience.

Linguistic Approaches

Three of the many developments in linguistics deserve special mention. On the one hand, there were reactions to aspects of the 'standard theory' and alternatives have appeared in the literature challenging either one or another of the assumptions posited by Chomsky and the mechanisms he posited as necessary. Nonetheless, in one way or another, these alternatives share some similarity to questions posed, or assumptions taken, by Chomsky found in various forms of Generative Semantics, Extended Standard Theory, Trace Theory, Case Grammar, X-bar theory, among others.

A second and ever-growing development is described under the general rubric of 'cognitive linguistics.' This approach developed because of the sense that Chomskyan theories (and their derivatives) could not account for many instances of everyday language. Most radically, cognitive linguists hold that linguistic structures are motivated by, and otherwise related to, human conceptual knowledge and the communicative functions of discourse. In direct opposition to a modular view, language is assumed to be motivated by cognitive structures which in turn can be traced to the ways we perceive, physically manipulate objects and interact with our environment. From this perspective, speaker's use of language activates knowledge in one's conceptual system; the linguistic input alone, however, is not sufficient to explain the emergent meaning that arises. One can also analyze the language one produces to get insights into the underlying conceptual systems. Simply

put: if language is creative it is because of basic cognitive processes and not because of linguistic properties alone. This general approach can be traced to various theorists working from the 1970s onward, including George Lakoff, Ronald Langacker, Adele Goldberg, Paul Kay, and others. With respect to the study of creativity, two developments within this school of thought are most influential, namely conceptual metaphor and conceptual blending.

Conceptual blending is most associated with the writings of Mark Turner and Gilles Fauconnier. In general these theorists have expanded on Arthur Koestler's notion that 'bisociation of matrices' is the basis for human creativity. Blending theory has attempted to more formally describe the way concepts are structured (in mental spaces) and the various optimality principles that guide its usage. In essence, blending theory is an attempt to describe how information from two or more spaces is combined to produce a novel cognitive structure. Their basic model consists of four connected spaces, namely two separable 'input spaces' that can be blended, a 'generic space' of stock conventions and image-schemas that allow the input spaces to be understood from an integrated perspective and, finally, a 'blended space,' which consists of a representation in which selected projection of elements from both input spaces are combined and inferences arising from the combination. A set of principles describe how a well integrated novel structure arises: for instance, the 'access principle' holds that a value in one input space can be described by the role that its counterpart plays in the second space, even if that role is invalid for the first space. Thus 'blends' provide a cognitive representation and creative synthesis that permits for the manipulation of separable events as an integrated whole. Blending theory has been applied to a wide range of creative products, including metaphor, humor, and neologisms. In recent years there has been some success to implementing blending theory in a computationally-realized model by Francisco Pereira, and supportive psychological evidence has been found by Seana Coulson using fine-grained temporal measures of comprehension. Despite these successes, the theory is mute on creative motivation; the theory has yet to describe how a given individual chooses the input spaces to be blended to produce a desired, creative, effect.

Conceptual metaphor can be traced to a seminal book by George Lakoff and Mark Johnson, *Metaphors We Live By* and has since been expanded by Mark Turner, Zoltan Kövecses, and others. The fundamental tenet of the theory is that metaphor operates at the level of thinking, not language per se. Metaphors link two conceptual domains, the 'source' domain (typically consisting of literal and concrete entities and relationships) and the 'target' domain (often a concept more abstract or less amenable to a simple description, such as 'LOVE' or 'ANGER'). The target domain takes its structure and is understood in terms of the source domain. Thus how we conceptually structure, and talk about the target domain parallels the structures and knowledge held about the better-delineated source domain. Target domains are therefore believed to have relations between entities, attributes, and process that mirror those found in the source domain. At the level of language, one can thus find words and expressions (so-called metaphoric expressions) about the target domain that refer directly or implicitly to the source domain. Indeed the main source of evidence for the reality of conceptual

metaphors is based on patterns of word or expression use. Thus for instance, a proponent or conceptual metaphor theory might notice a set of sentences that are, from a traditional perspective, semantically distinct but can be shown to share a metaphoric relation, such as sentences that all are based on the notion that LIFE IS A JOURNEY or that the MIND IS A BRITTLE OBJECT or LOVE IS A DISEASE. Despite the widespread popularity of this theory, evidence for the psychological reality of conceptual metaphors is largely based on examination of patterns of language use, largely has been uncritically accepted, and has not been supported often when tested in ways other than through the intuitive linking of patterns of language use. The weakest evidence to date is for the proposition that conceptual metaphors are automatically engaged when one processes language.

The import for creativity is twofold. First, conceptual metaphor theory explicitly denies that literal and figurative language, even expert-level creativity found in creative literature, differ in important ways; literal language too is motivated and structured by conceptual metaphors. Given the importance of metaphor, neologisms, irony, humor in creative writing, and other forms of creative discourse, conceptual metaphor theory makes the strong argument that the cognitive underpinnings of creative output, such as with poetry or avant-garde literature, does not differ from noncreative output, such as found in everyday speech. Second, metaphor and analogy have long been discussed as the basis for scientific and artistic creativity alike. In principle then one can envision that conceptual metaphor theory can serve as a basis for understanding both everyday and novel creative output. However, to date, conceptual metaphor theory is underdetermined with respect to how novel metaphor mappings occur. For instance, it has been shown that the historical introduction of a novel mapping (such as describing personality to perceptual qualities, such as 'she is rough around the edges' or 'he is a smooth talker') is within a short period of time followed by an explosion of new expressions based on that mapping. Presumably some mechanism is required for that initial insight which, retroactively, might be describable as instances of conceptual metaphor. In principle, the many determined attempts to implement computational models of analogy and metaphor, some based on conceptual metaphors, might provide some insights into the initial novel mapping, as might applied creativity programs based on the use of metaphor and analogy, such as Synectics.

A third linguistics development can be found in what has been labeled 'corpus linguistics,' the study of language based on samples (or corpora) of 'real world' text or speech. Typically these corpora are very large, encompass a wide range of types of texts or social situations, are computerized and can thus be used to examine any number of questions, such as the frequency with which different types of speech (e.g., irony or metaphor) are actually used in everyday communication. This development can be seen, in part, as a reaction to another distinction made by Chomsky, namely the distinction between linguistic competence and linguistic performance. The former refers to the knowledge held by an ideal set of speaker-hearers and was the database to Chomsky and many of those who followed in his linguistic footsteps. According to Chomsky one can tap for this knowledge by asking adult native speakers about their intuitions regarding presented sentences.

In contrast, linguistic performance refers to the actual use of language in specific situations, and, from Chomsky's perspective such language is error riddled with extraneous factors and not the proper source with which to understand human linguistic competence. Performance-related 'errors' would, from a Chomskyan perspective, include limitations and distortions such as those produced by fatigue, working memory capacity, stress, and the like. The contrary argument is that corpora provide a basis for language as actually used and thus permit for the study of language in an ecologically valid manner and for consideration of sociological and pragmatic factors in language production and comprehension. For instance, CANCODE (the Cambridge and Nottingham Corpus of Discourse in English) is a collection of spontaneous spoken English comprised of about five million words obtained in a wide variety of situations, including casual conversation, people working together, people shopping, people finding out information, and in discussions. Examination of corpora, especially by Ronald Carter and his colleagues, has shown that original, creative speech is frequently found in everyday speech (and is not the unique province of poets or professional writers) and, when used, is a marker often of social standing and interpersonal relationships. It is expected that the use of corpora will become even more important in coming years.

Experimental Psycholinguistics

By experimental psycholinguistics we are referring to studies in which laboratory based experiments are performed, using linguistic stimuli under well-controlled conditions in which select variables are independently manipulated. The emphasis in recent years has been on the use of online measures derived from techniques that permit the tracking of mental processes during the act of comprehension or production. One such technique that has proven useful are Event Related Potentials (ERPs), the tracking of electrical brain activity tied to the onset of some stimulus, such as a presented word or a word embedded in some longer context. An ERP component of especial importance is a negatively going electric wave with a maxima about 400 ms after stimulus onset (the N400); the amplitude of this component is a measure of the violations of expectation, and hence of the difficulty of integrating the new information into the discourse structure being constructed online.

Comprehension Experiments

In the 1960s, psychologists attempted to take one or another linguistic theory as the basis for their experiments, testing whether the tenets of the theory were psychologically real. For instance, considerable research examined whether a sentence would be more difficult to process the further its s-structure was from its d-structure, whether people psychologically parsed sentences as predicted by a phrase structure grammar, and whether observations of children's acquisition of language provided evidence for an innate schema or universal grammar. The evidence in support of Chomsky has been questionable and in more recent years psycholinguists have abandoned a strict dependence on formal psycholinguistic models of the type championed by Chomsky to study language production and comprehension, largely using online

methodology and explaining their findings within memory-based or other mainline thinking in the cognitive sciences.

One active area of research has been on testing syntactic modularity, which is the notion that the initial syntactic analysis of a sentence proceeds independent of semantic, contextual, and pragmatic knowledge. One early influential theory by Lynne Frazier adopts a modular perspective in which people adopt two strategies in comprehending syntax: late closure (the tendency to attach each word to the clause or phrase being processed) and, minimal attachment (the tendency to add that word to build the simplest possible syntactic structure). Tests of this theory have tended to employed so-called garden path sentences such as 'The lady sent the flowers was very pleased' and have employed online measures, such as the monitoring of eye movements while reading such sentences. The assumption is that one can get insights on how a sentence is parsed, assuming word by word processing. In the sample sentence above, minimal attachment would place the words 'sent the flowers' as the verb phrase which would attach to the noun phrase 'The lady.' According to the theory, on encountering the next word, 'was,' the parser would recognize that the initial assigned syntax is incorrect, causing a delay in the processing of that word (seen in longer than expected time spent looking at that word and regressive eye movements back to the earlier words, assumed to indicate a reassignment of syntactic constraints). Within this paradigm, modularity has been tested by placing the critical sentences in extended context that bias toward one or another reading, or by using sentences in which pragmatic factors are important. On balance, these studies indicate that even the most basic syntactic resolution involves the continuous consideration of syntactic, semantic, and pragmatic factors. Some of the models that have emerged from this line of research have been implemented in psychologically real computational algorithms, often adopting a processing approach (such as 'constraint satisfaction') that is similar in kind to mechanisms proposed for other mental processes. In a more general way, processing of language is considered in relation to the structure and operations upon knowledge held in permanent memory stores and, as such, are aligned more with cognitive psychology than with linguistic theory.

Another very active area of research over the past decade has been into the processing of nonliteral language (in which what we say differs from what we intend to convey), including metaphor, irony, idioms, proverbs and the like, all instances of creative language use, and in some cases artistic endeavors. These ubiquitous forms of language were marginalized in Chomskyan theory. Many of the same issues discussed above are found here as well, namely arguments surrounding whether there are obligatory processes that one must initiate before a nonliteral meaning can be assigned or whether one can directly adduce the figurative sense. Proponents of the former stance include those who argue that one must process the literal sense or, in a more recent variant by the linguist Rachel Giora, the salient (most frequent usage) sense. In contrast others, including most notably the psychologists Sam Glucksberg and Ray Gibbs, have argued for their own versions of direct access. These latter approaches have tied metaphor and some other forms of figurative language to mainline cognitive psychology, such as that studied in the semantic memory, event

structure, categorization or the embodied cognition literatures. The latter approach is complementary also to the cognitive linguistics approach described above, and by a psychological linguistic theory, Relevance Theory, in de-emphasizing a standard distinction between literal and nonliteral language traditionally held as important for explaining processing differences between figurative and nonfigurative language.

Production

It is generally held that the production of speech (or in writing) consists of a set of steps, from having a thought, translating the concept in a way that makes it available for output, accessing the appropriate units (such as words or morphemes), arranging these units into the appropriate sequence (syntax), and engaging the appropriate motor or output units. There is now an extensive literature on each of these topics, most of which describe everyday language production issues in general and not those related to more exceptional or artistic creative production. As with the work on comprehension, a salient question that remains to be answered is whether language production is modular, and especially whether language production and comprehension are mediated by the same set of processes. In very recent years there has been some work at understanding literary production, both by people working in the cognitive linguistic tradition and by some experimental psycholinguists. For instance, poetic (haiku) language production has been studied both offline and online by Dawn Blasko and her colleagues.

Conceptual Combinations

A task that has gathered considerable interest in recent years is that of 'conceptual combination,' a task that simplifies the examination of linguistic creativity. The task consists of presenting two words, such as the noun-noun pair 'pet shark' (in which the first term is considered the modifier term and the second as the head noun) and asking for an interpretation. Of interest is the speed with which an interpretation is typically given and the diversity (creativity) of the interpretations offered. Theoretical explanations for performance in this task mirror those found in the more general post-Chomskyan psycholinguistic literature when examining sentence and discourse processes. There are theories rooted in the semantic memory literature such as those that posit a schema-based explanation in which the head noun consists of a set of slots that can be filled by specific attributes, which in turn is facilitated by semantic and pragmatic factors. There are theories based on the event structure literature such as those that argue task solution is based on finding an appropriate thematic relation that links the head and modifier nouns; thematic relations would include location, causal, temporal and similar event-based factors, with preferred solutions based on a pragmatic factor – the frequency with which a modifier has been used in different relations. Finally, there are constraint-based explanations such as those that argue interpretation is based on three 'constraints' found in the pragmatics of communication: diagnosticity, plausibility, and informativeness. Creativity arises because these constraints can be satisfied in many ways. Constraint-based theories have their origin in explaining

perceptual processes but have been extended to higher level processes in more recent years, resolution of syntactic problems and, even to the resolution of proverbs by Albert Katz and Todd Ferretti and to irony by Penny Pexman. Strength of the constraint-satisfaction approach to the processing of conceptual combinations is that it allows for interpretations emphasized by both the schema-based and the event structure based models. Recently, Fintan Costello and Mark Keane have produced a computational algorithm to instantiate the theory; simulations of this algorithm produce responses similar to those produced by people.

Language as a Social Phenomenon

Creativity has been viewed predominately from the perspective of the individual creator and not as a social phenomenon in which creativity involves the interactions of people working together. This perspective predominates in the psycholinguistic literature also. An exception can be found in the study of eminent creators by Dean Keith Simonton who, employing statistical analyses, examines eminence in a range of creative fields, has examined the role of cultural and situational factors in perceived creative expertise. Recent work, examining the communicative aspects of everyday language is also challenging this traditional view, finding linguistic creativity often to be a product that emerges from interactive cocreation between interlocutors.

Several instances of this emerging literature are reviewed here.

Repetition and Recontextualizing

One observation in sociolinguistics has been that elements of a speaker's language in conversation (such as accent or use of specific words) are often repeated back by others in response. Two approaches to this phenomenon predominate in everyday interactive language creativity. According to Communication Accomodation Theory, the pattern wherein a person mimics or repeats the speech pattern of an interlocutor (or diverges from a common usage) can reflect displays of identity and social cohesion. Thus, for example, a person's ethnic accent may become even more pronounced when talking to a person openly hostile to his/her ethnic group. The emphasis here is social communicative factors. In contrast, a cognitive theory, the Interactive Alignment Model, places repetition as a priming mechanism in which the type of language used by one person automatically primes the corresponding representation in an interlocutor. Thus if one person uses passive sentences frequently, an interlocutor will tend to adopt this form of speech in response. Once activated, other levels of representation can be aroused in a spreading activation manner. Thus, the use of passives by one person can activate a corresponding structural representation in the interlocutor which, in turn, could spread to related semantic representations. These effects from one person to another proceed automatically and hence are not under motivational control. This theory best explains aspects of convergence and is less successful in explaining divergence, such as described above.

Both theories do posit that the creative or novel use of language by one person is triggered by the person with whom one is

talking. Very recent work has shown that use of metaphor by one person is met by repetition by an interlocutor, in the sense that the interlocutor adopts metaphor in his or her responses. Some have speculated that repetition in language is related to musical creativity, such as found with the call-response in African music and the later usage in jazz, and, as well, with sampling, a music style in which the artist creates a new piece of music from fragments of music already available in the canon.

Creative Language as Playful Pretense

As a developmental construct, play is viewed as learning through mimicry, that is, based on everyday observation of the behaviors of others. Children's language in pretend play has been taken as indicating the child has mastered the symbolic and creative use of words. For instance, a child may label a bowl of mud as 'soup' but never attempt to consume the mud. A related interactive observation has been labeled 'comical hypothetical discourse,' namely playful creative linguistic behavior which depends on the conjoint production by interlocutors in its creation. This cocreative conversational phenomenon typically begins with a reference to an imaginary circumstance. Unlike storytelling, the comical hypothetical invites interlocutors, often indirectly, to participate in the creation of a hypothetical event or situation. For instance, when a conversation has been about the loss of a winning lottery ticket, an interlocutor might ask a friend to imagine what he or she could do if they found the ticket. After initiation, the exchange must be acknowledged by creative additions and an imaginary scenario built by more than just the initiating speaker to become a comical hypothetical exchange. The exchange itself represents a form of playful pretense; such creative language play is seen as maintaining and reinforcing social bonds.

Play Theory and Gender

Recent work has examined the use of metaphor in conversation. One finding of interest is that males are more likely to use metaphorical and other forms of figurative language, and to use it at an earlier age than females. This effect is most marked in same-sex conversations and when the males are strangers to one another. Friends of either gender produce roughly equivalent amounts of metaphor in conversation. On the face, this observation not only is consistent with comical hypothetical discourse but, given its prevalence when communicating with strangers (and not friends) is consistent also with the hypothesis that creative and humorous language use in male-male conversations are instances of male dominance display and consequently as an expression of socially acceptable male competitive behavior.

Online Communications and Creativity

In contrast to the face-to-face examples described above, in which communication can depend on prosody, gesture, dress, and other cues in addition to the language employed, online cues minimize many of these factors, though the need for extra-linguistic or pragmatic factors in creative communication is still apparent by the development of emoticons and the

use of newly created neologisms to mark intent, such as 'lol' (for 'laugh out loud'). A novel enterprise has been to look at the nature of the communications themselves, shorn of obvious cues to social factors such as gender or race. For instance, both gender and personality may be marked in online communications. Examination of e-mails have shown that men and women tend to describe their holidays in different ways, with men emphasizing impersonal topics (such as description of location and the journey) whereas females tend to write about social and domestic topics and, contain a higher incidence of features associated with the maintenance of rapport and intimacy. With respect to personality, higher levels of extraversion have been shown to be associated with a tendency to use adjectives in e-mails, whereas lower levels of neuroticism are associated with a preference for the use of adverbs. Finally, there are studies that have looked at group creativity in a 'virtual' setting. There is a long history of examining group creativity in science research labs, technological and business units. A recent manifestation is 'virtual' groups brought together to solve problems, each member working with the unit at a distance, linked by computer. To date, the emphasis has been on understanding how people in this context can create a common ground and visual workspace in which to interact. It is expected that the efficacy of such groups in producing creative output will be examined in coming years.

Summary

In general, the data and theorizing arising from the psycholinguistic literature emphasizes: (a) similarities between everyday linguistic creativity and creators with the creativity exhibited in domain specific fields and eminent creators; (b) muting the distinction between everyday 'literal' language and the language found in creative literature and scientific expression; and (c) the role played by social interaction in creative output.

See also: Definitions of Creativity; Problem Solving; Research and Methods; Sociobiology.

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Otto Rank 1884–1939

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Rank's Originality

Otto Rank was a highly original psychologist whose ideas continue to influence creativity researchers, psychotherapists, organizational theorists, and students of the arts and humanities (Figure 1). Many of his important concepts have entered the mainstream of psychological thought. He was Sigmund Freud's closest associate for 20 years, a major contributor to the literature of psychoanalysis, editor of two journals in the field, and a prolific writer and lecturer in France and the United States. He wrote about philosophy, art and literature, anthropology, spirituality, and education, and he developed an approach to psychotherapy based on existential and humanistic beliefs. Rank is known especially for his description of the 'artist-type,' the strong, self-created type of person Rank himself became.

Rank was a comprehensive thinker and researcher who, throughout his life, was drawn to aspects of human experiences that occur across cultures, and was fascinated with the recurrent themes of literature and myth: the mystery of creation, the heroic overcoming of tragedy, and the importance of living life artfully. From a young age he thought of his own life as a challenge to be met creatively through honest self-reflection, conscious and intentional action, and what he called 'self-appointment,' that is, creation of one's own personality.

Born in 1884 in Vienna, Otto Rank grew up in a working-class Jewish neighborhood. He was the second child of an alcoholic and abusive father. His older brother was permitted to pursue a career in law, but at age 14, after middle school, the young Rank was steered toward more practical, technical training that would equip him to work in a machine shop. Resolving as an adolescent to escape from his father's rages, Rank engaged in a process of self-reflection, reading, and self-education, and began recording his thoughts in a diary. At 19, as a gesture of rebellion against his father and renunciation of his Jewish religious heritage, he adopted the name 'Rank' to replace his given surname, Rosenfeld.

Hungry for intellectual and aesthetic stimulation, Rank immersed himself in the rich cultural environment of turn-of-the-century Vienna. The city was abuzz with new art, music, and theatre, and the latest thinking in philosophy and science. Rank frequented the library, where he read Charles Darwin's *Origin of Species* as well as the writings of Friedrich Nietzsche, Arthur Schopenhauer, and other philosophers. He attended the theatre, where he saw Henrik Ibsen's plays, and the opera, where Richard Wagner's work was being performed.

He was also fascinated with the newest thinking in psychology by another resident of Vienna, Sigmund Freud, whose book, *The Interpretation of Dreams*, had created a cultural stir. Freud's book, and his thought in general, offered a new perspective on our psychic lives. Into the intellectual conversation of the time, Freud introduced the idea that many of the motives for our behavior are unconscious, but that a careful listener could follow the symbolism in a person's free associations back to early childhood feelings that had been ignored or forgotten. Rank was inspired by Freud's thinking but also stimulated in his own thinking. After reading Freud, he suggested in his diary that "art is life's dream interpretation." Even at an early stage in his life this precocious young man was contrasting his own ideas with Freud's. Rank noted in his diary that dreams may represent unconscious wishes, but that the 'driving element' in our conscious, waking lives is the 'will,' a notion that was to become central to his later 'Will Therapy.'

At age 20, Rank eagerly incorporated Freudian notions into a manuscript he prepared about creative individuals, *Der Kunstler (The Artist)*. Through Rank's contact with his physician, Alfred Adler, the work was brought to Freud's attention. Freud read it approvingly, made suggestions for revisions, and the work was published. At this point in his life Rank was, as he would later acknowledge, fully 'under the spell' of Freud. The feeling was mutual: Freud was charmed by this bright, young, self-taught thinker. He sensed that Rank's appreciation for the arts and humanities, and his grasp of philosophy, myth, and literature, could help broaden and deepen psychoanalysis. Freud, by the way, welcomed those outside the medical profession into the newly emerging domain of psychoanalysis which he considered relevant to many other fields of endeavor. Freud named Rank secretary of the Wednesday night group that became the Vienna Psychoanalytic Society. He encouraged and financially supported Rank's return to academic high school and his eventual doctoral studies in philosophy and German literature at the University of Vienna. Freud, who was almost 30 years older, was more than just a patron; he became a mentor and surrogate father to Rank, which would make their eventual separation especially difficult and painful.

Freud's project was interdisciplinary. He believed symbolic references to unconscious wishes were everywhere: in dreams, slips of the tongue, and jokes, but also in myths and fairy tales. Rank was already well versed in cultural anthropology and what we would today call ethnopsychology. Like the early



Figure 1 Otto Rank, about 1920.

psychologist Wilhelm Wundt, Rank thought myths provided insight into the inner psychic life. In *The Myth of the Birth of the Hero*, published when he was 25, Rank catalogues many stories across cultures and across time, in which a hero or savior is born under difficult circumstances or abandoned soon after birth. Rank looked for common themes in the stories of their births and applied a Freudian template to these stories, revealing recurrent Oedipal themes, that is, themes of ambivalence and conflict with one's same-sex parent.

Rank's doctoral thesis, the first on a psychoanalytic topic, *The Lohengrin Saga*, published in 1911, delves into the story of an Arthurian knight, the same knight who was the subject of Wagner's opera, *Lohengrin*. *The Incest Theme in Literature and Legend*, a nearly 700 page study that showed Oedipal themes were universal, followed soon after, in 1912. Meanwhile bitter rivalries and conflicts had led to Freud's split with Adler in 1911 and Jung in 1912, and Freud sought to avoid such problems in the future by forming a group of trusted colleagues to further the movement. He invited Rank into his secret 'Committee' of followers and defenders of psychoanalysis. The other members were Karl Abraham, Sandor Ferenczi, Hanns Sachs, Ernest Jones, and Max Eitington. In 1913 Rank and Sachs wrote a monograph on *The Significance of Psychoanalysis for the Mental Sciences*, and in 1914 Rank wrote *The Double*, a study of the theme of an unconscious twin or substitute self, a book that continues to be appreciated by scholars of world literature. Thus, by age 30, Rank had firmly established his reputation as a Freudian thinker and a prolific writer.

The First World War dominated the landscape of Europe over the next several years. Rank served in the Austrian army in Poland as editor of a newspaper. He met and married his wife, Beata Mincer, in 1918. The birth of their child, Helene, in 1919, sparked Rank's interest in early childhood development, especially the pre-Oedipal phase before a child is four or five years old. This would eventually lead Rank to a way of thinking that would challenge his mentor. Freud believed that his patients did not have access to memories of this early time in their lives, and discounted the impact of pre-Oedipal experiences on the adults he analyzed, but Rank was beginning to think otherwise.

Rank worked closely with Freud over the next few years; they established an international journal and Rank was responsible for training psychoanalytic candidates who came to Vienna from around the world. Meanwhile, it was a time of both emotional and physical pain for Freud. The war, and postwar inflation had hurt him financially. In 1920, his beloved daughter Sophie died, and his grandson, Sophie's son, died a year later. In 1923 he underwent the first of what

were to be many surgeries for cancer of the jaw, during the remainder of his life. Rank's loyalty was important to Freud during this difficult period, and when Rank dedicated his new book to his adoptive father it was no surprise.

Separation and Individuation

In 1924 Rank published what was to become an historically important book, *The Trauma of Birth*. In it, Rank described birth as the prototype for anxiety and highlighted the patient's relationship with his or her mother as central to analytic work. Rank felt he was extending psychoanalytic thought into new territory. He didn't fully realize at the time that he was declaring his independence from Freud. Previous Freudian thinking emphasized the transference to the father in therapy (the unconscious way patients re-experience ambivalence toward the analyst who symbolically represents their father). At first *The Trauma of Birth* was welcomed by Freud, who only later criticized what we might today call the first 'neo-Freudian' approach. Rank was hurt by Freud's rejection of his thinking and by the cold response of Freud's associates who began to shun him. Being a rebel and an outsider was a familiar role for Rank, however, and over the next few years, while in his early forties, he essentially gave birth to a 'new,' more fully individuated, self.

At the same time his European colleagues were turning away, Rank found an eager audience of social workers and psychologists in the United States, who were looking for a shorter-term alternative to psychoanalysis. Over the next few years he developed what we today regard as one of the earliest existential-humanistic approaches. While psychoanalysis modeled itself on systematic scientific observation like that carried out in chemical analysis, Rank began to talk about therapy, which had connotations of a healing relationship. Rank wrote about his new approach to psychotherapy in *Truth and Reality and Will Therapy*, published in German between 1929 and 1931, and in English in 1936.

Rank's approach stands out in contrast to Freud's. While Freudian psychoanalysis traditionally takes place with the analyst behind and out of view of the patient, relies on the patient's memories, and encourages the analyst to be a neutral observer (a 'blank screen'), Rank's psychotherapy involves the face-to-face dialogue between therapist and client and emphasizes the actual relationship between the two in the present or 'here and now.' In this view the therapist is a real person to be dealt with, a presence in the room. Rank thought of the present moment in therapy as a microcosm, a world in miniature that provides access to the client's life struggles. Therapy becomes less a linear process of "recollection, repetition, and working through," as in the title of Freud's famous 1914 paper, but is rather a mindful engagement in the dynamic therapy relationship. Rank was prescient: current research on psychotherapy process points to just that relationship as a primary healing factor.

While Freud emphasized the importance of consciousness and insight – the gaining of understanding of factors in one's past that influence one's current feelings, Rank placed emphasis on intention and agency, which he called 'will'; this was one of his most important contributions to psychology. Rank thought will arose in response to early prohibitions. The child's

belligerent response to the parent's 'no,' may be the first manifestation of what Rank called 'counter-will,' a negative form of willing out of which positive willing emerges. As the child grows older and becomes socialized he or she learns to hold back or inhibit many impulses and conform to others' expectations. Later in life, the new adult may discover ways to assert him- or herself, separating in a creative and constructive way from others, and establishing a unique identity in the world. Thus will is an organizing, integrative force that can both inhibit and impel action; the ability to freely choose and act in accord with one's choices is essential to full individuation and self-determination.

In his new approach to psychotherapy, Rank was finding his own course of action, and choosing to go against Freud. What Rank called 'will therapy' or 'constructive therapy' elicits the intention and agency of the client. Consciousness alone, like that awakened in psychoanalysis, is not considered sufficient; action is needed to effect change. Insight is not enough; given the choice between new understandings of the self and new experiences, right here and right now in therapy, Rank would have always opted for the latter.

Life Fear and Death Fear

In emphasizing free will and self-determination, Rank was advocating an existential approach to psychotherapy: he thought Freud's view was too deterministic and fatalistic. For example, Freud believed patients are drawn toward death by a 'compulsion to repeat.' He spoke of a 'death instinct,' that inexorably leads toward entropy, an ultimate winding-down of all things in the universe. In contrast to Freud's notion of a 'death instinct,' a drive that impels us fatalistically toward the end of life, Rank talked about a dual fear: 'death fear,' accompanied by 'life fear.' Rank thought that becoming an individual requires separation, the willing choice to live as an independent person, which is the source of life fear. Death confronts us with the prospect of loss of individuality thorough dissolution into the whole, and thus elicits in us the fear of death. Rank recognized that living life fully, that is consciously and intentionally, brings with it an awareness that all things must end, that death is the ultimate limitation on freedom and choice. Both fears can easily lead to anxiety and inaction. Faced with the fear of life we inhibit ourselves and then feel guilt over the unlive life. Faced with the fear of death, we become like a deer in the headlights, frozen in our tracks, and unable to make the choices and take the risks that a full life requires.

Based in part on his reading of the philosopher Friedrich Nietzsche, Rank had an existential understanding of death; he believed loss and limitation are part and parcel of everyone's lives, but that we tend to avoid and deny that reality. Therefore, for Rank, it is important for clients to acknowledge and come to terms with the inevitability of death; one way they do this is through dealing with time-limits, such as the necessary ending of the therapy relationship. Freud's view is sometimes characterized as pessimistic. He saw humans as subject to powerful instincts or drives, such as the drives toward sex and death. Rank, on the other hand, viewed his clients as capable of creating their own futures though acts of will, that is by taking responsibility for their own actions, challenging even death,

and by tapping into the creative resources available to each of us, but largely unused. Rank encouraged his clients to live fully 'in spite of' the inevitability of death and limitations.

In Rank's view, the human personality itself is a creative project. We are not hapless victims of fate, chance, genetics, or early upbringing; instead, we are each capable of creating our own destiny, legacy, or in Rank's terms, we are capable of immortalizing ourselves. Rank based his approach on a belief in transformation and the possibility of change; he saw the human personality as a medium to be formed and modified in response to life's changing demands.

Since the days of his adolescent diary, Rank had seen himself as a creative person, and it is not surprising therefore, that the creative individual, the artist, is the central figure in Rank's emerging theory of personality first articulated in the mid-1920s. His theory is based on three character types: the normal or 'average' type, the neurotic type, and the artist type. (Originally, Rank also wrote about a fourth type, the 'criminal type,' which we might today call the sociopath.)

The average person is someone who is not likely to seek therapy. For this type of person, life with its inevitable limitations presents a challenge that each of us must endure. Conformity to societal norms and expectations is the way to avoid internal conflict, and get on with one's life. Rank considers this type of person well-adjusted, as able to adapt to external circumstances without feeling burdened or victimized.

'Neurotic' is a term that has fallen out of favor these days, but it describes an inhibited and overly-self-conscious type of response to daily living. Rank thought neurotics are characterized by an excess of psychological knowledge, and a desire to interpret their behavior rather than act. Neurotics attempt to rationalize and justify their 'I can't,' obscuring the 'I won't' that lies behind it. The last thing a neurotic wants is to change. Neurotic individuals feel conflicted; they know what they could or should do, but feel constrained, inhibited, and unable to act.

Rank used a powerful economic metaphor to describe the neurotic's situation: life is a loan and death is the debt. According to Rank, the neurotic refuses the loan, which is life, in hopes of avoiding paying the debt, which is death. This is a superstitious approach to life, and one based on holding back, inhibiting, or postponing, rather than fully living. The neurotic person is plagued both by will, in the form of sensed inability to act, and by consciousness, manifesting itself as a relentless need to know. Rank saw neurotics as paralyzed and ineffectual in their actions, and insatiable in their introspective curiosity. At the core of this attitude is the neurotic's belief that what is needed is increased self-knowledge; that if only one knew oneself better one would understand why one does the things one does and why one feels the way one feels. Rank's insight was that the neurotic symptom – the apparent inability to act – is a distorted attempt at creativity. He proclaimed the neurotic a 'failed artist,' and encouraged the therapist to draw out the neurotic individual's creative resources to solve his or her own problems.

The Artistic Ideal

Rank thought every person was capable of creativity, but that some people typically responded to life's challenges by

attempting to live artfully. 'Artist,' for Rank, meant any person, regardless of their occupation. Thus scientists, musicians, mechanics, nurses, and painters are all capable of creativity. Rank's 'artist-type' is a person who lives fully in the present, overcomes personal and societal limitations, and makes a commitment to creating something enduring. In contrast to neurotics whose self-consciousness gets in the way of action, artists turn their energies outward; they come to know themselves as a result of their expressive actions in the world.

Rank's view of the artist, like many of the ideas he developed, stands in contrast to Freud's. In Freud's writings about artists like Leonardo da Vinci and Michelangelo, he emphasizes the artist's unconscious motives and the role of art in fulfilling wishes and desires. Although Freud appreciated art and collected historical art and artifacts, he tended to regard the artist's actions as an escape from conflicts and pressures into fantasy. Art, for Freud, was regressive – a return to an earlier, simpler time. Rank on the other hand, saw art as progressive; he believed works of art point toward something, that they refer not only to the past, but also to the future, and especially to the artist's own process of personality development. While Freud focused on the symbolism of the work of art and attempted to interpret its significance in terms of the artist's early life, Rank was one of the first psychologists to give attention to the creative process artists engage in, the actual making of art.

Artists are different. The creative process often involves doing something radical, something so new that it may not initially be understood. Rank believed that artists need to distinguish themselves from others. He thought it essential for the creative person to establish a separate identity, to nominate or appoint oneself as an artist, and in this way to assert one's difference. It is important for the artist to separate from existing conventions and styles in order to make a unique statement. He called this aspect of the process 'self-appointment'; it involves a conscious choice to live a creative life. The neurotic questions his or her identity: 'Who am I?' The artist's question is instead one about individuation: 'Who do I want to be?' Rank believed that self-appointment is the first step in the process by which artists are able to regard their differentness as uniqueness and originality.

But the path is not always smooth for the artist. The sense of being different in one's approach to life can be alienating and isolating. Society resists change and rewards conformity. From Rank's perspective, though, even a negative reaction to the artist and his or her work can be used constructively; artists need the resistance of the world against which to form their personalities. Artists, in Rank's conception, make a willing sacrifice; being misunderstood or unappreciated goes with the territory.

The obstacles to creation are not all external. Artists face, and must overcome, inhibitions – apparent failures of will – along the way. Rank understood this well and first wrote about it in 1914 in his scholarly book on *The Double* or *Doppelgänger*. In works of literature or drama the double appears as a substitute self who takes the place of the person. In Oscar Wilde's *Picture of Dorian Gray*, for example, the double is a painted portrait of the main character that gradually grows old while Dorian Gray remains forever young. Rank, with his continuing interest in folk beliefs and mythological themes, traced the idea

to pre-literate cultures in which the double is the soul of a dead person, appearing in a dream. At first the double is a haunting, uncanny apparition and a cause for fear, but is eventually interpreted by the dreamer's culture as reassurance that there is an afterlife. Rank saw that, in a sense, the double is a reminder that what we don't know can hurt us, that there is a realm outside our awareness and control, but that conscious action is the antidote to fear.

For creative individuals, the double is an alter-ego, a potentially inhibiting aspect of the self that hovers over the artist and causes grief by judging and criticizing, and ultimately, by shutting down the creative process. Artists, in other words, are sometimes confronted by creative block, an inability to produce due to seemingly self-created conflicts. Problems like procrastination and avoidance, self-consciousness, self-criticism, and perfectionism have often been seen as symptoms of fear of failure or fear of success. Rank thought creative block had more to do with fundamental issues of birth and death. Artists sometimes struggle to let go of their works – to give birth to them so to speak. By keeping the work from public view, the artist attempts to avoid both failure and success; the failed work may be a monstrous source of embarrassment, but the successful work is problematic too: it represents a standard one can never meet, a success that can never be achieved again. Thus the work that has gone before as well as the work that is yet to come can both be sources of inhibition. In *Art and Artist*, Rank's most important book, published in 1932, he described an artist's way out of the dilemma of creative block: the two works. Rank noted that artists sometimes divide their attention between two projects simultaneously. The two works may represent different styles, they may be carried out in different media, or they may be executed in different locations. Rank thought keeping creativity going even when one feels stuck was the key to overcoming blocks and inhibitions. Rank himself was extremely prolific perhaps in part because he typically had several projects in the works at once.

The artist also struggles with the existential reality of limitation: the limitations inherent in the medium, the artist's own limited technical skill, and the limitations of time and energy in each person's life. The artist whose work is perpetually in process and unfinished is denying the real limitation that death imposes on life; that is to say none of us lives forever; each of us is mortal. For Rank the will at its highest stage is a creative urge to go beyond even the final limitation of death by immortalizing oneself in creative works. Artists who come to terms with both personal limitations and the limitations of the external world need not despair; instead, they can attempt to make a mark on life for all time, and in this way transcend death. Artists, according to Rank, make voluntary sacrifices. They invest their time and energy in creative pursuits, forgoing other pleasures and desires; they live life fully without attempting to cheat or bribe death. Their creative work is intrinsically meaningful and rewarding. For some rare individuals the works live on and have an enduring impact beyond the artist's life, but even if the person does not achieve this kind of immortality, the way the artist lives his or her life – consciously and willingly immersed in creative action – is what is important.

Rank identified with both ideal and real artists. He thought of himself at first as one of the rare individuals Freud singled out as constitutionally predisposed to creativity. It is clear

that Freud considered Rank especially suited to the tasks he had in mind. This, coupled with the respect and admiration he initially received from his colleagues, must have contributed to Rank's sense of himself as a specially gifted person.

Rank's avid interest in art provided him with larger-than-life heroes. Among those we know he admired to begin with were Johann Wolfgang von Goethe, Fyodor Dostoyevsky, and Henrik Ibsen. Early in his life he called Richard Wagner his 'ideal leader and guide.' During the later, especially productive period of Rank's life, he associated with members of the artistic community in Paris and New York who flocked to see him, and in whom he saw himself reflected.

Rank's writing, first about mythological themes in psychoanalysis, and later about his own unique approach, and still later about the artist and his culture, became his art work. Although in his personal notes he frequently refers to great novels or dramas he was attempting, only Rank's psychological writings have actually survived him. Rank poured himself into his works, and they represent an achievement that can justifiably be called 'art.'

The years between 1924 and 1932 represent a very productive period in Rank's life. With his colleague Ferenczi, Rank published *The Development of Psychoanalysis* in 1924: in it they offered some of the first criticisms of Freud's method. They challenged the focus on the patient's early childhood experiences and the emphasis on the patient's transference toward the analyst. In so doing, they paved the way toward an approach to psychotherapy in which the real relationship between client and therapist is acknowledged and appreciated. Not surprisingly, the book was attacked by several Freudians, notably two of Freud's followers, Abraham and Jones. The publication of Rank's *Trauma of Birth* that same year was too much for the Freudians to take; it seemed like heresy for Rank to suggest that the client's anxiety might arise from the trauma experienced in separating from the mother (at birth, at weaning, and when the child takes his or her first independent steps). That the relationship with the mother might be even more significant than that with the father was seen not as the post-Freudian revolution it represented, but as anti-Freudian, deviant, and even deluded.

Rank was turning 40 and separating from his mentor and surrogate father, Freud, after almost 20 years at his side. In the summer of 1924, when Rank visited The United States, it was as Freud's emissary and as a teacher of psychoanalysis. He was greeted by an eager audience of social workers and psychologists more interested in his therapeutic innovations than in orthodox analytic method. What Rank offered was the first active psychotherapy, a time-limited approach, in contrast to the seemingly endless process of psychoanalysis. The emphasis on the actual relationship between therapist and client gave the therapist an active role and allowed the therapist to address the emotions that arose in the relationship rather than interpreting the fantasies projected onto the therapist. The client's new emotional experiences in therapy were a necessary complement to the intellectual understandings possible in analysis. This was a precursor to the idea that therapy provides a 'corrective emotional experience,' introduced by Franz Alexander years later.

The appreciative reception Rank received at his lectures in New York and Philadelphia buoyed his enthusiasm, but he was

confused by Freud's reaction to his theories. Freud had responded warmly at first, but while Rank was in America, some of Freud's associates seized the opportunity to criticize him behind his back. On his return to Vienna in October, 1924, conflicts between Rank and Freud were more conspicuous. Rank briefly recanted some of his views, but by 1926 it had become clear that their differences were irreconcilable; Rank severed his ties with Freud's committee, resigned from his various editorial positions, and moved to Paris to set up a practice on his own. Back in New York and Philadelphia that year for lectures, Rank was now explicating his fully independent approach. Shunned during a chance encounter with his former friend, Ferenczi, in New York, Rank was now convinced he needed to speak for himself. Rank's membership in the American Psychoanalytical Association was revoked a few years later, and all those he had analyzed would now need re-analysis by more orthodox practitioners. The separation from what had become Freudianism was now complete.

Although hurt by the rejection, these events only served to stimulate Rank's independence and creativity, which was evident in his prolific writing during this period. His work included books that took a broad social and cultural perspective on religion, education, and art. Rank turned his own painful experience of separation into a creative act of willing. He was interested in how easily an interpretation can become a tenaciously-held belief or ideology, as he called it.

Psychology and the Soul, first published in 1930, challenged other psychological interpretations. Freud had a materialistic and scientific view of religion. He had called religion an illusion, and predicted it would have limited importance in the future. Carl Jung had studied religious writings in his search for universal symbols or archetypes, but skirted the topic of the function of religious beliefs. Rank looked at religious beliefs as natural human phenomena – as ways of collectively dealing with primitive fears, and making life meaningful and significant even in the face of death. Returning to a theme he previously developed in his work on the double, Rank traced the idea of a soul to the recurrent 'urge to immortality.' Rank's study of anthropology informed his theory that this urge is manifest in various forms: in the belief in a soul that lives on after physical death, in the belief in reincarnation, in ancestor worship, and in beliefs that one's group or society has special access to immortality through ritual or divine intervention. Rank thought that for individuals living in a more psychologically-minded, post-religious era, immortality was something to be achieved through one's creative legacy, through works that continue to have a life even after the person's death.

Psychology and the Soul also established Rank as a thoroughly modern thinker. For example, Rank thought soul-belief was a product of one's ideology, and attributed Freud's criticism of religion to his nineteenth century reductive, causal, and materialistic scientific thinking. Rank was by this time reading the latest scientific theories of Albert Einstein and Werner Heisenberg. He argued that notions like relativity and indeterminacy made it difficult to support a mechanistic, causal scientific attitude. He advocated factual relativism, the understanding that so-called 'facts' are actually interpretations, and criticized psychoanalysis for its insistence that repetition of the past is more important than even actual experience in the present.

The same year *Art and Artist* was published in 1932, also saw a book called *Modern Education*. Here again, Rank challenged an ideological approach. Freud had interpreted the child's behavior in terms of sexual striving, while his follower, Alfred Adler, had regarded the child as seeking power and recognition. While he saw in both of these approaches an advance over authoritarian educational systems of his day, he felt neither adequately addressed the emerging will of the child. Rank felt the child's independent willing was stifled by educational ideologies that reward conformity and suppression of feeling. Rank thought parents had a vital role in understanding and acknowledging the child's spontaneous expressions of emotion. Rank also proposed an alternative to education primarily designed to help the individual learn a vocation. He thought discovery of one's skills and talents was a lifelong process, and he encouraged supporting self-exploration rather than training the person to fit a pre-determined job-description. Rank was himself an interdisciplinary thinker and an inspiring educator who, through his teaching and his example, influenced numerous psychologists and social workers to find their own integrative paths.

By 1934, Rank's ideas were becoming known; his lectures were well received and some of his books had been translated into French and English. Rank resisted establishing a school of Rankian therapy, having seen for himself what can become of one's ideas in the hands of zealous followers who could become dogmatic and, in his terms, 'ideological.' Rank separated from his wife Beata, who several years later moved to Boston where she set up a psychoanalytic practice with children. Rank's secretary in Paris, Estelle Buel, an American, came along in 1935 when Rank moved from Paris to New York. There he continued lecturing and practicing. He spoke at Harvard, where he impressed the important American personality psychologist, Henry Murray. At a lecture in Rochester, New York, the following year, a young Carl Rogers was in attendance. The publication in 1936 in English of Rank's theory of psychotherapy (two volumes: *Truth and Reality*, and *Will Therapy*), introduced his approach to an even wider audience. In contrast to Freud's emphasis on the unconscious and instinctual drives, Rank saw conscious choice and intention as critical. His approach emphasized a creative, improvisational therapy in which the relationship between client and therapist in the present, or 'here and now,' was paramount.

Beyond Psychology

From 1937 until 1939 Rank worked on a draft, in English, of what was to be his final book, *Beyond Psychology*. As suggested by the title, at this point in his life, Rank was advocating an alternative to what he considered the overly rational and reductive attempt to explain human behavior scientifically, the tendency to 'psychologize.' He returned to several of the themes he had dealt with previously: neurosis is not the result of societal inhibitions or repression of impulses, but the attempt by the neurotic to exert excessive control over his own nature; Rank called this 'willing the spontaneous.' Returning to a recurrent theme in his work, he saw the double as representing: first the shadow or identical self, next the person with his or her past, and finally the immortal self. Again contrasting his 'constructive' experiential therapy with psychoanalysis, he regarded the

task of therapy as helping the client's steps toward life fully lived, not more interpretation. He challenged several of Freud's assumptions: that bringing the unconscious into conscious awareness is curative, that the actual unconscious is made conscious (and not just an interpretation of it), and that emotional expression in therapy is nothing but a projection, a transference onto the therapist. Rank claimed that what is unconscious is the 'life force' itself, the dynamic spark that animates everyday existence. Rank's final message in *Beyond Psychology*, which was published posthumously, was that the full meaning of human experience is not graspable with our rational intellect, and that we need to allow for the irrational in life.

The year 1939 was momentous. Rank had been in poor health, but having finished his draft of *Beyond Psychology*, in which he advocated a life lived fully, he was eager to get on with his own life. He traveled with Estelle Buel to the western United States. Once his divorce from Beata was finalized, he married Estelle in July. Returning to New York in September, just as the Second World War was beginning, Rank learned that Freud had died in London, relieved from his suffering by a morphine injection by his physician. Ironically, Rank was briefly hospitalized soon after with a kidney problem, and then struggled at home with infection and fever. Rank wrote to Jesse Taft, his first biographer, that despite his illness he was at peace with himself. On October 31, back in the hospital, he died from a reaction to medications used to treat his infection.

Rank's Immortality

Only recently has Rank's influence begun to be acknowledged. *The Denial of Death* by sociologist Ernest Becker, brought Rank's ideas to a broad spectrum of the intellectual community. A full biography has been published, Rank's influence on post-Freudian psychology has been explicated, and several of his major books have been re-translated and made available to a wider readership. Rank's American lectures, delivered by Rank in English, have also been published. Various myths and rumors about Rank (e.g., that he was mentally ill, that he was a 'fascist'), have also been debunked by serious scholars. Many of Rank's ideas about creativity, education, human culture, and psychotherapy have entered into the mainstream of thinking in psychology.

Rank's work has had impact in several fields. Creativity researcher Donald MacKinnon, who had had been introduced to Rank's thinking by Henry Murray at Harvard years before, found Rank's notion of the artist type invaluable in his study of architects. Rank's theory of creativity has also influenced Organizational Theory, especially in the 'action learning' approach to team building and group problem solving. 'Terror Management Theory' in experimental social psychology, owes a debt to Rank's ideas about death fear. Rank is also receiving attention these days for his ideas about soul-belief and the development of spiritual traditions across cultures. Rank's works have continually been held in esteem by scholars in the humanities and social sciences.

Rank's creativity speaks very directly to psychotherapists. Carl Rogers incorporated Rankian notions into his client-centered psychotherapy, and Rollo May acknowledged Rank's influence on his existential approach, as did Irvin Yalom.

Writer Paul Goodman considered Rank's work essential to the newly emerging Gestalt psychotherapy. Transpersonal psychology, as practiced by Stanislav Grof for example, has been influenced by Rank's thinking about birth trauma. Rank's emphasis on the early mother-child relationship, ego development, and the importance of the actual therapeutic relationship anticipated key features of post-Freudian interpersonal and relationship therapies. Depth psychotherapy approaches that acknowledge the importance of irrational and unconscious processes are indebted to Rank, as are experiential psychotherapies that call on the therapist's ability to improvise in the moment.

Rather than leaving behind a school of thought or an ideology, Rank left a body of work that continues to inspire. He refused to become an inhibiting precursor, whose ideas become rigid and petrified in the hands of dutiful followers. Rank instead stepped aside to allow future psychotherapists to discover their own unique ways of eliciting their clients' creativity and resourcefulness. Over the years writers like Anais Nin and Henry Miller, as well as other artists, were drawn to Rank, in part because they felt understood by him, and especially because he resisted tampering with their creativity. Rank left artists alone, believing that the last thing they needed was more analysis, more psychological interpretation. A creative person who was not fully appreciated in his own time, Rank spoke with prescience about the future of psychological thought and practice. Rank's legacy is a creative, improvisational, approach to life that is constantly being rediscovered.

See also: Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity.

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Remote Associates

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Glossary

Associative theory of creativity Notion that creativity results from forming unusual or appropriate combinations between uncommon responses to given stimuli.

Concept attainment The formation of rules or categories about objects or ideas based on repeated experiences to various stimuli related to them. For example, an individual develops and refines the category 'cat' after repeatedly encountering and interacting with various forms of cats (pictures of cats, live cats, stories about cats, etc.).

Remote associates The less common responses evoked by a given stimulus, or in the context of creativity, by elements being considered in a creative activity. Responses that appear at first to be unrelated (or very distantly related) can be

brought together through connections made by a response that is uncommon for each of the elements, remote associates, but common to all of them.

Remote associates test (RAT) A measure of creative thinking developed by Mednick and Mednick consisting of problems with word triads which are solved by the generation of a fourth word for each problem that is remotely associated to each of the words in the triad.

Word association tests Measures of conceptual understanding in which individuals are asked to generate word responses. Individuals can make free associations to word stimuli in which they respond in any way they desire, or they can be given directions to respond in a certain way, for example, make unusual responses.

Introduction

Remote associates form the basis of Sarnoff Mednick's associative interpretation of the creative process which he put forth as an explanation of "processes that underlie all creative thought." Using the experiences of a host of creative individuals, particularly Henri Poincaré, as evidence for his theory, Mednick claimed that the creative process is "the forming of associative elements into new combinations which either meet specified requirements or are in some way useful" (1962, p. 221). To measure creativity under these terms, Mednick and Martha Mednick, with the assistance of Sharon Halpern, ultimately devised an instrument, named the Remote Associates Test (RAT), which is still widely used in research. Since his initial work was published, the term 'remote associates' has come to be used when referring to the 'mutually remote elements' that are combined during the creative process.

Mednick's Associative Theory of Creativity

Mednick developed his associative theory of creativity using literature related to concept formation. As discussed in this literature, concepts are more easily formed if the stimuli in which the concepts are presented evoke the same or similar associations over repeated encounters. Word association tests were used to examine concept attainment in order to determine individuals' various associations to presented concept stimuli. Like others espousing associative views of creativity, Mednick believed that remote associations, as indicated by unusual responses on these word association tests, were indicators of originality and thus creativity. The more remote the associates, the more creative the result. As a distinguishing feature of his theory, however, Mednick emphasized the "imposition of requirements on originality" in order for creativity to be achieved. Unusual responses may be original,

he claimed, but they may not be relevant. Creative individuals find remote responses that are appropriate to the constraints of their situation.

Mednick outlined three methods of achieving a creative solution by means of bringing together remotely associative ideas.

1. *Serendipity*: Finding a creative solution when two or more concepts, or their associations, are placed near each other, usually by accident. An example is the discovery of penicillin which was a result of Alexander Fleming accidentally leaving open a Petri dish containing *Staphylococcus* culture which was then tainted by mold.
2. *Similarity*: This type of creative solution occurs when the concepts or their associations are similar. Examples here include rhyming words, musical tones and harmony, colors, and natural themes. These creative solutions would occur most likely in creative domains in which the use of symbols is not required such as painting and music.
3. *Mediation*: This method is what is suggested by the term 'remote associates.' Here an individual uses a mediating concept that acts as a bridge between the initial concepts. Mediation is helpful in creative situations when the use of symbols is necessary, such as in the sciences. As an example of this principle, an individual studying creativity and depression might join the two by mediation with the common associate neurochemicals, as is being done in current research.

Mednick believed that individuals differ in the likelihood in achieving creative solutions. First, he stated what he seemed to consider a given; individuals with more information are more likely to make creative combinations. Beyond this basic element, he predicted that differences in probability and speed of attainment of creative solutions would be related to differences in individuals' organization of and accessibility to their associations, measured by what are called associative hierarchies.

In developing the idea of associative hierarchies, Mednick relied again on the work related to concept attainment. Concept associations could be ranked in their order of likelihood of response and this rank level correlated with attainment of the concept involved. Associative hierarchies are the relative strengths of the various associations individuals make to a given stimulus. Concepts ranking higher in associative hierarchy to a set of nouns would be more quickly attained than concepts that had lower levels of association with the same set of nouns.

Many individuals, according to Mednick, make predominantly stereotypical responses to most stimuli, such as a response of 'chair' to the stimulus 'table.' These stereotypical associations being so strong, these individuals have difficulty making any other associations. Such individuals are said to have an associative hierarchy with a 'steep slope.' After the first or second typical response; their associative strengths drop off quickly. Others, however, have 'flat associative hierarchies.' Individuals with flat slopes take a little longer to come up with responses, and may begin with the stereotypical responses, but because the strength of these responses is not so strong, more, uncommon responses come to mind as well. For example they may also respond to 'table' with 'chair' at first, but because this typical response is not so strong that it dominates their thinking, they will eventually respond with more remote associates such as 'periodic.' This concept of associative hierarchy, as depicted in graphic form by Mednick, is presented in Figure 1 which shows both a steep and a flat associative hierarchy for the stimulus item 'table.' Mednick predicted that less creative individuals would have a high concentration of association in a few typical responses and thus would be unlikely to be creatively productive. He predicted that, on the other hand, highly creative individuals could produce creative solutions due to the lowered levels of associated strength and thus the remoteness of their associated responses.

Mednick also pointed to the number of associations an individual makes, a variable related to associative hierarchy, as a factor in the likelihood of producing a creative result. Individuals with a steep slope will undoubtedly be less likely to produce a large number of associations to a given stimulus. Consequently, they would be unlikely to find an associate common to all elements in a given situation that would result

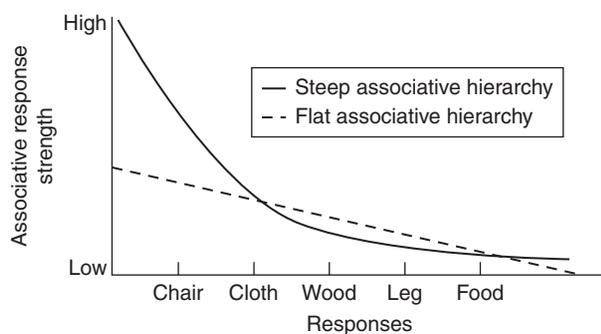


Figure 1 Posited associative hierarchies to the stimulus word 'table.' Adapted from Mednick, S. (1962). The associative basis of the creative process. *Psychological Review* 69: 220-232.

in a satisfying combination. Mednick also said that speed may not be an important factor in the number of associations an individual makes as time may be necessary for finding the associations that serve as mediators between the concepts involved in a given situation. Finally, Mednick proposed that individual differences may also occur as a result of cognitive styles and selection of the elements to be used as a source for creative combinations.

Individuals in many fields have taken advantage of these factors to boost their creative production. For example, humor writers use a strategy incorporating the making of remote associations as a means of generating ideas for cartoons, gag lines, and jokes. In 1990, Gene Perret, who named his version of this strategy "Random Associations," (p. 75) suggests that a writer make a list of about 50 "words, phrases, people, places, or things – anything at all" related to a topic under consideration. Perret recommends including atypical items on the list to increase the likelihood of uncommon or unexpected associations. After creating the list, the writer should peruse it, at first trying consciously to make unusual connections between some of the items and then letting the mind work unconsciously to make unusual connections. Writers can take a more focused approach by making specific categories within the overall topic and forcing unusual connections between random associations in the different categories. For example, a writer might use the categories 'people,' 'places,' and 'things' within the topic 'education' and generate the following associations in each of these categories respectively: professor, dissertation, expulsion, Little Tree; one room schoolhouse, desk, Colgate University, football field; and dictionary, pencil, school bus, essay. Then, the writer randomly would select one item from each of the categories and think of a way to link them together. Thinking of more and varied associations for each of the categories within the general topic likely leads to remoter connections between them. This remoteness is a key facet of creating humor. The linking of remote ideas brings about unexpected results, and the unexpected is the foundation for humor.

The Remote Associates Test

To test the associative theory and measure individual differences in processes fundamental to creativity, Mednick and Mednick, with Halpern, developed the RAT. Demonstrating that the test was in line with all aspects of his theory, Mednick stated that the test was designed to "provide stimulus elements from mutually remote associative clusters" to which individuals taking the test must "find a criteria-meeting mediating link which combines them." Although remote associates do not necessarily have to be thought of as a verbal construct, Mednick's test was based on earlier word association tests, and much of the research investigating this concept since his time has involved a similar structure.

RAT Structure

The RAT, which engages the individual in 'verbal associative habits that could reasonably be assumed to be familiar to almost all individuals brought up in the United States English

speaking culture' consists of 30 items. There are two forms of the instrument which is aimed at college age students and adults. Each item consists of a triad of words which are remotely associated to each other. The individual completing the RAT must come up with the correct fourth word which is remotely associated to the first three and joins them together. An example item is 'railroad,' 'girl,' 'class' for which the answer is 'working' as in 'working on the railroad,' 'working girl,' and 'working class.' The time allotted for the test is 40 min, and an individual's score is the total number of items answered correctly. The premise of the test is that individuals should be able to tap unusual associations to each of the stimulus words, by means of divergent thinking, to generate the remote associate common to all of them.

Establishing Validity of the RAT

During an initial study of reliability of the RAT, Mednick reported rates of 0.92 with a group of 289 college women and 0.91 with 215 college men. Validity was established in several ways. To establish criterion validity, RAT scores were correlated with faculty ratings of creativity among design students. This yielded a significant correlation of 0.70. In addition, a set of high and low RAT scorers at another university were each rated by one faculty member as being either high or low in research creativity, defined by the extent to which they had devised new research methods and put forth original research ideas. For the most part, the high RAT scorers were rated high on creativity and the low RAT scorers were not rated high on creativity. Finally, Mednick used results on word association tests as a means of building construct validity arguing that the more associations to which an individual has access the more likely he/she will be to make a creative combination with these associates.

Mednick examined the relationship between RAT scores and personality characteristics associated with creativity as a means of building validity. Significant differences in the attitudes and occupational interests between the high RAT and the low RAT scoring women were revealed. The high RAT scores demonstrated more 'atypical' and 'liberal' views than low scorers, for example, interest in occupations such as artist, psychologist, physician, mathematician, and author-journalist. On the other hand, low scorers preferred such occupations as farmer, math-physical science high school teacher, office man and pharmacist. Furthermore, Mednick reported that among architects RAT scores correlated significantly at a rate of 0.31 with scores on a scale of originality and -0.31 on a scale of conformity. In an effort to establish that the RAT was not a test of intelligence or verbal ability, Mednick found a modest negative correlation (-0.27) among the RAT and college grades.

Criticisms of the RAT

Others have not been convinced that the RAT is a valid measure of creativity. Despite Mednick's failure to find a relationship between RAT scores and verbal ability or intelligence, results from some later studies suggested there may be inherent verbal and intelligence biases in the test. In addition, there has been little to support Mednick's findings that RAT scores are related to other measures of creativity, especially measures

of overall creativity. In addition, in attempts to replicate Mednick's studies correlating word associations and RAT scores, little corroborating evidence has been found. In fact, in some cases, low RAT scorers actually produced more word associations than high RAT scorers. A more fundamental problem with the RAT is its effectiveness in measuring the very thing it purports to measure, the making of remote associations. Critics have pointed out that test items may favor structural associations over functional, or semantic, ones. For example, the RAT is criticized for having too many idiomatic associations and associations based on words that commonly appear together in the language like 'square' and 'deal.' Others have been concerned about the remoteness of the associations needed for success. After an analysis of the items on the RAT, one group of researchers concluded that the remoteness of response words from the stimulus words was not consistent throughout the test.

Other Forms of the RAT

The RAT has been adapted into many different language and cultural forms so that it can be used with other populations than the adult, English speaking population for which it was developed. These new forms of the RAT are used primarily for research purposes. The Mini Rat, an alternate form of the RAT, was designed by Mervin Lynch for administration among elementary school-aged children to determine the effects of teaching practices on creative potential. The instrument, which is administered orally, consists of 20 word doublets to which students provide a third word equally associated to each of the words in the doublet. Examples from the Mini Rat are: (1) pine/ice cream – answer: cone; (2) ahoy/shape – answer: ship; (3) peanut/fly – answer: butter; (4) water/Autumn – answer: fall. Split half reliability rates of 0.78 and 0.79 were found on two different forms of the Mini Rat, respectively. Noteworthy differences were recorded between groups described as high and low level creative students.

To deal with the structural flaws found in the RAT, Blaine Worthen and Philip Clark created the Functionally Remote Associates Test (FRAT). The specific goals for the FRAT were to construct items that had low or moderate functional associations but very remote structural associations, not too extreme in remoteness in free association response, and an appropriate level of difficulty. Analyses of the FRAT showed it to have promise as an alternative to the RAT. Recently, a list of 144 compound remote associate problems was developed by Edward Bowden and Mark Beeman for use in research related to insight in problem solving. The list was intended to provide a larger pool of items available in the RAT and provide a set of items with more consistency. Each item contained a triad of words the solution to which was found by forming a compound word with each of the words. Reliability rates for these items were fairly high, between 0.71 and 0.93; however, the authors may have created a list more structurally associated rather than functionally associated compound words.

The RAT has also been used as the basis for remote associates tests in different languages and/or for different cultures. The Paramesh Remote Associates Test (PRAT), a 71-item Tamil language remote associates instrument, is used to measure creativity among adolescents. Another adaptation of the RAT

was constructed in the regional Indian language Orissa. In addition, the RAT was modified to make a Jamaican culture-specific instrument for measuring creativity.

Improving RAT Scores Through Training

Researchers have postulated that free-association training would enhance RAT scores. In an early study investigating this premise, participants were trained by being asked to respond repeatedly, with a different association each time, to one stimulus and then again to another stimulus for a number of stimuli. This training procedure failed to improve RAT scores. Arguing that successful performance on the RAT is a result of the act of generating many associations, Jonathan Freedman tried a different approach to enhancing RAT scores. Freedman divided 90 college students into three groups. Individuals in one group made free associations to each of ten words and individuals in a second group wrote definitions to the ten words. Words used were unrelated to RAT items used later. A third group was comprised of individuals who, instead of generating their own associations, read those generated by the members of the first group. Overall, the group that engaged in free association scored significantly higher than the group that wrote definitions. Although the third group had the same words available to them as individuals in the first group, their RAT scores were significantly lower than the first group. This led Freedman to conclude that it is making the associations rather than the associations themselves that is important in RAT performance. A later replication of Freedman's study, with adaptations, showed conflicting results. No differences emerged between participants in groups who either made associations or read associations made by others in a first experiment. However, retraining in the middle of RAT administration resulted in higher RAT scores of participants who generated multiple associations to stimulus words than participants who either defined words or read associations made by others.

Factors Related to Remote Associates Abilities

Since the creation of the RAT, a number of factors have been linked to associative processes believed to be part of creativity. The RAT and other similar instruments have been used to study the extent to which variables such as stimulation through novelty, level of attention, and affect are linked to the making of remote associations.

Attention

As part of his theory of creativity, Hans J. Eysenck proposed that overinclusive, or original thinking, which he claimed is best measured by word association tests, is a trait of creative individuals. According to Eysenck, overinclusive thinking for creative individuals, like schizophrenics, may occur because they exhibit less attentional filtering and thus extend attention to a wider array of information. As a result, creative individuals have access to more and unusual associations when confronted with a stimulus. Unlike schizophrenics, though, creative individuals make associations that, while unusual, are also relevant.

Recent research employing the RAT supports the notion that the making of unusual associations may be linked to attention capabilities. Colin Martindale used neural network theory to link remote associates and attention. According to neural network theory neurons and/or clusters of neurons in the human brain that are activated at the same time and/or are in close proximity of each other are likely to become associated with each other. Later when one of these neurons or neuron clusters is engaged, the others are activated. Martindale relied on this theory to explain how defocused attention is related to making unusual associations. Martindale explained that the neural network system has a built in safety valve, called lateral inhibition, which keeps the overall level of neuron activation relatively constant. As a result, when individuals actively focus on a task, their arousal level increases activity among the most relevant neurons while nearby 'irrelevant' neurons are inhibited. This can potentially block associations. According to Martindale, defocusing attention allows for equal levels of activity throughout the neural network which results in activation of a wider range of neurons. This in turn allows for connections to be made among a broader range of thoughts, concepts, or memories. Martindale proposed that cortical arousal was a means of determining level of focus of attention. Measuring cortical arousal using electroencephalograms (EEG), Martindale found that at higher levels of cortical arousal individuals made strong but few associations on the RAT whereas at lower levels of arousal they made weaker but more associations.

Need for Novelty

In explaining the differences between associational abilities between high RAT scores and low RAT scorers, John Houston and Mednick proposed that creative individuals receive some type of reinforcement when they tap into remote associates for novel production. To test their hypothesis, they administered the RAT and placed individuals into either a high scoring or low scoring group depending on their total scores. Then, individuals were asked to choose which of a pair of words (a noun and a nonnoun) they preferred. When individuals chose a noun, the examiner responded with a novel association, and when individuals chose a nonnoun, the examiner responded with a common association. After controlling for preference for noun or nonnoun, Houston and Mednick found a significant difference between the two groups. The number of nouns chosen by members of the high RAT scoring group increased whereas the number of nouns chosen by the low scoring RAT members decreased. Support for their work was found in a later study in which a measure of need for novelty predicted divergent responses to a word association test. However, later replications of Houston and Mednick's study did not yield any significant results. Colin Martindale proposed that creative individuals, as defined by high scores on the RAT, may seek novelty to increase their level of arousal.

Incubation

The associative theory of creativity has been used to explain what processes may occur during the incubation stage, the second stage of Graham Wallas' four stage theory of the

creative process. Mednick and his colleagues used RAT performance to demonstrate incubation effects. Individuals were given a set of RAT items to complete. Then experimenters primed the individuals with the answers to half of ten items they missed. This was done by asking them to complete a set of analogy problems, some of which contained answers to the problems they missed. High creative individuals, as defined by previous scores on the RAT, gave significantly more corrected responses the second time around than the number of corrected responses given by low creative individuals. According to Mednick and his colleagues these findings supported an associative view of incubation. Although the idea of incubation itself has met with skepticism in the past, recent research replicating and refining that of Mednick and his colleagues continues to provide mounting evidence for their claims and the phenomenon of incubation as a whole.

Mood/Affect

The associative view of creativity has been used as a bridge in linking affect with creativity. Eysenck suggested that word association tests provided the best means of determining creativity because they located the point in a continuum between normality and psychosis which could be identified by a point in a continuum between common and bizarre associations to words. On the affective side, he labeled this point 'psychoticism' and on the creative side he labeled this point 'originality.' Much of the research verifying and expanding on Eysenck's work has been done with word association tests. In addition, word association tests have been used in studying the relationship between schizophrenia and mood.

The RAT, and other similar instruments, on the other hand, have been used, particularly recently, to link creativity to everyday moods rather than to psychopathology. Positive affect has been shown to increase RAT scores and individuals' ability to judge the extent to which varying levels of related word triads adapted from the RAT are in fact related. In some cases, judgments of coherence, under positive mood conditions, may be overcorrect, that is judgments of coherence were given even when triads were weakly related. Both spread of activation and broadened attention have been suggested as the mediator between positive affect and enhanced capability of making connections between remote associates. Varying mood has also been implicated in remote associates performance. In one study by E. M. Fodor, individuals who showed a bipolar inclination, though were not at a clinical level, performed significantly higher on the RAT in an enhanced mood than all other participants, including other individuals with bipolar inclinations who did not have their mood manipulated.

Conclusion

Mednick had a profound effect on the field of creativity when he introduced his associative theory of creativity. Although his theory was not an entirely new idea, he provided much support for his theory including a means for measuring it. Many of the criticisms of his theory and his test are warranted. Still, the idea of remote associates is one that has merited the attention it has received and deserves further investigation. New developments in the area of neuroscience may enlighten us as to what processes underlie the making of remote associations and how these processes are related to creativity. Research related to spreading activation and neural network theory is another means of bringing this concept to light. In addition, burgeoning research in the area of mood and creativity may help to bring greater understanding of how individuals differ in their ability to make remote associations and what this means for their creative capabilities.

See also: Bipolar Mood Disorders; Brain and Neuropsychology; Incubation; Serendipity.

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Relevant Websites

- <http://www.quizcreativity.com/readData.php> – Creativity Quiz.com.
- <http://socrates.berkeley.edu/~kih1strm/RATest.htm> – Remote Associates Test.

Research and Methods

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Glossary

Cognitive creation approach An approach that emphasizes creative capacity as an essential property of normative human cognition and suggests that the relevant processes are open for investigation.

Cognitive neuroscience approach An approach that involves relating cognitive functions to their underlying basis in the brain.

Confluence-theories approach An approach which assumes that multiple components must converge for creativity to occur.

Creativity A process in which one generates a contextually and culturally original and valuable product within a certain domain.

Insight problem An open problem that has a closed solution; it typically requires the mental restructuring of problem information, which leads to a clear and immediate understanding of how to solve the problem.

Working memory An executive and attentional aspect of short-term memory involved in the integration, processing, and retrieval of information.

What Is Creativity?

Definition of Creativity

Creativity is an important ability to have if one is to remain flexible and cope with the problems and changes that are a part of our daily lives. Creativity is a process in which one generates a contextually and culturally original and valuable product within a certain domain; moreover, a creative product or outcome is the result of the interaction of personal characteristics and the environment. Since J. P. Guilford's speech advocating the systematic study of creativity in 1950, creativity has been studied in a great variety of disciplines. Definitions of 'creativity' have evolved from the unidimensional to the multidimensional plane and from factors related to personal characteristics to those concerning social milieus.

Elements of Creativity

Creativity is comprised of certain basic elements that are nurtured through the accumulation of various life experiences. The nature of these experiences may very well be affected by personal characteristics, family environment, schooling, and even one's social milieu. Among these influential factors, personal characteristics have the most direct and greatest influence on creative performance. Such characteristics can be divided into categories of knowledge, disposition (attitudes, tendencies, and motivation), and skills. A sound knowledge base is essential to the development of creativity, and the ability to build new structures is at the core of knowledge-building. Creative thinkers require both the knowledge of a particular domain and that of cross-domains. As for their disposition, creative individuals are usually curious, willing to share ideas, brave enough to express themselves, and highly motivated to learn and achieve self-improvement; they also attempt to solve different problems and have a persistent urge to keep on trying. Finally, the skills required for creative performance include both cognitive and metacognitive skills. Creativity is the ability to transform materials into new and original forms; it is also regarded as a metacognitive process in which such

metacognitive abilities as planning, monitoring, and evaluating cognitive operations are required.

Types of Creativity

Creativity can be divided into four categories: mini-c, little-c, pro-c, and big-c. To date, most investigations of creativity have focused on big-c and little-c. The creativity types mini-c and pro-c were recently proposed. Big-c creativity consists of eminent creative contributions. The goals in studying eminent creativity are to learn about creative genius and to discuss what creative works may last forever. Typical creators who might be studied are eminent classical composers whose works have lasted for centuries, the winners of prestigious awards, or great inventors whose inventions have had a great impact on human civilization. Examples of those who are classified as big-c are Mozart, Einstein, and Darwin.

The study of little-c is based on the assumption that creativity is part of human nature and can be found in average people's everyday lives. For example, a person may creatively paint his/her room to look like a blue sky. Such everyday creativity is called little-c. Most studies that focus on students or children examine this type of creativity. The little-c category is important for identifying and nurturing creativity at home and in schools, the workplace, and social settings.

Mini-c creativity refers to novel intrapersonal insights about and interpretations of personal experiences or actions; it highlights the personal and developmental aspects of creativity. For example, a four year old boy told his mother that he wants to have a 'rocket bicycle' because it could take him to any place that he wanted to visit immediately. The little boy had a mini-c insight about combining two things he loves: rocket and bicycle. The mini-c helps to explain young children's creativity; it is useful for distinguishing between the genesis of creative expression (mini-c) and the recognizable expressions of creativity (little-c).

Pro-c represents a level of developmental progression and effort that extends beyond that of little-c but does not reach that of big-c yet. People who attain professional-level expertise in any creative area are likely to have pro-c. For example, an individual of this nature might be a professional composer

who makes a living composing songs for famous singers. However, not all working professionals in creative fields can reach the pro-c level. Prominent creators may require 10 years of preparation in a domain to become world-class experts.

Evaluation Indices of Creativity

The great majority of creativity studies have been based on divergent thinking tests, which are open-ended and designed to assess the ability to generate novel alternative solutions. Performance on these tests is usually scored based on three indices: fluency, cognitive flexibility, and originality. Fluency refers to the number of unique ideas or problem solutions that are generated, while flexibility refers to the number of categories that a person accesses; it reflects the capacity to switch approaches, goals, and sets. Finally, originality refers to the uniqueness of an idea; it reflects the ability to approach a problem in a novel way. Because fluency and flexibility are contagious and because of the development of creative theories, the consensus is that the evaluation of creativity must include originality (or novelty) and valuation (usefulness or appropriateness).

Is Creativity Domain-General or Domain-Specific?

The debate over whether creativity is domain-specific or domain-general includes three important perspectives. The first perspective is that creativity is a domain-general trait; that is, creative individuals can be creative in many domains. Studies based on the psychometric approach usually assume this perspective. The second perspective is that creativity is domain-specific; that is, people who are creative in one area are not necessarily creative in other areas. Studies based on socio-cultural and problem-solving theories support this domain-specific perspective; when tasks reflect the domain of expertise, expertise plays an important role in creative problem-solving. The third perspective, discussed by J. A. Plucker and R. A. Beghetto in 2004, is that creativity has both specific and general components. Such a hybrid model suggests that the level of specificity may change with the social context and with development through childhood into adulthood, and while some general factors may influence creative performance in all areas, only several domain-specific factors will influence creative performance in specific activities.

Development of Research Approaches and Models of Creativity

Approaches for Creativity Research

The study of creativity can be traced back to Plato, who argued that a poet is able to create only when the Muse dictates; however, more scientific and systematic studies of creativity started after the psychometric approach was proposed in 1950. The development of creativity research included eight approaches.

1. The mystical approach regards a creative individual as an empty vessel that a divine being can fill with inspiration. The individual will then pour out the ideas with which he has been inspired and form a creative product.
2. The pragmatic approach primarily concerns the development of creativity, and most studies are not concerned with testing the validity of creative ideas.
3. The psychoanalytic approach hypothesizes that creativity is derived from the tension between conscious reality and unconscious drives. Case studies of eminent creative persons are examples.
4. The psychometric approach claims that creativity can be studied in everyday subjects using paper-and-pencil tasks. Such tasks usually measure creativity based on fluency, flexibility, and originality.
5. The cognitive approach seeks to understand the mental representations and processes underlying creative thought.
6. The social-personality approach focuses on personality variables, motivational variables, and social culture environment. Through correlational studies and contrasts between high- and low-creativity people, many potential traits have been identified.
7. The confluence-theories approach assumes that multiple components must converge for creativity to occur. Most recent studies are based on this assumption.
8. The cognitive neuroscience approach involves relating cognitive functions to their underlying basis in the brain. Via neuroscience instruments, brain activity during the process of creation can be specified.

While the first two approaches seem to damage the scientific study of creativity, the psychoanalytic approach can be regarded as the first major theoretical approach to studying creativity in the twentieth century. Moreover, the cognitive approach and social-personality approach were developed at about the same time. Recently, the cognitive neuroscience approach has started to be employed in studies concerning the creative process.

Confluence Theories of Creativity

Most studies have defined creativity from the perspective of one of the '4Ps': personality, process, place/press, and product. More recent studies, however, have interpreted creativity from a more holistic, dynamic, and multidimensional perspective due to the flourishing of the following confluence theories.

Componential model of creativity

This model suggests that three components are essential for the production of original responses or works. These three components are domain-relevant skills, creativity-relevant procedures, and task motivation. Domain-relevant skills include technical skills, factual knowledge, and special talents in a given domain. Creativity-relevant procedures are composed of cognitive styles, work styles, and the application of heuristics to exploring new pathways. Task motivation is comprised of motivational variables that determine an individual's approach to a given task. The level of creativity varies as a function of the strength of each of the three components.

Evolving system model of creativity

The characteristics of this model are three-fold: (1) the creative person is unique; (2) developmental change is multidimensional; and (3) the creative person is an evolving system.

Creative people do not follow some well-charted path; they are unique in unexpected ways. The notion of an evolving system emphasizes that development is multicausal and that reciprocally interactive relationships exist both among the internal elements of the system and between creative individuals and their external milieu. Additionally, the evolution of creative ideas is influenced by personal expertise, motivation, emotions, and environment. Moreover, creative individuals seek not just answers but also new questions.

Systems model of creativity

This model suggests that creativity is a process that can be observed only at the intersection of individuals, domain, and field. In this model, individuals draw on information in a particular domain and transform or extend it through their cognitive processes, motivation, or unique life experiences. The field, consisting of people who influence a particular domain, evaluates and selects new ideas. The domain, a culturally defined symbol system, preserves creative products and transmits them to other individuals and future generations. This model also emphasizes that individuals undertake creation within a particular domain and that, therefore, domain knowledge is required.

Interactive perspective of creativity

This model emphasizes the creative results of the interaction of three core elements: the individual, other persons, and the work. The individual can be a child or a master. As for other persons, when the individual is a child, the influential other persons are family and peers, whereas when the individual is a mature adult, they are rivals, judges, and supporters in the field. The work refers to relevant symbol systems in the domain or discipline. The model also suggests that three factors (symbol systems, mental skills, and ways of communicating in different domains) vary dramatically from one another.

Investment theory of creativity

This theory suggests that creative people are willing and able to buy low and sell high in the realm of ideas. Buying low refers to pursuing ideas that are unknown and/or out of favor but that have growth potential. These ideas are often intensely resisted by others when they are first introduced to them. Creative people persist nevertheless and eventually sell high. This theory suggests the confluence of six distinct but interrelated resources that are required for creativity: intellectual ability, knowledge, a particular style of thinking, personality, motivation, and environment.

Ecological systems model of creativity development

This is the most recently proposed confluence model; it suggests that four systems – the microsystem, mesosystem, exosystem, and macrosystem – have a far-reaching impact on an individual's development of creativity. The microsystem specifies inherent and learned personal characteristics: mainly knowledge, dispositions, and skills. These personal characteristics are the most fundamental to the generation of a creative product, and they directly affect all stages of the creative process. The mesosystem, meanwhile, consists of family and school experiences. These two subsystems interact with each other and greatly influence the creative potential of a person throughout

his or her childhood and even into his or her teens. However, as the creative person grows up, these influences may become more indirect and perhaps less influential. The exosystem is comprised of organizational factors that relate to an individual's work, including the people, events, and things within an organization. This system interacts with the creative person and influences the creative process both directly and indirectly. Finally, the macrosystem refers to a social milieu, including the values, laws, and customs within a culture. This system has a substantial impact on the evaluation of a creative product. From a mature adult perspective, the four layers of the system interact with one another, but only the microsystem and macrosystem directly influence the current creative process.

Approaches for Studying Creative Processes

Creative Processes

Some confluence theories have identified specific stages of creative processes. For example, the componential model of creativity indicates five stages of creativity:

1. problem or task identification, in which task motivation determines whether the search for a solution will begin or continue;
2. preparation, in which domain-relevant skills determine which pathways will be available during the search for a response;
3. response generation, in which creativity-relevant procedures serve as an executive controller and influence how the search for a response will proceed;
4. response validation and communication, in which domain-relevant skills determine which criteria will be used to evaluate a response; and
5. the outcome, in which an appropriate decision is made; the result of the outcome will, in turn, influence task motivation and further determine whether the process will continue or end.

Similarly, the ecological systems model of creativity development identifies four stages of creativity:

- preparation: collecting related information, and organizing it into schematic patterns;
- incubation: analyzing and synthesizing the information in the schema;
- insight: finding connections between information in the schema and forming a creative product; and
- evaluation: using the product and validating its originality and value.

On the other hand, the creative cognition approach claims that five types processes commonly occur during creation:

1. the retrieval of existing structures from memory;
2. the formation of simple associations among the structures or combinations thereof;
3. the mental synthesis of new structures;
4. the mental transformation of existing structures into forms; and
5. the analogical transfer of information from one domain to another.

Accordingly, creative processes are comprised largely of the retrieval, integration, and retention of knowledge, the close connections between cues and the activation of knowledge, the crucial role of motivation, and the contribution of incubation to insight. Exploring how these factors or components may actually interact in the process of creation, undoubtedly, is central to any understanding of creativity. To date, most studies based on one of the 4Ps or the confluence theories have employed a psychometric approach; as a result, how a creative solution is produced remains a mystery. The creative cognition approach and cognitive neuroscience approach may provide a new window into this mystery.

Creative Cognition Approach

What is creative cognition?

Cognitive creation emphasizes that creative capacity is an essential property of normative human cognition and that the relevant processes are open for investigation. It also emphasizes that creative ideas and products emerge via the application of ordinary, fundamental cognitive processes to existing knowledge structures.

Creative cognition seeks to move beyond traditional psychometric approaches to an understanding of creative thoughts. It has three goals. The first goal is to advance the scientific understanding of creativity by adapting the concept, theories, methods, and frameworks of mainstream cognitive psychology to the study of fundamental cognitive operations that produce creative thoughts. The second goal is to extend the scientific understanding of cognition by conducting experimental observations of the cognitive processes that operate when people are engaged in creative tasks. Finally, the third goal is to specify the factors and processes that determine how existing knowledge will be applied to new situations and the precise way in which such information can either facilitate or inhibit creative functioning. Some studies that involve understanding the cognitive process of creativity have undertaken the creative cognition approach.

Creative cognition approach

The major concern of the cognitive approach to creativity is how differences at the level of information-processing operations can influence creative performance. Early models within the creative cognitive domain suggest that the ability to be creative is influenced by the manner in which semantic networks are organized. Specifically, less creative people have steep associative hierarchies in semantic networks, such that a stimulus activates many closely associated or stereotypical representations and therefore generates few unique representations. Highly creative people, in contrast, have flat associative hierarchies, such that they have comparable access to both closely and remotely associated concepts and therefore generate more unique representations.

In the 1990s, a creative cognition approach called the Geneplore model was proposed that has been employed to studies of insight, the extension of concepts, recently activated knowledge, conceptual combinations, and creative imagery. This model seeks to distinguish the differences between the cognitive processes that are used in creative

cognition and the types of mental structures through which they operate. The central idea of this model is that many creative activities can be described as the initial generation of candidate ideas or solutions followed by the extensive exploration of those ideas. The initial ideas are sometimes preinventive in the sense that they are not complete plans for a product or tested solutions. Usually, one would alternate between generative and exploratory processes and refine the structures according to the demands or constraints of a particular task.

Cognitive Neuroscience Approach

The goal of cognitive neuroscience

Despite six decades of experimental investigation, there are still many open questions concerning the essential nature of creativity. For example, what operations are involved in creative thinking? How is creativity brought about by and implemented in the brain? Such questions concerning creative processes are central to the cognitive neuroscience of creativity. Cognitive neuroscience involves relating cognitive functions to their underlying basis in the brain; it helps us to find the link between creative activities and their corresponding brain dimensions.

Cognitive neuroscience and creativity research

Recently, neuroscience instruments such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), electroencephalography (EEG), magnetoencephalography (MEG), and event-related potential (ERP) have been employed in studies of creativity. However, most related studies have focused on brain symmetry; studies that focus on the cognitive abilities required for creativity and how insights are produced remain scarce.

The abilities required for creativity, such as working memory, sustained attention, and cognitive flexibility, are typically ascribed to the prefrontal cortex. Moreover, stored knowledge and novel combinations of that knowledge are implemented in two distinct neural structures – the TOP (the temporal, occipital, and parietal regions) and the prefrontal cortex. Such findings contribute to our understanding of the difference between creative and noncreative thinking.

However, a simple search for the brain regions involved in creativity would be fruitless. The involvement of the prefrontal cortex is presumably restricted to domain-general creative processes; when it comes to domain-specific aspects, other cerebral areas are more likely to be at work. It is also suggested that the creative insights that are produced after concerted deliberation and those that are generated spontaneously activate different regions of the brain. Moreover, a study conducted by fMRI found that expert subjects' creativity was quantitatively correlated with the degree of dominance of the right prefrontal cortex over that of the left, but only a negative correlation with creativity was observed in the bilateral inferior parietal cortex among the novice subjects. Therefore, when employing a comprehensive neuropsychological approach, it is essential to break down the underlying cognitive processes involved in creativity tasks and investigate the involvement of different regions of the brain in each of these processes.

Studies of Insights

What Are Insight and Insight Problem?

Creativity is generally conceived of as the generation of insights or problem solutions that are both novel and useful. Insight is the process through which a problem-solver reconstructs the problem and suddenly develops a solution after systematic attempts to find one. In essence, insights are sporadic and unpredictable exceptional thinking where unwarranted assumptions must be discarded before solutions to problems can be obtained.

Unlike divergent thinking tests, insight problems are commonly used when the cognitive approach is emphasized. An insight problem is characterized as an open problem with a closed solution; it typically requires a mental restructuring of problem information that leads to a clear and sudden understanding of how to solve the problem. The Duncker Candle task is a classic insight problem. Moreover, the process of insight problem-solving requires both convergent thinking and divergent thinking. It is convergent in the sense that it aims for a single correct solution. On the other hand, when the problem needs to be restructured by means of flexible thought, it requires divergent thinking.

Cognitive Neuroscience Approach of Studying Insight

The paradigm of studying insight has been extended outside the realm of traditional experimental design to incorporate cognitive neuroscience since the latter was developed. However, related studies have just begun to be developed. Creative insights can be the result of two processing modes, deliberate and spontaneous, each of which can guide neural computation in structures that contribute emotional content and provide cognitive analysis. The cognitive neuroscience approach is able to provide concrete evidence of such assumptions.

An ideal experimental paradigm for studying the neural correlates of insight with cognitive neuroscience instruments should have at least the following features.

1. Be able to elicit restructuring of the problem.
2. Elicit multiple insight events within a limited time period. Routine event-related fMRI or ERP studies require 10–50 trials in each condition to guarantee reliable analysis.
3. Allow one to test various kinds of research hypotheses, including general hypotheses derived from theories as well as hypotheses about the precise function of particular brain areas.
4. Enable researchers to define suitable reference states (i.e., the baseline). Brain imaging analysis relies heavily on the contrast between a target state and a reference state.
5. Allow one to study internally and externally triggered insights.

To elicit creative insight in a short time period, solution hints can be used. Such a design allows one to obtain multiple insight events and their accurate onset times, which are required for fMRI and EEG, and to reliably record the activity associated with the restructuring component of insight. Moreover, to relate the dynamic development of insight to neural

activity, implicit learning tasks can be employed; such tasks enable researchers to pursue the development of an insight on a trial-by-trial basis.

Studies of Emotions and Creativity

Emotional Valence and Creativity

Emotional valence includes positive emotions and negative emotions. Over the last 30 years, systematic studies have examined the relationships between emotions and creative cognition. Some experimental studies have found that a positive emotional state facilitates creativity, whereas others have found that a negative emotional state enhance creativity. The approaches to explaining the relationships between emotional states and creativity include the following.

Cognitive justifications

This perspective argues that positive emotional states influence an individual's attention, which enhances the possibility of combining different elements, facilitates access to positive material in one's memory, promotes the spread of knowledge activation, and increases the possibility of making remote associations conducive to creative thought, therefore facilitating creative problem-solving.

Broaden-and-build theory

This theory proclaims that positive emotions momentarily broaden people's attention and thinking, enabling them to draw on higher-level connections and a wider range of percepts or ideas, and thereby leads to creative thought. In turn, these broadened outlooks help people to discover and build consequential personal resources that contribute to the development of creative abilities.

Hedonic contingency theory

This theory assumes that happy individuals scrutinize the hedonic consequences of a particular action more carefully than do individuals in other moods and that they will choose actions that either maintain or improve their positive mood. Therefore, individuals in happy moods might be more creative because they are motivated to maintain or enhance their positive affective state.

Cognitive tuning theory

This theory suggests that negative moods indicate that the current situation is problematic and motivate actions designed to alleviate or eliminate the problem; creative solutions to the problem are thereby produced. In contrast, positive moods signal that the current situation is satisfactory and that no further action is necessary; creative thoughts are thereby inhibited.

The Interaction of Valence and Activation

The dual-pathway model suggests that mood states can be conceptualized in terms of two underlying dimensions – hedonic

tone (positive vs. negative) and activation (activating vs. deactivating). More specifically, cognitive activation is a necessary precondition for creativity, and hedonic tone determines the route (the flexibility route or the perseverance route) through which creative fluency and originality are achieved. In other words, activating moods with a positive tone is linked to cognitive flexibility and thereby promotes creative performance, whereas activating moods with a negative tone is linked to perseverance and thereby enhances creativity.

Research findings also suggest that the pleasanter one's emotional state and the greater the level of arousal, the more original ideas are produced. On the other hand, the more negative the emotional state is and the greater the level of arousal, the less likely it is that ideas will be produced. Moreover, the interaction between negative reactivity and level of arousal has an inhibitory effect; that is, when people react actively to negative stimuli, their creative ideas are inhibited because of increased arousal.

The Interaction of Valence, Activation, and Regulatory Focus

A three-dimension theory has been recently proposed to explain the relationship between one's emotional state and creativity; the three dimensions are hedonic tone (positive vs. negative), the level of activation involved (activating vs. deactivating), and its association with regulatory focus (promotion vs. prevention). Mood states that are associated with a promotion focus (e.g., anger, sadness, and happiness) should expand attentional scope and thereby facilitate creative performance, whereas mood states that are associated with a prevention focus (i.e., fear, relax, and calm) should produce a more constricted scope of attention and thereby impede creativity.

Based on this three-dimensional theory, a meta-analysis of mood-creativity research conducted over 25 years suggests that positive moods produce more creativity than do mood-neutral controls but that there are significant differences between negative moods and mood-neutral controls or between positive and negative moods. Moreover, creativity may be enhanced most by positive emotional states that are activating and with a promotion focus. Interestingly, negative, deactivating moods with such a focus are not associated with creativity, but negative, activating moods with such a focus are associated with lower creativity. Such findings need to be replicated to verify the validity of the three-dimension theory concerning emotion and creativity.

Studies of Working Memory and Creativity

What Is Working Memory?

Working memory is the executive and attentional aspect of short-term memory involved in the integrating, processing, and retrieval of information; it requires the simultaneous storage and processing of information. Recent studies have identified that the frontal cortex, parietal cortex, anterior cingulate, and parts of the basal ganglia are crucial for working memory function. Generally, the neural basis of working memory has been derived from lesion experiments in animals.

Theories of Working Memory

Multicomponent model of working memory

This model assumes that human thought processes are underpinned by an integrated system for temporarily storing and manipulating information. Four subcomponents are included in this model. The first is the central executive, responsible for directing attention to relevant information, suppressing irrelevant information and inappropriate actions, and coordinating the two slave systems: the phonological loop and the visuospatial sketchpad. The second is the phonological loop, which is comprised of a phonological store and an articulatory rehearsal process. The third is the visuospatial sketchpad, which manipulates visual images and spatial information. The fourth is the episodic buffer, which is a limited-capacity store that binds together information to form integrated episodes.

Embedded-process model

This model claims that the human memory system operates by way of rich interaction between attentional and memory mechanisms. Working memory is organized into two embedded levels. The first level is comprised of activated long-term memory (LTM) representations. The second level is the focus of attention. Attentional resources are used to stimulate information from LTM to meet current goals. Moreover, activated units can arise from sensory input as well as semantic and episodic information from LTM. Though one may or may not be consciously aware of these representations, they are readily accessible for use if necessary. A portion of these representations can be further promoted to a highly active state that comprises the focus of attention.

To date, most studies focused on working memory have employed the multicomponent model of working memory; in contrast, only a few studies have adopted the embedded process model.

Working Memory and Creativity

The multicomponent model of working memory suggests that a working memory buffer is critical for creative thinking. The dual pathway model also claims that activating rather than deactivating moods increase working memory capacity, thereby facilitating cognitive flexibility. It is also suggested that positive emotions may serve as a retrieval cue for positive material in memory, which leads to multiple interpretations and ways of organizing material in memory and therefore contributes to creative thinking.

Moreover, the cognitive network model of creativity indicates that a creative solution is a function of the degree to which frames that were previously distant from one another become saliently associated with one another through problem-solving. The frame is the basic unit of knowledge that is stored in memory. When the frames occupy short-term memory, they are salient; when two or more frames are simultaneously salient, they are associated. The association of remote frames is influenced by cognitive load and the sophistication of problem frames. When people use many salient frames simultaneously or use fragmentary frames to represent a problem, cognitive load may be high, and this may therefore

decrease the probability of combining remote frames and thus generate less creative solutions. However, when people chunk the problem into a sophisticated frame, cognitive load may be reduced and lead to more efficient short-term memory processing, which will ultimately lead to more creative solutions.

Cognitive Neuroscience, Working Memory, and Creativity

Findings from lesion, pharmacological, and preclinical studies indicate that the prefrontal cortex is a key brain structure in working memory. This is supported by neuroimaging studies showing a significant linear relationship between the increase in working memory load and the degree of activation observed in the dorsolateral prefrontal cortex.

Moreover, a few studies based on theories of working memory have been conducted to connect working memory and brain structure. For example, studies based on lesion location in patients and neuroimaging in normal subjects indicate that the basic components of working memory are localized in different brain regions. The phonological loop clearly involves the left temporoparietal region; visuospatial working memory is primarily localized in the right inferior parietal cortex, right premotor cortex, and right inferior frontal cortex. The nature of working memory is a topic that is difficult to tackle using purely behavioral methods, but neuroimaging studies are beginning to shed light on this complex process.

Conclusion

Creativity is commonly defined in terms of originality and valuation. Although there has been a long debate over whether creativity is domain-specific, most recent theories and research findings suggest that creativity is a domain-specific trait. However, compared to the domain-general realm, the domain-specific aspect of creativity is less well understood. If we are to develop a better grasp of domain-specific creativity, more studies are required that consider a single domain in depth and focus on examining the key ingredients of creative processes and people who differ across domains.

Creativity may be affected by personal characteristics, family environment, formal education, and even one's social milieu; personal characteristics, however, play the essential role during the creative process. Cognitive tests, such as those of divergent thinking, remote association and word association, have been commonly used to examine the relationship between creativity and its influential factors as well as to validate major theories of creativity. Only a few standardized domain-specific tests and insight tasks have been developed, and few studies have been conducted to test the complete confluence theories of creativity. Accordingly, more domain-specific creativity tests (especially those other than divergent thinking tests) and path models of the confluence theories based on empirical data need to be developed.

Among the many variables that have been shown to predict creativity, emotion stands out as one of the most widely studied predictors. Studies that focus on the relationship between emotions and creativity have gradually evolved from one dimension (valence) to two dimensions (valence \times activation)

and, recently, to three dimensions (valence \times activation \times regulatory focus). More empirical studies that focus on interactions among varied dimensions of emotions are required to establish the interaction theory of emotion and creativity. Moreover, in emotion-creativity research, it is suggested that activating mood states come together with higher levels of dopamine and noradrenalin and greater working memory capacity, thereby facilitating the restructuring of information and cognitive flexibility. Working memory is critical if creative thoughts are to emerge. Employing a cognitive neuroscience approach to examine the interrelationship among emotional states, working memory, and creativity would shed light on the relationships among these variables in terms of brain function.

Due to the development of cognitive neuroscience, the paradigm of studying insight has recently been extended outside the realm of traditional experimental design to incorporate cognitive neuroscience. However, related studies are still scarce. Further studies of insight that employ cognitive neuroscience instruments should take into account the aforementioned ideal experimental paradigm in order to broaden our understanding of how insights are produced.

In conclusion, the development of the research paradigm of creativity is basically in line with that of psychological studies. The cognitive approach, creative cognition approach, and cognitive neuroscience approach have focused on uncovering the mystery of the creative process and related factors. Studies that employ the cognitive approach have defined many mental operations involved in creative thinking: for example, attention, working memory, and emotions. The way forward would be to assume a process-based approach, such as that of creative cognition, to define a process that reflects one aspect of creative thinking in a specific domain; then, one might use cognitive neuroscience methods to assess the features of this process in terms of cognitive and neural functions. Such studies should contribute to unraveling the fascinating complexity that is central to creativity.

See also: Attitudes and Creativity; Brain and Neuropsychology; Componential Models of Creativity; Definitions of Creativity; Emotion/Affect; Everyday Creativity; Evolving Systems Approach; The Four Ps of Creativity: Person, Product, Process, and Press; Insight; Knowledge; Memory & Creativity; Metacognition; Personality; Autonomy and Independence; Problem Solving; Theories of Creativity.

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Relevant Website

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Research: Phenomenology

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Glossary

Flow A mental state in which a person is fully immersed in an activity, associated with a feeling of energized focus, full involvement, success in the process of the activity, and feelings of pleasure.

Peak experiences Moments of highest happiness and fulfillment.

Phenomenological philosophy A branch of philosophy that concentrates on the study of consciousness and objects of direct experience.

Qualitative research A research approach applied in many disciplines that explores and tries to understand people's beliefs, experiences, attitudes, behavior, and interactions. It generates nonnumerical data. The best-known qualitative methods of inquiry include in-depth interviews, focus groups, documentary analysis, and participant observation.

Introduction

This article addresses phenomenological research into creativity. The phenomenological approach is a form of qualitative enquiry that emphasizes *experiential, lived* aspects of a particular construct – that is, how the phenomenon is experienced *at the time that it occurs*, rather than what is thought about this experience or the meaning ascribed to it subsequently. For this reason, phenomenology is sometimes described as dealing with 'prereflective' experience. It is a research approach well-suited to analyzing the process and experience of creativity, as opposed to the creative product or the creative person. These aspects of creativity (the process and experience of creativity) have not been adequately studied to date. As Mihali Csikszentmihalyi and Jacob Getzels (1971) write: "Despite much recent research on creativity, perhaps the most critical aspect of the problem has eluded systematic inquiry: the process of creative production itself" (p. 47).

Below, a selective review of phenomenological studies of creativity is presented. These studies have tended to focus on *artistic* creativity, as opposed to other forms of creativity, and this is reflected in the article. When describing phenomenological findings, indeed qualitative findings more generally, it is often necessary to adopt the language and terminology of the researcher in order to do justice to the subtlety of what they are attempting to capture descriptively.

Phenomenological Studies of Creativity

The findings of an early phenomenological study of the creative process have been repeated and echoed in a number of subsequent studies. This study therefore provides a useful starting point. Charlotte Doyle (1976) offers a phenomenological account of the artistic creative process, the findings of which are largely supported by a later empirical study by the same author with five recognized fiction writers. She draws attention to the variety – and the contradictory and sometimes *paradoxical* nature – of statements made by creators and theorists about creativity. Doyle focuses on the temporal unfolding of the

creative process and uses this dimension of time to contrast the differing views on creativity. According to Doyle's account, the beginning of the creative process is marked by *a sudden trigger or a vague intuition that something is available to work on* – either way, it begins with a sense of *direction*. However, at this point, the final form or nature of the artwork is not clear, it is not yet articulated. Rather, the artist needs to "*think(s) through his medium*" (p. 115; italics in original). There is a sense in which the direction of the artwork evolves through interaction with the medium. In the adoption of the medium as a means of 'thinking,' certain "so-called logical distinctions disappear, for example, the distinction between intellect and emotion" (p. 116). In order to be able to adopt the medium as a means of thinking, the artist needs to have developed a certain degree of skill or control over her craft. The development and clarification of the original germ by thinking in the medium does not occur instantly – rather, the artist experiments until she experiences a sense of *recognition*, a sense of having made manifest the original inspiration of the piece.

Rather than there being a single moment of discovery, a sudden insight or recognition that provides resolution, Doyle (1976) describes "... extended periods of work punctuated by surprises large and small" (p. 119). Affective elements may vary according to this fitful unfolding of the process: despair and loneliness may accompany the periods of searching, whereas satisfaction and pleasure may be brought on by the sense of discovery. At some stage in this process, Doyle asserts that a "period of total centration" (p. 119) takes over. She describes this as involving a sense that the work is 'creating itself' (e.g., the melodies flow without forcing, the characters seem to have a life of their own, and so on), the artist is totally absorbed in and directed toward the work, he is no longer self-conscious, and experiences a sense of freedom, spontaneity, and joy (cf. the construct of 'flow,' described below). Although creative episodes can reach a climactic conclusion in periods of centration, these periods typically come and go in waves.

The final stage of creative work is driven by attempting to capture the 'truth' or meaning that the artwork is dealing with as well as one can. This is often characterized by a sense of commitment and determination, which has helped the artist

survive the awkward attempts at 'thinking through the medium' and the multiple cycles of centration and failure. The act of showing the work to an audience is an "affirmation of (the artist's) relatedness to human society" (p. 123).

Doyle (1976) argues that this account of the experiential aspects of creativity as it unfolds through time helps resolve the paradoxes in various other accounts of creativity. From this perspective, Doyle is able to assert:

The creative process involves freedom and spontaneity. The creative process demands discipline and concentration, and a commitment to work. It involves the primitive and emotional, intelligence and thought; it calls upon fantasy and inventiveness, a willingness to deviate from what is; it demands honesty and a commitment to truth. It is an expression of self and it cannot take place without forgetting the self; it is a joy and a terror; it is its own reward; it requires encouragement and understanding from others. (p. 123)

These statements are not contradictory when the different experiential states associated with the temporal unfolding of the creative process are considered. Her nonlinear model is a challenge to more traditional 'stage models' of creativity, such as Wallas' (1926) classic model of four stages (preparation, incubation, illumination, verification) unfolding sequentially over time.

Sophia Reinders (1992) investigated the phenomenology of artistic creativity through open-ended interviews with three internationally recognized artists from the diverse fields of choreography, painting, and musical composition. The participants were asked to describe their experience of creating a recent or current artwork, particularly the way in which they perceived and solved problems in the creative process.

The study's findings were as follows. The artist assumes an artistic perspective toward certain aspects of his 'life-world,' or experience. This gives rise to a sense of lack, which engages his artistic desire to produce an artwork that will fulfill or 'speak to' this felt lack. The artist has a vague, intuitive sense of the artistic object and the direction in which he should project his artistic pursuit in order to fulfill the sense of lack. Within this tension between desire based on a felt lack and an intuited artistic object, the artist engages in a process of exploration – he engages in repeated trials and variations in order to come closer to the intuited artistic object. This exploratory process also clarifies the artist's implicit guiding idea. The artist actively manipulates his artistic material as a means of exploring its expressive possibilities with regards to his global intuition of the artistic object he wishes to create. The exploratory search is informed by what Reinders terms the "demands of the artistic object." In this exploratory process the artist 'recognizes' artistic constellations or 'units' that bring the work closer to realizing the intuited intentional object. The spontaneous discovery of fulfilling artistic structures is felt to be beyond the artist's control.

The exploratory process is characterized by a number of seemingly paradoxical attitudes. First, the artist adopts an attitude of 'purposive-playfulness,' which refers to the active manipulation of his artistic materials in a highly playful, probing manner in order to realize his intentional object. The attitude of 'circumscribed indeterminacy' is also assumed. This refers to holding at bay the knowledge derived from previous artistic experiences and trusting that his artistic intuition and artistic perception will recognize emerging artistic

configurations that speak to the intentional object. The artist is being both active and receptive: active in the sense that his actions are informed by his artistic intuition of the intentional object and receptive in the sense of remaining sensitive to the emerging artistic configurations. Reinders (1992) writes: "... the artist lives his or her experience paradoxically as bringing forth and attending to the emergence of the artistic object" (p. 6). Another paradox at work is 'distant-engagement' – that is, an alternation between immersion in the manipulation of material and distancing oneself, looking at the emerging artistic structures from the perspective of the audience, in order to clarify the overall structure or gestalt of the object.

As the artistic structures for the intentional object continue to develop and become more complex, the sense of recognition becomes stronger. This is experienced as "a global bodily felt sense of meaning" (p. 67). A sense of completion is attained as the artist gradually forms the configuration of artistic tensions into "a balanced totality of artistic significance" (p. 68). Again, the sense of completion is felt on a physical level. The completion also has a paradoxical element to it, because although the artist 'feels' the work to be completed, the meaning of the artistic object remains ambiguous and open to change. The temporality of the process is characterized by a nonlinear but rhythmic progression. For example, phases of direct involvement with the artistic material may alternate with periods in which the artist's conscious attention is directed to some unrelated pursuit. An attitude of risk-taking characterizes the overall process – in the bracketing of previous experiential knowledge, the maintenance of an open-ended attitude, and engaging in a process of exploration without knowing exactly what is being searched for.

Central to Reinders' (1992) account of the experience of artistic creativity are concepts of desire, exploration, discovery, intuitive recognition, and paradox. The sense of lack, exploration and the dialogue between the artist and her material concur with Ó Cluanáin's (1979, 1981, 1987) series of non empirical qualitative studies of the phenomenology of creating and appreciating art. After reviewing the writings of four phenomenological philosophers and two contemporary psychologists on the phenomenology of art and aesthetics, Ó Cluanáin (1987) offers several general conclusions. First, he writes of artists discovering a 'special world' in the immediate, 'given world': "This 'special world' has been present in the 'given world' as a potential of which we have had glimpses on occasion, but also of which we have perceived but little, on account of preoccupation with mundane things" (p. 104). This discovery is achieved through utter respect for the 'otherness' of the medium. As in Reinders' (1992) findings, Ó Cluanáin sees the creative process as requiring a novel, exploratory encounter with the medium: "Presumption of familiarity with media is not allowed" (p. 105). This encounter does not involve a sense of control over the medium, but rather an "accommodation to its character" (p. 104). Ó Cluanáin observes that this aspect of the creative process, in addition to requiring humility, involves "... a decentration of one's subjectivity, which is an edification of one's subjectivity" (p. 104). Although different in nature, this dynamic relating to the artist's subjectivity echoes Reinders' (1992) emphasis on the paradoxical elements of the creative process. Another point of contact between the studies is the motivating force of

desire borne of a sense of lack: while Reinders (1992) writes of “an artistic perspective which gives rise to the experience of a lack” (p. 5), Ó Cluanáin (1987) writes of an “... unease in the artist, a yearning to resolve toward completeness the experienced fragment of a vision” (p. 105).

The themes in Reinders’ (1992) and Ó Cluanáin’s (1987) findings of not being ‘in control,’ of discovery, and of the role of intuition are also apparent in Amedeo Giorgi’s (1984) phenomenological study of the artistic process. This study was based around descriptions provided by two visual artists. The phenomenological structure that Giorgi found to be common to both artists was described as follows:

In creating a work of art, a person must pursue the achievement of the artwork in an open-ended way that constantly risks failure. The risk of failure is defined by the constraints of the task demands which are simultaneously precise, yet incomplete, and understood by the artist initially primarily through their excesses (e.g., literalness or surrealism). As the work progresses, specific positive guidelines also emerge, but still final closure is held off until the last possible moment. Conscious and unconscious processes intertwine constantly as do personal and artistic perspectives. In general, what the artist is aware of are the general aim and demands, and what he or she is least aware of, it at all, are the specific achievements that are accomplished. The obscurities in the process are due largely to the fact that artists are guided by feelings rather than knowledge, and to the fact that artworks are as much the result of spontaneous actions of the artist body as planned activities. (p. 26)

Sheree Conrad (1990) takes a somewhat different tack in her phenomenological analysis of artistic creativity. Rather than approaching the phenomenon through accounts provided by artists, Conrad’s investigation is based on her own experience of artistic activity (specifically, fiction writing), in the tradition of philosophical phenomenology. Conrad justifies this introspective approach by drawing on the philosopher Husserl’s (1913/1931) notion that the logic of any human experience is, in principle, available to any human subject.

Conrad’s (1990) description of the fiction-writing process starts with a sense that engaging in the production of the artwork is not ‘optional’ – that there is an imperative driving the artist. This imperative is the result of the artist sensing that the artwork “already exists” (p. 111). Indeed, the process is characterized by trying to *discover* the nature and character of the artwork. This is achieved by navigating a dynamic between recognition, which is associated with a sense of excitement, and sensing that the artistic production has strayed from what it ‘should’ be. The ‘discovery’ of the artwork occurs through interaction with the medium, as opposed to being a pre-formulated image that the artist is trying to capture through manipulation of the medium: “The writer has to find out what the story is by writing it” (p. 112). The language of intuition rather than critical mental processes is used to describe this process: “The writer feels toward it, knowing quite clearly what isn’t it, yet still unable to see what is” (p. 112). In fact, conscious, critical processes (referred to as “the voice of invention, of conscious creation” (p. 112)) are presented as interfering with the intuitive grasping of the artwork. In this sense, the artist is not so much in control of the creation as coaxing it along, letting it emerge: “If I push too hard, the thing evaporates” (p. 113). When the artist emerges from the trance-like

state of ‘discovering’ the artwork, she can be exhausted and disoriented, and experience a sense of detachment from her surroundings. The process of looking over the work is characterized by a twofold reaction: surprised certainty that this is as the artwork *should* be, that ‘it’ has been captured, and rejection of elements of the piece on the basis that they do not accurately capture the character of the artwork (“(they) are wrong, not it, bits that shatter the re-unfolding dream or flatten and muddy it” (p. 113)).

The writer’s twofold reaction is paralleled by the double reaction of the reader – the reader “... responds to a story with either shocked recognition – ‘Yes. That’s it, exactly’ – or with scorn – ‘That’s a lie, that’s not it at all’” (p. 113). For Conrad (1990), this ‘double’ recognition on both the part of the artist and the audience is testament to the fact that artwork is concerned with revealing meanings that are hidden, but common, to all human experience, rather than merely reflecting the idiosyncrasies of the creator. Drawing on tenets of philosophical phenomenology, she writes: “Because the logic or meaning of experience is invariant across time and culture, and directly available to any subject independently of theoretical constructs, the reader, no less than the writer, can see places where the story, the text, departs from the necessary logic of the human experience it presents. ... The present analysis sees the *sine qua non* of art as truth, not novelty, that of artistic activity composition, rather than creation” (p. 115). (The emphasis on artwork as revealing ‘truth’ rather than being concerned with innovation or the artist’s individual psychology is of interest with regards to cross-cultural perspectives on creativity. Ironically, considering Conrad is writing from the decidedly Western perspective of Continental phenomenology, her account of experiential aspects of the creative process is consistent with central elements of Lubart’s (1999) summary of Eastern views on creativity – particularly the notion of creativity as a process of repeating or rehearsing a ‘known’ truth through skilled composition rather than inspired novelty, which is more characteristic of Western views on the construct.)

Clearly, Conrad’s (1990) account displays significant overlap with the other phenomenological accounts of creativity outlined above, particularly with Reinders’ (1992) and Giorgi’s (1984) sense of the artist responding to the ‘demands’ of the artwork (Conrad in fact adopts this term at one point: “The artwork, the meaning grasped, makes its own demands, suggests its own proper or optimal instantiation ...” (p. 115)). The sense of the artist not being in ‘control’ of the process, the prominent role of intuitive, emotional processes, and the sense of discovery through interaction with the medium are also points of contact with the other accounts. Particularly prominent in Conrad’s account is the interfering role of conscious, critical mental processes.

Nardone (1996) applied a phenomenological analysis to the experience of improvisation in music. She conducted open-ended interviews with three jazz musicians recognized as proficient in performing and teaching musical improvisation. Her analysis yielded two phenomenological structures: one emphasizing the psychological experience of improvisation and the other the musical context in which improvisation takes place. The first of these structures was composed of eight elements: ensuring spontaneity while yielding to it; being present and

not present to musical processes; exploring familiar and unfamiliar musical terrain; drawing from a corporeal and incorporeal source of musical inspirations; attending moment to moment to temporality; having trust and confidence in oneself and musical others in musical risk taking; being sustained by and sustained by the musical other; and extending toward the listening other in musical risk-taking. The second structure was composed of three elements: perceiving temporality as altered; identifying the narrative context as grounding and providing a structure for concretization of musical expression; and recognizing the existing sociocultural context as liberating and transforming. Dialectical paradoxes play a prominent role, as in Reinders' findings, particularly in the structure relating to the psychological experience of improvisation. As with the other studies, "non-rational intelligence" (p. 4) is also seen as primary in the creative process, although Nardone emphasizes the role of the body in these nonrational processes.

Barnaby Nelson (2009) investigated the phenomenology of artistic creativity through semi-structured interviews with 11 artists. The findings consisted of 19 interlinked elements, with three dynamics operating within these elements: a dynamic between intuition and analysis, between a sense of union and division, and between freedom and constraint, which is consistent with the findings of the studies reviewed above. A questionnaire, the Experience of Creativity Questionnaire (ECQ), was developed and validated based on these findings. This questionnaire was applied to a sample of 100 artists to investigate the relationship between aspects of creative experience and personality and psychopathological features. The study revealed a strong relationship between schizotypy, an aspect of personality related to psychotic-like experience or psychotic vulnerability, and a range of aspects of creative experience. This indicates that people with schizotypal tendencies may be particularly suited or driven to creative activity, which is consistent with biographical studies of eminent creators through history. This study illustrates the useful integration that can be achieved between qualitative and quantitative studies of creativity.

Phenomenological Studies of Constructs Related to Creativity

The phenomenology of several constructs related to creativity have also been investigated by a number of researchers, at times using a stricter phenomenological method, as described above, and at times using a more general qualitative approach. Examples include Csikszentmihalyi's (1975, 1990b, 1996) construct of 'flow' and the notion of peak experiences, most commonly associated with the work of Abraham Maslow (1968, 1971). The construct of 'flow' was developed through interviews with people such as chess players, rock climbers, dancers, and composers, who seemed to be engaged in activities that they enjoyed but for which they were not rewarded with money or fame. Csikszentmihalyi (1996) outlined the quality of experience that kept people motivated to pursue such activities. He suggests that this experience, referred to as 'flow,' is composed of nine main elements: there are clear goals every step of the way; there is immediate feedback to one's actions; there is a balance between challenges and skills;

action and awareness are merged; distractions are excluded from consciousness; there is no worry of failure; self-consciousness disappears; the sense of time becomes distorted; and the activity becomes autotelic.

Some of these elements of 'flow' are apparent in the accounts of creative experience outlined above. Csikszentmihalyi's (1996) own interview-based study of 91 individuals recognized for their creative achievements indicated that flow experiences play a prominent role in the creative process. He proposes that the pleasure or joy characteristic of flow-type experience is an intrinsic 'reward' for the creative process, thus motivating creative activity. Drawing on evolutionary principles, he suggests that human beings are 'programmed' for creativity through this mechanism.

Susan Perry (1998) examined flow experiences in 62 regularly publishing writers. She found that writers identified flow experiences as central to their work and that they often actively constructed conditions that facilitated entry into this state. Five key conditions were identified for entry into the flow state: personality factors, including emotional resilience, openness to experience, absorption, and looseness of boundaries in thinking; a combination of motivational factors; physiological and psychological relaxation; becoming engaged with and focusing on the work; and maintaining a balance between the opposites of willing/not willing, thinking/not thinking, and audience awareness/unawareness.

'Peak experiences' are defined as moments of highest happiness and fulfillment. Maslow (1971) and Laski (1961) provided accounts of such experiences in religious and non-religious contexts, such as during childbirth or athletic events, and while enjoying music, nature, or dancing. It has been argued that heightened creativity is a characteristic of peak experiences and that creative work is a common trigger of peak experience. Maslow (1962) stated that peak experiences release a person "for greater creativity, spontaneity, expressiveness, idiosyncrasy" (p. 101). Maslow (1971) also asserted that it is the power to evoke peak experiences that distinguishes great art from the inconsequential. Rollo May (1959) stated that ecstasy, the central feature of peak experiences, describes a level of consciousness that occurs during the creative act.

Moncrieff (1989) examined aesthetic appreciation, referred to as 'aesthetic consciousness,' but not with particular reference to peak experiences. Although Moncrieff's findings indicated a variety of features of aesthetic consciousness, involving personhood, creativeness, performance, appreciation, symbolization, and expression, his discussion focused on 'oneness,' which he found to be a central feature of aesthetic consciousness. The experience of 'oneness' involves a structural wholeness, in the sense of a perception of a constant series of relations between the various elements of the experience (i.e., an enhanced sense of inter-connectedness). It also involves a loss of distinction between the experiencer and the experienced, between the inner and outer worlds; it can be experienced as a transitional moment; the particular experience can symbolize the more general "rhythms of life" (p. 250); it can involve a sense of expansion of personal presence; there can be a flowing quality to the experience; and language can seem to be an inadequate means of describing the experience. A central feature of the experience is contact between the individual ego or persona and the Self in the Jungian sense of the unifying and

identity-making center that subtends the ego. This can have the effect of leaving the individual feeling more deeply engaged with themselves and the world.

Recurrent Themes

A number of recurrent or common themes are evident in the phenomenological studies of creativity and related constructs outlined above. These themes include motivation to produce creative work (based on factors such as a felt sense of lack, the sense of importance of or desire for expression, etc.) within the context of having developed appropriate skills; 'exploration' of possibilities, often including trials and variations, and the sense of recognition of emerging structures in the creation; responding to the 'demands' of the piece being created; the prominent role of intuition; interaction between the creator and the medium; lack of a sense of control over the unfolding process; and the role of affective pleasure and flow-type experiences. Studies of aesthetic awareness or consciousness have indicated that this construct can involve a transition in experience of the self-world relationship, particularly involving the dissolution of boundaries and the experience of 'oneness.' This experience is also evident in studies that investigate creativity more directly.

Concluding Remarks

This article has illustrated how phenomenological studies of creativity can be a useful way of elucidating the subtleties and details of creativity, particularly with regards to the creative process and experience, as opposed to the creative person or product. As Louis Sass has remarked:

... (I)n the absence of such studies, there is a sense in which we literally do not know what we are talking about (or looking at, or counting up in our research studies) when we speak of creativity, creative psychological processes, or certain types of psychopathology. (2000–2001: 42)

A challenge for the field is to integrate the findings from phenomenological studies with other areas of creativity

research in order to build multi-faceted models that capture the complexity of the construct. The detailed descriptions provided in phenomenological studies may shed light on research into such areas as personality, affective, and motivational aspects of creativity. For example, questions might be asked such as: Does the experience of the creative process contribute to our understanding of why people with particular personality characteristics or psychopathological vulnerabilities are attracted to creative work? Do affective components of creative experience shed light on some of the contradictory findings in the creativity-affect literature? How do experiential aspects of the creative process relate to motivational factors driving creative activity?

See also: Research: Quantitative.

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Research: Quantitative

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Glossary

Effectiveness of creative problem solving The number of solutions receiving a rating of likely or very likely to achieve an objective.

Efficiency of creative problem solving The number of effective solutions divided by the total number of solutions.

Flexibility of creative problem solving The number of generated solutions in different categories.

Fluency of creative problem solving The number of solutions not previously generated.

Gordon's synectics The motto of which is 'making the strange familiar, and making the familiar strange.'

Making the strange familiar is critical thinking involving data gathering, analysis, synthesis, and evaluation to connect prior knowledge with the present problem, define the problem, and evaluate the solution. Making the familiar strange is creative thinking embracing breaking old associations, incorporating imagery, analogy, and broad search to produce new ideas or products.

Quasi-experimental designs The experimental designs that no process of randomization was conducted by the assignment of participants either to experimental or to control group.

Real experimental designs The experimental designs that demand a process of randomization by the

assignment of participants either to experimental or to control group.

Single-case experimental design This kind of design has two basic forms, the reversal design and the multiple-baseline design. The reversal design contains at least three phases: the first baseline phase, a treatment phase, and the second baseline phase. The purpose of reversal of treatment phase to baseline phase is to ascertain that alternative interpretations of the treatment effect are precluded. The multiple-baseline design contains at least two baselines across participants, behaviors, or situations. The treatment is introduced to the second baseline after it has shown effect on the first one.

Structural equation modeling analysis In such an analysis, a common factor among the correlated independent and dependent variables is extracted and labeled as independent latent variable and dependent latent variable respectively. The latent variables cannot be measured but can be represented by observed variables. A structural equation model can contain multiple independent latent and dependent variables. A gamma coefficient depicts the effect of independent latent variable on the dependent latent variable. The error term represents the percentage of variances of dependent latent variable that cannot be explained by the independent latent variable(s).

The understanding that the experience of failure whilst knowing its cause is worthier than that of success without knowing its reason is an important guideline in scientific research. Researchers employing quantitative research methods should keep reliability and validity of measurement of creativity in mind to eliminate the measurement errors as much as possible; otherwise it will be difficult to build up a replicable body of knowledge in the field of creativity.

This article describes the quantitative methods used in empirical research into creativity. Quantitative research methods include experimental studies, correlation methods, and meta-analysis. Experimental studies aim to identify the controlling variables relevant to creativity by means of experimental designs. Correlation studies attempt to find relationships between creative behaviors and various variables, such as personality characteristics and environmental settings under which the creativity of individuals is encouraged and facilitated.

Experimental Studies

The purpose of experimental research is to build replicable findings leading to the establishment of a scientific body of

knowledge in creativity. In 1996 Runco and Sakamoto made a thorough review of experimental studies of creativity that included the manipulation of relevant variables in creativity. A prerequisite of an experimental study is the operational definition of the independent as well as the dependent variables. In 1996 Runco defined creativity in terms of transformation, discretion, and intentions and tried to get close to the mechanism of the creative process. To this point the mechanism that underlies creative thinking is still unclear. Ma conducted a meta-analysis in 2009 and tried to define the process of creativity as "the ability to reorganize the available knowledge, information, cues, facts and/or skills in a person's reservoir to generate new ideas or useful solutions." Ma arrived at this conclusion partly in accordance with the evidence derived from the meta-analysis and partly based on the concepts and series of experimental studies (process-based measures of creative problem solving skills: I-V) made by Mumford and his colleagues. Many of us have had the experience of incubation, that is, if we confront a problem and find that we cannot solve it after working hard on it then we take a break or do something else, then we can suddenly find the solution. The question whether the process of incubation is a mechanism of reorganization of knowledge should be addressed in future research.

Between Groups Experimental Designs

Real experimental designs

Experimental studies demand a process of randomization by the assignment of participants either to an experimental or to a control group. The definition of randomization is that every member of the target population must have an equal chance of being chosen as an experimental participant. The purpose of randomization is to ensure that the unknown background variables of the experimental and control groups are equal before the implementation of treatment. In 1993 Fontenot conducted an experiment to examine the effectiveness of a training program based on the Osborn–Parnes Creative Problem-Solving Model. Sixty-two business people were drawn from six different businesses as participants and were randomly assigned to either the experimental or control group. The dependent variables were operationally defined as: (a) fluency in data finding or information retrieving (the number of different data or information generated); (b) fluency in problem finding (the number of alternate problem statements produced); (c) flexibility in problem finding (the number of categories created by the generated alternate problem statements); and (d) quality of the problem statement (the complexity of each group's final problem statement judged by two experts in terms of the degree to which the needs and motives of all those involved in the problematic situation including the owner, goal, and constraints identified in the final problem statement were satisfied). The results demonstrated that the training program was effective on the four dependent variables. The statistical significances reached at least at 0.10 level when using a one-tailed *t* test for independent samples.

Quasi-experimental designs

It is difficult to utilize random sampling in the natural settings such as schools, so there is usually an arbitrary assignment of one class in a school as an experimental group and the other as a control group. The internal validity of quasi-experimental designs is often threatened, because differences may exist before the experimental treatment is implemented; hence alternative interpretations of the results of the experiment cannot be excluded.

In 1996 Gendrop described his research as a quasi-experimental study. After taking pretests, which contained the TTCT, the Gordon Creative Problem Solving Test (GCPST), and the Watson–Glaser Appraisal of Critical Thinking (WGACT), 51 participants were randomly assigned to an experimental group and 46 to a control group. The fact that all of the mean scores of the control group in the creativity tests were higher than those of the experimental group cast the process of randomization in doubt. If the randomization process occurred before the pretesting, it would become a real experimental design. The treatment encompassed 4 h of reading a self-paced text 'The New Art of the Possible: The Basic Course in Synectics' and completing exercises, and 6 h of workshop, which consisted of interactive peer experience in small groups, a short quiz, and practices. The participants in the experimental group underwent the treatment before taking the posttests in creativity while those of the control group took the posttests before undergoing the treatment. The key treatment

was the use of Gordon's synectics, the motto of which is 'making the strange familiar, and making the familiar strange.' Making the strange familiar is critical thinking involving data gathering, analysis, synthesis, and evaluation to connect prior knowledge with the present problem, define the problem, and evaluate the solution. Making the familiar strange is a form of creative thinking which embraces the breaking of old associations, incorporating imagery, analogy, and broad search to produce new ideas or products. The results of Gendrop's study exhibited that pretest–posttest differences between the means in fluency, flexibility, and originality on the TTCT and on the GCPST were significantly larger for the experimental group than for the control group.

Observational method

This method puts two different groups under conditions of laboratory control and observes whether differences between groups exist in the dependent variable. Suppose that we want to investigate whether the thinking process of highly creative people differs from that of less creative ones, we may employ a meta-cognitive approach. After a creativity test is administered and scored, the participants can be divided into a highly creative group and a less creative group on the basis of whether their creativity scores are above $M + 0.5$ standard deviation (SD) or below $M - 0.5$ SD. Both groups undergo the same treatment, that is, during the time that they are solving problems, they are asked to speak what they are thinking aloud. The experiment is carried out individually. Their responses are audio-visually recorded, verbatim transcribed, and coded in accordance with the following categories:

1. redefining the problem;
2. retrieving information from their own reservoirs of knowledge, skills, experiences, and cues, etc.
3. reorganizing the knowledge and formulating a strategy of problem solving;
4. trying the solution;
5. evaluating the appropriateness of the solution;
6. finishing the problem solving or returning to the previous steps;
7. others that cannot be classified into the above steps; such as incubation including taking a break.

This kind of experimental study is a hypothesis-formulating exploration, not a hypothesis-testing study, because the difference that exists in the process of problem solving between the highly and less creative groups is unknown. A hypothesis of the process of creative problem solving can be formulated only after a difference is found by comparison. After that, a randomized real experimental design must be conducted to test the formulated hypothesis. Differing from the aptitude or intelligence tests, the participants in a creative problem solving test should be allowed to take breaks during the test session so that possible incubation may occur.

Single-Case Experimental Designs

Single-case experimental design, within-subject design, and single-subject design are synonyms. This kind of design has two basic forms, the reversal design and the multiple-baseline

design. The reversal design contains at least three phases: the first baseline phase, a treatment phase, and the second baseline phase. The purpose of the reversal of the treatment phase to baseline phase is to ascertain that alternative interpretations of the treatment effect are precluded. One of the important characteristics of single-case experimental design is that both the independent as well as the dependent variables are operationally defined. An experimental study was successfully carried out by Glover and Gary in 1976 to stimulate the creativity of the four basic components of creativity proposed by Torrance: fluency, flexibility, elaboration, and originality.

In a single-case experimental design, authors usually judge the effectiveness of treatment according to their intuition. It would be scientifically more acceptable if the effectiveness could be expressed in terms of percentage of data points exceeding the median of baseline phase (PEM) scores and judged in accordance with the criterion set by Scruggs and his colleagues in 1986, which categorized scores equal to or larger than 0.90 as highly effective, equal to or larger than 0.70 but less than 0.90 as moderately effective, and less than 0.70 as questionable or not effective. 'Questionable' and 'not effective' are combined together as it is hard to distinguish between them visually.

The data points in a single-case experimental design usually have autocorrelation and hence preclude the use of parametric statistics to test the significance of the difference of data points between the baseline- and the treatment-phase due to violation of one of the three basic assumptions of the parametric statistics, that is, the independence of the distribution of residuals. The PEM approach is a nonparametric statistic and therefore suitable for this purpose.

Calculation of PEM scores

A PEM score is calculated from the data points of a pair of baseline-treatment phases. To compute the PEM scores, one needs only to draw a horizontal median line in the baseline phase. This horizontal median line will hit the median when the number of data points in the baseline phase is odd, and go between the two middle points if the number of data points is even. This median line will stretch out horizontally to the treatment phase. Then the percentage of data points of treatment phase above the median line may be calculated.

Figure 1 is the simulation of the results of the experiment carried out by Glover and Gary in 1976. The treatment in Glover and Gary's study was reinforcement with edible foods and 10 min of recess as reinforcers. Students were instructed to list all the possible unusual uses they could think of for an inanimate object listed on the board in each session. The four components of creativity were defined as: (a) fluency, number of different responses; (b) flexibility, number of verb forms; (c) elaboration, number of words per response; and (d) originality, statistical infrequency of verb forms. In a calculation of their results using the PEM method, the PEM scores of the effect of reinforcement on all of the four components of creativity were 1.0 (highly effective). In order to illustrate the method of calculation of the PEM scores, a new set of data is artificially generated and demonstrated in Figure 1. After 1 week of baseline measurements, the reinforcement was contingent on the fluency. The median of the baseline phase is 10. Hence a horizontal line of the median is drawn and extended to the treatment phase. Four points in the treatment

phase exceed the median line of the baseline phase. $PEM\ score = 4/5 = 0.80$. Likewise, the PEM score is 0.80, 1.0, and 0.50 for flexibility, elaboration, and originality, respectively. According to the criterion set by Scruggs and his colleagues, the treatment with reinforcement on fluency and flexibility is moderately effective, for elaboration it is highly effective, and for originality it is questionably or not effective.

The illustrative Figure 1 is a multiple-baseline design; however, a reversal design is simultaneously applied for the dependent variables except for originality (the lowest panel). This kind of research cannot only be used to test the effect of reinforcement on the single components of creativity but also to test the generalization of the learned industriousness theory proposed by Eisenberger in 1992, according to which, individuals learn which aspects of creativity are rewarded, resulting in the motivation to perform appropriately.

Correlation Methods

Cross-Sectional Study

The method of cross-sectional study is a kind of correlation method that administers questionnaires or testing to collect data at a time point to produce a correlation matrix, based on which different statistical analyses, such as regression, univariate analysis, multivariate analysis, structural equation modeling (SEM), etc., can be applied to test various hypotheses. Reuter and his colleagues in 2005 recruited 48 undergraduate students as participants and employed a laboratory technique to analyze testosterone from saliva samples of participants and then administered testing instruments to assess personality and creativity. Creativity was assessed by the creativity subscale 'inventiveness' of the Berlin Intelligence Structure Test. Scores of figural, verbal, numeric, and total creativity were calculated for each participant. For personality, two instruments were implemented: (a) Eysenck's psychoticism dimension which measures aggression, antisocial behavior, emotional coldness, impulsivity, hard-heartedness, and insensitivity; and (b) the SEEK dimension of Panksepp's new Affective Neuroscience Personality Scales which measures feelings of curiosity, the drive to explore, and striving for solutions. The results of the study by Reuter et al., showed that there were significant correlations between SEEK and testosterone and between SEEK and all four scores of creativity. However, no significant correlation was found between testosterone and creativity scores.

Cross-sectional studies on developmental trend in creativity

Developmental trends in creativity can also be investigated by means of cross-sectional studies. Charles and Runco in 2000–01 drew 102 children from the third, fourth, and fifth grades from two elementary schools to investigate developmental trends in divergent and evaluative thinking. The participants were asked to name instances of round things and things that make a noise. Contrary to the findings in the study conducted by Torrance in 1968, where a slump was found in the fourth grade in the developmental trends, from the third to fifth grade on fluency, flexibility, and originality, Charles and Runco found that children in the fourth grade scored higher than third- and fifth-grade children on fluency, flexibility, and originality. Whereas the method used by Torrance in 1968 was

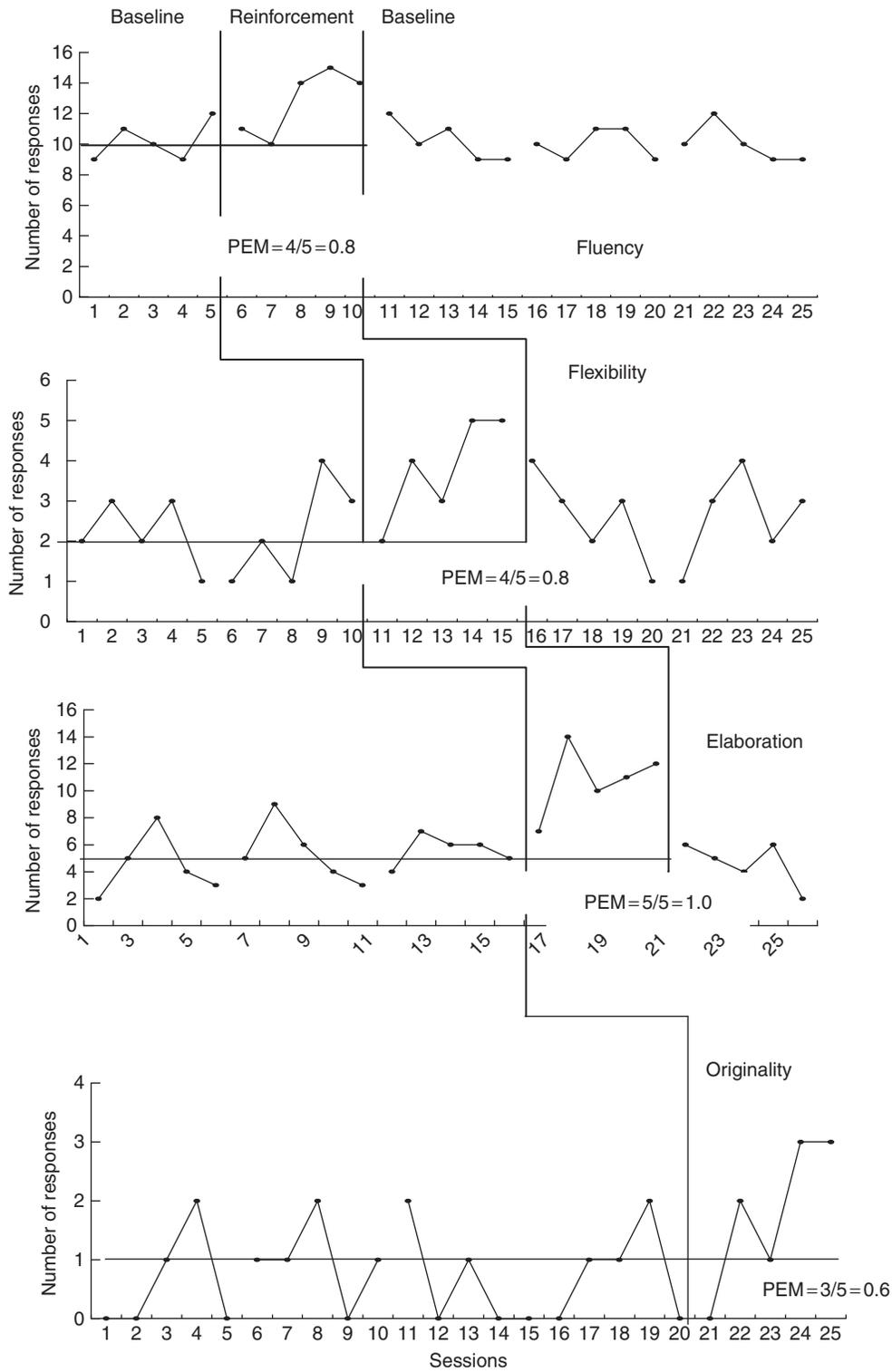


Figure 1 Demonstration of the calculation of PEM scores with artificially generated data.

longitudinal, the one employed by Charles and Runco was cross-sectional; further research is needed using the same reliable and valid measurement instrument, the same research method, and extension of grade span (from first grade to adult age) to portray the developmental growth curve of creativity.

The major difficulty in conducting a longitudinal study is the high attrition rate of the number of participants during the tracking, and a major one in conducting a cross-sectional study is to be able to collect data of large scale representative samples of grades extending from first-grade children to adult.

Longitudinal Studies

Predictive validity studies

Can the test scores of creativity be used to predict creative achievements in the future? In 1972 Torrance reviewed some longitudinal studies and found that the results were positive. In almost all of the studies, no matter whether short-range (1 week to 9 months) or long-range, the Torrance Tests of Creative Thinking (TTCT) were administered to the participants in the first wave of a predictive validity study. Using the median creativity score as the dividing line, the participants were divided into highly and less creative groups, then the creative achievements were measured at the second wave of the study at a later time. For example, in the study conducted by Torrance and Hansen in 1965, after taking a battery of TTCT, six highly creative and six of the least creative basic business teachers were selected for detailed classroom observation during five different class sessions over a 4-month period. The verbatim record made during the observation was analyzed in terms of divergent questions asked by the teachers. The highly creative teachers were found to significantly outperform the less creative teachers. For the long-range longitudinal studies, the variables selected as the indexes of creative achievement were such as writing a poem, story, song, or play; writing a book; publishing scientific papers; inventing patentable devices, receiving literary awards or prizes for creative writing, musical composition, art, etc.; and receiving research grants for original proposals. In a longitudinal study tracking precocious youths (top 1%) over 20 years conducted by Wai, Lubinski, and Benbow in 2005, based on the scores on the Scholastic Aptitude Test-Mathematics (SAT-M) of the participants at age 13, the top (Q4) and bottom (Q1) quartiles of participants were identified for a questionnaire survey at age 33. The results showed that the percentage of produced patents was 7.5% for the Q4 and 3.8% for the Q1. The effect size difference computed with an arcsine transformation, $h = 0.18$, was significant at 0.01 level. The results of Wai and his colleagues' study supported Huber's conclusion that the number of patents is an objective index of inventive and scientific achievement. In 2005 Cramond and his colleagues summarized the 40-year follow-up study conducted by Torrance, who administered various batteries of the TTCT, intelligence and achievement tests, and sociometric questionnaires each year from 1958 through 1964. In 1980 and 1998 Torrance carried out a second and third wave data collection of his longitudinal studies. The valid number of located participants in the 1998 follow-up was 80. Cramond and his colleagues employed a structural equation modeling analysis to investigate the predictive validity of TTCT scores from Torrance's longitudinal study. The observed variables for the creativity latent variable were scores of fluency, flexibility, originality, and elaboration of the figural TTCT. The observed variables for the latent variable 'creative achievement' were the 'quantity' and 'quality' of adult creative achievements, which were generated by ratings of three experts who judged the creativeness and importance of participants' creative achievement based on the information reported by the participants in the follow-up questionnaires. The results of the study of Cramond and his colleagues demonstrated that the TTCT scores of elementary school children had a significant relationship with adult creative achievement.

Longitudinal studies on the developmental trend of creativity

Researchers such as Torrance, in the field of creativity, have also tried to formulate a developmental trend of creativity as those who have done in delineating the developmental trend in intelligence and morality. Is the developmental trend of creativity a gradual but steady rise in creativity until a peak is reached? Has the developmental curve one peak or multiple peaks over time? Can a lump observed in the empirical studies be attributed to the need of school children to conform to the expectations in the school settings, or should it be attributed to other alternative interpretations? Can creative development be divided categorically into different stages, such as the stages in cognitive development (sensorimotor, preoperation, concrete operation, and formal operation) and those in socio-moral development (anomy or nonregulation, heteronomy, and autonomy)? These questions can be addressed by means of longitudinal studies. A longitudinal study was conducted by Claxton and colleagues in 2005 to explore the developmental trends in creativity longitudinally from the fourth grade through ninth grade. From 184 fourth grade predominantly middle class White students from rural schools, only 25 students (8 boys, 17 girls) completed all assessment tasks at three data collection points in the fourth, sixth, and ninth grades. Two instruments were used: (a) the Test of Divergent Thinking, comprising 12 unfinished pictures to be completed within a specific time frame and designed to measure fluency, flexibility, originality, elaboration, and title factors; (b) the Test of Divergent Feeling designed to measure dimensions of motivation and personality characteristics in creativity including curiosity, complexity, imagination, and risk taking factors. The results showed that significant increases in mean total scores were found from the sixth to ninth grades on both the Test of Divergent Feeling and the Test of Divergent Thinking, while no significant change in mean total scores was found between the fourth and the sixth grades on either.

Linear Structural Relations (LISREL) or Structural Equation Modeling (SEM) Analysis

This kind of research can be cross-sectional or longitudinal. In a regression equation, it is assumed that the independent variables must be mutually independent. If the independent variables are correlated, then the problem of multicollinearity emerges, by which the effect of a weaker variable would be partialled-out by another stronger variable. SEM analysis can improve this weakness, though not completely because it is possible that a correlation between two latent variables may exist. In an SEM analysis, a common factor among the correlated independent variables is extracted and labeled as an independent latent variable (ξ) or exogenous variable. The latent variable is a construct or a concept, it is not observable, but can be represented by observed variables. If there are correlated dependent variables, a common factor can also be extracted and labeled as a dependent latent variable (η) or endogenous variable. The gamma (γ) coefficient is similar to a regression coefficient, and depicts the effect of the independent latent variable on the dependent latent variable. In a structural equation model it is possible that more than two independent latent variables and more than two dependent latent variables are analyzed.

ζ is the error term of the structural equation model, and equals to $1 - R^2$, representing the variance of the dependent latent variable(s) that cannot be explained by the independent latent variable(s). Figure 2 is an SEM analysis with artificially generated data for the purpose of demonstration. Suppose that we want to understand the contribution of intelligence and creativity to the innovative performance of faculty members at technological universities. Under the agreement and cooperation of the conference organizer and sponsor agent, 300 participants in an academic conference on technological innovation are drawn as samples. They are faculty members of private or public technological universities. The participants are asked to take four tests (two IQ tests and two creativity tests) during their free time at a 3-day conference and paid \$50 each for taking the tests. They were also asked to send their list of publications including patents and scientific papers in self-addressed stamped envelopes to the researcher and are assured of confidentiality. Those who do not return the information within 2 weeks are contacted by telephone and asked to mail the publication lists. It is further assumed that there are 200 valid samples. The result of a LISREL analysis is displayed in Figure 2. All the estimated parameters in the path diagram are statistically significant. The artificially generated data in the path diagram can be explained as follows:

1. the symbol in a square means an observed variable and that in an ellipse means a latent variable;
2. the direction of an arrow means the direction of influence;
3. innovative performance (η) was significantly influenced by creative ability (ξ_1) as well as general ability (ξ_2) and the former ($\gamma_1=0.82$) had greater effect than the later ($\gamma_2=0.66$);
4. if a correlation matrix is used as input data, then the ϕ coefficient means the correlation between two independent latent variables, the coefficient is 0.54;
5. technological creativity (X_1) can better represent the creative ability of the faculty members at technological universities than general creativity (X_2), the lambda coefficients are 0.93 and 0.84, respectively;
6. the scores of a quantitative aptitude test, the Arithmetic reasoning test (X_3) can better represent the general ability of the teaching staff of technological universities than that of a verbal aptitude test, the General Classification Test (X_4), the lambda coefficients are 0.82 and 0.72, respectively;
7. the yearly mean number of awarded patents (Y_1) can better represent innovative performance than that of number of published scientific papers (Y_2), the lambda coefficients are 0.83 and 0.71, respectively;

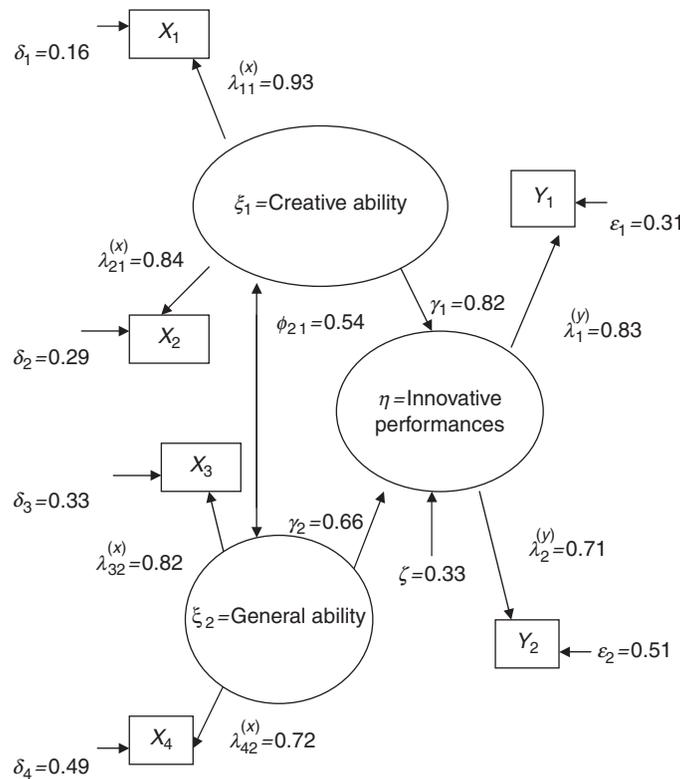


Figure 2 A structural equation model with artificially generated data, where X_1 = Technological Creativity Test (Treasure Hunt on a Deserted Island); X_2 = General Creativity Test (Figural Torrance Tests of Creative Thinking); X_3 = Arithmetic Reasoning Test (involving mathematical reasoning and problem solving); X_4 = General Classification Test (verbal test involving word comprehension and verbal reasoning); Y_1 = Yearly mean number of patents (total number of patents within the past 5 years \div 5); Y_2 = Yearly mean number of scientific papers published in peer-reviewed academic journals (total number of scientific papers within the past 5 years \div 5); η = dependent latent variable; ξ_1 and ξ_2 are the first and second independent latent variable; γ_1 and γ_2 are the first and second structural coefficient; ϕ_{21} = correlation between two independent latent variables; ζ = error term in the structural equation; δ_1 to δ_4 are the measurement errors in the observed independent variables (X_1 to X_4) respectively, and ϵ_1 and ϵ_2 are the measurement errors in the observed dependent variables (Y_1 and Y_2) respectively.

8. the error term (ζ) of the total model is 0.33, depicting that the independent latent variables can explain 67% of the variance of the dependent latent variable, that is, $R^2 = 1 - 0.33 = 0.67$; and
9. δ_1 to δ_4 are the error terms of the observed independent variables (X_1 to X_4) respectively, and ε_1 and ε_2 are the error terms of the observed dependent variables (Y_1 and Y_2) respectively, they are measurement errors, and the smaller the coefficient the better.

In 2006 Livne and Milgram used SEM analysis to investigate the construct validity of domain-specific abilities in mathematics. The sampling process in Livne and Milgram's research was a nationally stratified method. Altogether, a sample of 1090 tenth- and eleventh-grade students (565 males and 525 females) representing a wide range of intellectual abilities, was drawn from 22 public schools in urban and rural areas. Livne and Milgram used scores on the cognitive ability test, which assesses verbal, numerical, and nonverbal/figural abilities, and Raven's Advanced Progressive Matrices (APM), which uses abstract figures to measure reasoning, as the observed variables for the independent latent variable 'intelligence.' The observed variables used to represent the independent latent variable 'creativity' were scores on the Verbal Creativity Test, in which the students must generate different reasonable and innovative sentences out of four given letters, and that of the Application Test, in which students must produce different reasonable and innovative applications of given objects. The observed variables for the dependent latent variable 'school performance' were the grades or marks of Languages, Math-Physics, Science, and Humanities. Their structural equation model demonstrated that general ability, which was represented by IQ scores, could predict academic ability in mathematics (represented by the final grade in mathematics and an open-ended academic mathematical problems test), but not creative ability in mathematics (represented by creative out-of-school activities in mathematics and open-ended creative mathematical problems test), and vice versa, that creative thinking, which was represented by ideational fluency, could predict creative ability in mathematics, but not academic ability in mathematics.

The fit indexes most generally used to check whether a structural equation model is a statistically good-fit are that: (a) the χ^2 is not significant; (b) the Goodness-of-Fit Index (GFI) or the Adjusted Goodness-of-Fit Index (AGFI) is greater than 0.90; and (c) the Root Mean Square Residual (RMSR) is less than 0.05 or the Root Mean Square Error Approximation (RMSEA) is less than 0.08. If a model does not meet the criteria of the good-fit indexes, the modification index may be used to evaluate and modify the model.

Meta-Analysis

Meta-Analysis for Research Using Single-Case Experimental Designs

It is difficult to compare the effectiveness of more than two different interventions with a single single-case experimental design. A meta-analysis of research using single-case experimental designs can be used to overcome the difficulty. In the area of creativity, meta-analysis not only can be used to compare

the mean effect sizes of the different independent variables, the mean effect sizes of the different dependent variables (i.e., which components of creativity are more difficult to be fostered), but also the mean effect sizes of the different moderators (i.e., whether study characteristics, such as intelligence, gender, and age of participants; setting of treatment, and type of experimental design influence the effectiveness of independent variable). Whereas, the body of empirical studies using single-case experimental designs to investigate creative behaviors is growing, the number at present is too few to be used for a meta-analysis in creativity.

Meta-Analysis for Research Using Between Groups Experimental Designs

The function of meta-analysis is to use the standard deviation as the measurement unit to convert the results of research into effect sizes for the purpose of comparison. It can also aid in solving controversies of different findings on a certain topic (i.e., where some researchers found that Variable A had significant correlation with Variable B or Variable A had significant effect on Variable B, but the findings of other researchers could not be used to confirm that result or showed statistical significance in the opposite direction) by means of averaging the effect sizes of a variable investigated by different researchers. The general procedure of meta-analysis is as follows:

1. Locating the relevant studies. Using key words as search terms to conduct a computer search of the relevant studies from different data bases such as ProQuest, PsycINFO, and EBSCOhost. The creativity related journals such as *The Creativity Research Journal* and *Journal of Creative Behavior* must be searched manually. Some articles can also be traced from the references of selected studies. The required studies must contain at least correlation coefficients or means and standard deviations to be converted into effect sizes.
2. Categorizing the variables to be investigated, such as independent variables and dependent variables. In order to examine whether the effect of the independent variable on the dependent variable can be generalized to different settings, experimental designs, age and sex of participants, and moderators must also be coded.
3. Calculation of effect size. For the formulas of conversion were proposed by Cooper and Hedges in 1994. The most frequently used conversion formulas are:

$$\Delta = \frac{M_e - M_c}{SD_c} \quad (1)$$

$$g = \frac{M_e - M_c}{\sqrt{\frac{(n_e - 1)SD_e^2 + (n_c - 1)SD_c^2}{n_e + n_c - 2}}} \quad (2)$$

$$g = \sqrt{\frac{4(N - 1)}{N} * \frac{r}{\sqrt{1 - r^2}}} \quad (3)$$

where Δ is the effect size proposed in 1976 by Glass, while g is that proposed by Hedges. Glass' Δ has a pure denominator because it is free from contamination by the treatment. However, the bias and variance of g are both smaller than that of the corresponding Δ . M_e , SD_e , and N_e are the mean (M), standard deviation (SD), and the number of

Table 1 Strengths and weaknesses of each method as well as the difficulties or limitations in application

<i>Research method</i>	<i>Strength</i>	<i>Weakness</i>	<i>Difficulty or limitation in application</i>
Experimental studies			
Between-group experimental designs			
Real experimental designs	Internal validity is not threatened	Can only used in controlled settings	Researchers are often not able to carry out randomization of grouping in natural settings
Quasi-experimental designs	Can be applied in natural settings	Internal validity may be threatened	Dependent and background variables of the experimental and control group may be not equal before treatment is introduced
Observational method	A hypothesis can be formulated awaiting a test in a real experimental study	Weak for the study of causal effect	Two observers must be trained to reach high reliability in their observations
Single-case experimental designs	Effect of a strategy of fostering creativity for a single participant can be tested	Weak for the purpose of building a theory	Generalization of results to other persons is limited
Correlation methods	Large quantity of variables can be investigated in a survey study	Weak for the study of causal effect	Measurement error may be large if the data are collected through self-report
Cross-sectional studies on developmental trends of creativity	Data can be collected at a single time point	Representative participants must be recruited on a large scale	Difficulty in carrying out representative sampling of participants in each age or grade
Predictive validity studies	Causal effect can be investigated	Effects of unknown variables occurring between waves of data-collection and causing disturbance can not be precluded	Not easy to operationally define a creative performance as a criterion variable
Longitudinal studies on developmental trends of creativity	Data of the same group of participants are comparable throughout all stages of development	Long-term tracking needed	High attrition rate of the number of participants during tracking
Structural equation modeling	Used to investigate the causal effect of independent latent variables on dependent latent variables	Multi-collinearity between independent latent variables may not be totally precluded	Usually necessary to use a modification index to modify the model so that the criteria of goodness-of-fit are met. Additionally the optimal sample size is 200, small sample size is not suitable for analysis
Meta-analysis			
Meta-analysis for research using single-case experimental designs	When using the PEM score as the unit of measurement, the relative effectiveness of different independent, dependent variables, and moderators can be analyzed	Number of studies using single-case experimental designs to investigate creativity is too few to be used for a meta-analysis	Not easy to classify the variables into categories
Meta-analysis for researches using between-group experimental designs	Effect size can be used as the unit of measurement to show the relative effectiveness of different independent and dependent variables, and moderators can also be analyzed	Studies investigating more than two independent variables are not suitable to be included in meta-analysis because of the confounding of effects	Not easy to classify the variables into categories

participants (N) of the experimental group, respectively; M_e , SD_e , and N_e are the M , SD , and N of the control group, respectively; N is the total sample size, r is the correlation coefficient.

- Analyzing the data. In the case that one article has several effect sizes, these effect sizes are frequently correlated with each other. Therefore, when applying the statistical tools to analyze the data in a meta-analysis it must be kept in mind that the assumptions of parametric statistics should not be

violated, and one should test whether: (a) the residuals are independently distributed, that is, the data should not have significant autocorrelation, which is the correlation between i th and $i+1$ of the whole set of effect sizes; and that (b) the variance of the residuals is homogeneous. If these two important assumptions are violated, then non-parametric statistics should be used instead of parametric statistics. For example, Kruskal–Wallis one-way analysis of variance by ranks (K-W ANOVA) can be used to analyze the

difference between the mean ranks of more than two sub-categories of a variable and the Mann-Whitney U test can be used to make *post hoc* comparisons.

Conclusion

Experimental studies and correlation methods have been commonly used while the use of single-case experimental designs and meta-analysis in the creativity research are still new. Single-case experimental designs and real experimental designs are designs with internal validity. Meta-analyses using effect size as the unit of measurement not only can be used to compare the relative effectiveness of different independent variables, the dependent variables, and moderators but also to solve controversies in certain areas of research in creativity. **Table 1** summarizes the strengths, weaknesses, as well as the difficulties or limitations in applications of each method.

See also: Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Critical Thinking; Dialectical Thinking: Further Implications for Creative Thinking; Divergent Thinking; Research and Methods; Research: Phenomenology; Testing/Measurement/Assessment.

Further Reading

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Rewards and Creativity

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The Reward – Creativity Controversy

Dozens of studies have examined rewards' effect on creativity. Despite a sizable literature, the question of whether rewards enhance or hinder creativity remains controversial. Many creativity scholars and laypersons believe that rewards are an effective motivator for various kinds of performance including creativity. Among other reasons, people who are offered a reward may be more creative because the reward is desirable or because it symbolizes the person's status as a creative person. In contrast, others believe that performance on creative tasks suffers when rewards are offered. Perhaps reward distracts attention from and decreases interest in creative tasks, and lessens perceived control over one's choices.

Ample evidence has been cited to support both positions, as the results of studies examining the relationship between rewards and creativity have been inconsistent. Many studies have found that rewards increase creativity. For example, Robert Eisenberger and Michael Selbst found that children who were rewarded with pennies for creative responses on an initial word construction task subsequently produced more creative responses on a subsequent different picture writing task. In contrast, children who were rewarded for noncreative responses on the word construction task produced less creative drawings on the picture writing task. In contrast, other studies have found that rewards decrease creativity. For example, Arie Kruglanski, Irith Friedman, and Gabriella Zeevi found that high school students promised a reward for their participation were less creative on verbal tasks than were those not promised a reward.

As we shall show, the methodologies used by the researchers asserting positive effects of reward on creativity and those used by researchers asserting negative effects are quite distinct. Lacking an appreciation of these procedural differences, the two sides seem only to grow more vociferous in the advocacy of their original positions, consistent with their disparate ways of viewing human psychology.

We first turn to a discussion of the differing theoretical positions, including their historical background, followed by a description of their associated methodological differences that may be responsible for the difference in the findings. We then present the results of a meta-analytic review of the literature, informed by these procedural differences, that brings order and regularity to the findings, and conclude with practical implications.

Behaviorist Approaches

Rewards are consequences that strengthen the performance on which they are contingent. Evolution provided people with a strong motivation to pursue stimuli that enhance chances of survival. Humans, with their strong intellectual and socializing

capacities, are attracted to many acquired rewards in addition to biologically advantageous satisfiers. These include money and symbolic rewards such as prizes. Rewards also include information that is interesting in its own right, such as news about sports or politics, or information that serves as a means to an end. Some rewards also meet socio-emotional needs as in expressions of approval, esteem, or caring.

A long held view of motivation, embodied in Jeremy Bentham's psychological hedonism, emphasizes the importance of reward as a basis for human action. Bentham stated that "Nature has placed mankind under the governance of two sovereign masters, *pain* and *pleasure*." The behaviorists showed the power of reward to influence many aspects of human performance. So it seems natural to suppose that creativity, as with other human activities, can be enhanced by reward. Yet, creativity is different from behaviors or activities that are readily identifiable and occur frequently and therefore can be easily rewarded. By its nature, creativity involves the unusual. Sometimes a creative problem or goal has multiple useful solutions, as in generating advertising slogans for an airline. Sometimes only a single solution is correct as in the historic discovery of the structure of humans' DNA. But in either case, because the creative response is not in the individual's prediscovery repertoire, behaviorist approaches offer limited information concerning the processes used to generate such behavior.

In the past, behaviorists have tried to deal with this issue by stressing the importance of trial and error in creative performance. In this view, Kohler's apes' insights into using sticks or stacking boxes to retrieve bananas 'at first sight' were actually the result of previous kinds of unnoticed experience. Similarly, humans generally do not come to creative insights out of the blue, as has often been claimed by famous individuals to demonstrate their own brilliance, but as part of a considerable number of reconsiderations of facts and information obtained from false leads and premature solutions. The small gains in understanding acquired along the way to creative solutions and the social approval for perseverance at creative attempts may encourage the individual toward a greater contribution. For example, James D. Watson and Francis Crick, the discoverers of the double helix molecular structure of human DNA, were encouraged by many small successes along the way to their discovery. Those who study the *repeated* reward to enhance creative responses (e.g., novel uses for common objects), rather than a *promised reward* for a single final highly creative product, do so because they are interested in the cumulative motivational effects of reward.

But Watson and Crick did not simply undergo trial and error, although this was part of it. They engaged in complex directed cognitive processing. What role did reward play? We think Watson may have had a keen insight here. He stated that the anticipation of the Nobel Prize kept him highly focused on the task at hand and motivated to do the hard work despite

his strong inclination to putting all aside for a good time. And, we suggest, the information associated with solving parts of the puzzle along the way served as a secondary reward.

Watson liked science for its own sake but wanted to be a famous scientist more than a practicing scientist, and he stopped actively carrying out research soon after receiving the prize in order to direct the science of others as an administrator for the rest of his career. As in this example, reward can have a powerful effect on creativity. Admittedly, these examples tell us primarily about how rewards can intensify and direct individuals' efforts and tell us relatively little about the complex cognitive processes that underlie creativity. Still, we will see a very effective formula for enhancing creativity: provide what the individual wants, contingent on creativity, and make this creativity contingency clear.

Behaviorist approaches maintain that reward will increase creativity so long as the reward is valued by the recipient and the nature of the contingency can be readily discriminated. Thus, in most studies of creativity the reward is based on repeated creative performance, and this contingency is communicated to participants by verbal instructions. This is deemed necessary because participants who are simply told they will receive a reward may not receive enough experience with the reward contingency to understand the reward depends on creativity and thus would fail to display novel performance. For example, if a child is asked to state uses for common objects and is rewarded for every uncommon use, the child has a low base level of providing uncommon uses and may be very slow to discriminate the dependence of reward on creativity. Thus, the typical behaviorist situation involves an experimental condition in which the nature of the creative performance is defined by instructions and the individual is repeatedly rewarded for a creative response. A control group is included with no reward and no mention of creativity.

The results of these studies have been impressive. Decades ago, a review of 20 such studies by Andrew Winston and Joanne Baker concluded that reward can be used to increase divergent thinking. Unfortunately, the findings reviewed by Winston and Baker confounded the instructions to be creative with the reward for being creative. Perhaps the simple instruction to be creative was responsible for the findings.

Romanticist Approaches

Another philosophical tradition, romanticism, equates creativity with freedom, and views reward as a kind of constraint on freedom that discourages creativity. This view can be traced to the early renaissance in the Italian city states and was associated with such subsequent popularizers as Jean Jacques Rousseau in France, and the American transcendentalists Emerson and Thoreau. The romanticists saw the excesses of early industrialization as producing emptiness in the lives of working people. The romanticists embraced sensuality and nature, and rejected the enlightenment's dependence on reason in place of intuition and feeling. In modern guise, romanticism rejects constraints on freedom as antithetical to creativity. We hasten to add that we are using the term *romanticism* in the historical and philosophical sense and not with the alternative meaning associated with a lack of clear and rational thought. Specifically, some researchers

have viewed reward as representative of control, emblematic of the kind of control represented in the excesses of the factory system, against which the romanticists rebelled.

Those contemporary approaches hewing to this approach, such as Teresa Amabile's early views of creativity and Edward Deci and Richard Ryan's analyses of intrinsic interest, place reward in the same category as constraints on performance such as time restrictions and limitations on how one is allowed to carry out an assigned task. Reward is assumed to be experienced as a loss of self-determination, with a lessened interest in the task for its own sake (intrinsic interest), a greater focus on the narrow requirements necessary to obtain the reward, and a necessary decrease in creativity. This view is understandable. Many people are forced to take jobs they abhor because they have low skills and must do so because of the pay. Others may possess considerable skills and talents and put them to use in jobs they dislike because the jobs require little effort or because the pay is high. In these situations pay seems constraining. Moreover, as Amabile suggests, a focus on rewards may limit attention toward what it takes to obtain the reward to the detriment of attention to novel information that is useful for creativity. Indeed, James Watson, in his search for the DNA molecular composition declined to attend lectures that were not directly related to his quest, and this narrowness might have slowed him down had he chosen to pursue additional research problems.

Common Ground

As we have seen, the behaviorist approach was flawed methodologically by the confound between the use of reward and instructions that told recipients that creativity was expected of them. Thus, most of the evidence seems to favor the romanticist view holding that reward decreases creativity. And yet the argument against rewards as a source of creativity seems too sweeping. Is it actually common for individuals to feel constrained by rewards, reducing their feelings of freedom and self-determination and narrowing their attention span? Further, can such a powerful motivator as reward be ineffective for this one category of human behavior? Three decades ago the first author began his research on creativity after being approached by a student, Michael Selbst, who had heard about the decremental effects of reward on creativity and wanted to do research with me on the topic. As a newcomer to the field who had no commitment to either camp in the controversy over whether reward decreases or increases creativity, I was startled by two seeming discontinuities in the empirical literature.

First, most of the studies reporting that reward increased creativity were carried out by behaviorists who made reward contingent on repeated creative performance. In contrast, most of the studies reporting that reward reduced creativity involved giving a promise of reward for unspecified performance. Was it possible that whether reward increases or decreases creativity depends on whether recipients understand that the reward depends on creative performance rather than on conventional performance? Second, there were very few studies that reported whether reward reduced perceived self-determination, a key mechanism that Deci and Ryan suggested was responsible for lessening the effects of reward on intrinsic interest. Is it really the case that reward reduces perceived self-determination?

In a series of studies, my colleagues and I found that when the relationship between reward and creativity was made clear to participants, creativity increased. This clarity could be achieved either by instructions or by a preliminary task in which instructions for creativity were used. For example, Eisenberger and Linda Rhoades asked college students to generate creative story titles, with or without the promise of reward. Students promised reward for creativity produced story titles that were rated as more creative by judges than did students given the same instructions without the promise of reward.

Because people are rewarded more often in everyday life for conventional rather than creative performance, individuals offered a reward for nonspecific performance, as in the typical romanticist study, may believe that conventional performance is the most effective way to obtain the reward and respond accordingly. A study by Amabile is telling. She found that offering children a reward for constructing a collage, without an indication that creativity was expected, produced less creativity than the same instructions without the offer of reward. Yet, the children offered the reward constructed collages that were better planned and organized and more representational than those of children in the control group. Lacking guidance concerning the type of performance that was desirable, the children may have attempted to obtain the reward by the conventional performance that had been rewarded in the past.

The behaviorists appear to produce creativity by making reward contingent on creative performance. The romanticists appear to reduce creativity by being vague about the nature of desirable performance. However, it is also the case that individuals generalize their experience from similar situations so that, as the first author has found in many studies, reward for creativity in one task with clear directions increases creativity in subsequent tasks with vague directions.

In a study and subsequent meta-analytic review of the literature, the first author and his colleagues also found that, rather than reducing perceived freedom and self-determination, reward increased perceived self-determination. Compared to a control group simply given task instructions, a rewarded group experienced increased self-determination. Eisenberger and Linda Shanock explained these findings as follows.

The use of reward in everyday life conveys not social control but increased self-determination. People understand that reward's use in everyday life is utilitarian, involving the reward giver's lack of control over the potential reward recipient; those offering the reward believe that favorable consequences are needed to obtain the cooperation of the person being asked to carry out the task. Specifically, the promise or repeated use of reward communicates that (a) the individual or group giving the reward lacks control over the performance of the potential reward recipient, and (b) the recipient can, if desired, decline the reward and not act as directed.

We now summarize the conclusions of a quantitative review, combining the findings of similar studies so that an overall effect size can be determined for each type of reward procedure.

Meta-Analytic Review of the Literature

Although a diversity of study designs has the potential of furthering knowledge about rewards and creativity, it also

makes it difficult to make sense of the findings. The literature on rewards and creativity is highly diverse in terms of where and how rewards and creativity have been studied and who and what has been studied. Researchers have examined the effects of rewards on the creative performance of people of various ages (children, college students, adults). Additionally, research has been conducted with different types of rewards (praise, activities, money, prizes), with different types of creative tasks (creative writing, collage-making, divergent thinking tasks, in-basket tasks), in different settings (laboratories, schools, workplaces), with a variety of research designs (experimental and non-experimental, within- and between-subject), and with different reward schemes (before, during, and after performing a task).

Kristin Byron and Shalini Khazanchi's recent meta-analysis of more than 60 studies examining rewards' effects on creativity in humans serves to enlighten this debate by using this powerful statistical technique to average the findings separately by category. Although there is no simple answer to the question "Do rewards help or hinder creativity?," there are some generalizations – and some finer points – that can be derived from this meta-analysis regarding rewards' effect on creativity. In fact, these results generalize across different types of creative tasks (e.g., divergent thinking tests and the creation of creative products such as collages) and different types of studies (e.g., experimental studies in laboratory and other settings and nonexperimental field studies conducted in work organizations). **Table 1** summarizes the results of the meta-analysis that are reviewed below.

In general, the results of the meta-analysis found that rewards increase creative performance when people expect that the rewards are contingent on *creative* rather than routine performance. Clarifying a contingency on creative performance can be accomplished through a variety of means. The two most straightforward and direct ways are to simply specify that rewards are only for creative responses or to reward creative

Table 1 Summary of meta-analytic results examining the rewards-creativity relationship

<i>Factors that Increase, Decrease or Have No Effect on creative performance</i>	
Increase	<ul style="list-style-type: none"> ● Creativity-contingent rewards produce greater creativity than performance-contingent rewards which, in turn, produce greater creativity than participation-contingent rewards. ● Creativity is increased by the value, number, proximity or choice of rewards. ● Adults are more responsive to rewards than are children. ● Rewards influence the number of creative ideas more than the originality of creative ideas. ● Rewards generate greater creativity on complex tasks with diminishing returns as the task becomes highly complex.
Decrease	<ul style="list-style-type: none"> ● Participation and completion-contingent rewards decrease creativity.
Have No Effect	<ul style="list-style-type: none"> ● Simple competition fails to increase creativity. ● No one reward type (e.g., praise, money, desirable activities) has been found to be generally more effective than another at generating creativity.

responses thereby creating an expectation that future rewards are also contingent on creativity. Results of many studies suggest that people are more creative when they are told that they have to be creative to receive a reward or when they have received rewards in the past for creative (rather than noncreative) responses. Other methods are also effective at conveying to people that creativity is expected, desirable, and will be rewarded. For example, many of the studies that successfully motivated creativity did so by providing instruction on how to be creative or providing a model of creative work – both of which probably convey to those who are offered rewards that creative performance is likely to be rewarded.

Several other factors seem to improve the likelihood that rewards can help people to be more creative. First, more rewards are better than fewer rewards. People who were both praised and offered other types of rewards for being creative were more creative than people only given praise or only offered other types of rewards. Second, when monetary rewards are contingent on creativity, the size of the reward also appears to matter. In the studies meta-analyzed, people offered more money for being creative were more creative than were those offered smaller monetary rewards. Third, creativity-contingent rewards are more effective at motivating creativity from adults than from children. Lastly, when rewards are contingent on creativity, having the reward in sight appears to be better at motivating creativity than does having the reward out of sight. However, this finding may be truer for adults than for children – who may be more easily distracted by having rewards in sight.

The existing evidence suggests that creativity-contingent rewards motivate people to be more creative. However, the results of the meta-analysis add a few caveats to that statement. First, creativity-contingent rewards are effective at motivating both different and highly original responses, although they are more effective at motivating people to generate more responses (e.g., ideas, artistic forms) than they are at motivating people to produce highly original responses. Second, the results suggest that rewards are less effective at producing creative responses on highly complex creative tasks. Rewards are increasingly effective at motivating creative performance on tasks of greater complexity but only to a point. On highly complex tasks, rewards are still effective – though less so – at motivating creativity, perhaps because prior skill level or aptitude constrains any motivating effect of reward.

In addition to pointing out factors that may increase creativity, the results of the meta-analysis also point out factors that *decrease* the likelihood that rewards will help people to be more creative. Namely, rewards are less effective at motivating creativity when people do not expect or are unlikely to expect that the rewards are contingent on creative performance. When rewards are offered for completing a task or participating in a task, rewards seem to have no effect on creativity. For example, Teresa Amabile, Beth Hennessey, and Barbara Grossman found that children who received a reward (being able to play with a Polaroid camera) in exchange for later participating in a story-telling task subsequently told less creative stories. In contrast, those who did not receive a reward (playing with the camera was not linked to their participation in the story-telling task) told more creative stories.

Many studies that have sought to examine the effects of rewards on creativity have used these types of rewards – to an

unsurprising effect. When people are told that rewards are for merely completing or participating in a task or when people receive prior rewards for output irrespective of its creativity, creativity tends to decrease or, at the least, not increase. With this type of reward, referred to as completion-contingent rewards, rewards appear unable to motivate people to be more creative. Alternately, when rewards are offered for performance but not explicitly *creative* performance, they are less effective at motivating creativity. With this type of reward, referred to as performance-contingent rewards, rewards motivate people to be more creative but less so than for creativity-contingent rewards.

As discussed above, creativity-contingent rewards increase creativity – and, while some factors serve to enhance or mitigate this effect, other factors seem to have no effect at all. Namely, what type of reward is offered and whether the reward is offered competitively or noncompetitively do not seem to significantly affect the relationship between rewards and creativity. According to the results of the meta-analysis, whether people are offered praise, money, desirable activities, or prizes to be creative does not alter rewards' effect on creativity.

Clearly, much research has sought to illuminate the relationship between rewards and creativity. Despite this sizable literature, there are some questions that remain unexplored. First, many scholars have suggested that there may be important individual differences that may account for the mixed results found in the literature. Individual differences that have been put forth as potentially important include intelligence, thinking style, creative aptitude, sex, and others. For example, Linda O'Hara and Robert Sternberg found that, when they were not given any special instructions about how to complete a potentially creative task, people who tend to play with their own ideas were more creative than were people who tend to analyze and evaluate ideas. It may be that rewards similarly interact with thinking style to determine creative performance. Rewards may increase creative performance of those who tend to analyze and evaluate ideas because they are less inclined to think creatively in the absence of a specific motivator. Conversely, those who tend to play with their own ideas may be less affected by rewards because they are already inclined to think creatively.

Second, many studies outside the creativity literature have examined the relative effects of different reinforcement schedules on individuals' motivation and subsequent performance. Although there are few studies in the creativity literature that have examined reinforcement schedules, it seems likely that the findings regarding motivation and performance on noncreative tasks transfer to creative ones. Specifically, rewards that are administered on a variable reinforcement schedule, such that individuals are rewarded intermittently for creative performance, are likely to be more motivating than are rewards that are administered on a continuous reinforcement schedule, such that individuals are rewarded every time or at regular intervals for creative performance. Reinforcement schedules may also help determine how long-lasting the effect of rewards is. Unfortunately, existing research does not allow for firm conclusions about the extent to which rewards administered under different reinforcement schedules may affect performance and persistence on creative tasks.

Additionally, how rewards are administered and distributed for creative output probably determines persistence. Being

creative often results in false starts or ideas or products in need of further refinement. Smaller rewards administered during the creative process may help to increase persistence toward more novel and appropriate products or ideas. Further research may examine how rewards can be used to increase experimentation and risk-taking – both of which are essential to the creative process.

In summary, the bulk of the evidence suggests that rewards can increase creativity. To do so, the rewards must be clearly contingent on creative – rather than routine – performance. When people are not clear that they should be original and innovative, rewards are less effective at increasing creativity. Much insight can be derived from existing studies on rewards and creativity, although more work needs to be done to further what is known about how and when rewards affect creativity.

Promoting Creativity at Work and School

Many educators wish to increase their students' creativity, many managers wish to increase their employees' creativity, and, as a society, we often wish to increase the creativity of the artists, musicians, and writers whose work we enjoy. Fortunately, research on rewards and creativity offers insights about how to achieve these goals. Below, some of the primary lessons gleaned from research on rewards and creativity are presented.

First, be explicit about expectations. For people to be creative, they must know that creative work is expected. Without a clearly stated expectancy regarding creativity, people are likely to assume that other aspects of performance such as technical goodness or speed are more valued. Therefore, to promote creativity at work and school, educators and managers should explicitly state that creative work is desired and valued. The key issue to improving the effectiveness of rewards is to make it clear that receiving the reward is contingent on creative performance.

Second, offer training and modeling to increase creative skills. When people receive training or modeling of creative behavior, they learn how to be more creative. In addition to learning new skills, training and modeling also help to clarify expectations about what is valued. As stated above, people are more likely to be creative when they understand that creativity is expected and considered desirable. When people are trained to be more creative or are provided with a role model who exhibits creative behavior, then they come to understand that they should also seek to be creative.

Third, different types of rewards may help to increase creativity. Praise, privileges, money, and prizes have all been found to successfully motivate creativity. It is, however, always wise to offer people rewards that they personally value, as rewards that are considered unattractive are unlikely to be motivating. Further, although the type of reward does not seem to matter in general, educators and managers may consider offering multiple rewards. It may be that offering more rewards increases perceived choice and improves the likelihood that those being offered the reward will find at least one of the rewards offered attractive.

Fourth, make sure rewards are distributed equitably. What is equitable? People probably make two primary considerations when determining the fairness of a reward in response to their creative output. First, they probably consider the extent

to which their rewards are fair in comparison to those rewards received by others. For this reason, people who are more creative should receive greater rewards. Second, individuals probably consider the extent to which their rewards are fair in comparison to the value of their creative work. For this reason, people who produce more valuable creative responses should receive greater reward. For example, if an employee finds a creative solution that saves his or her employer millions of dollars, then the employee probably expects a greater reward than if the employee had developed a creative solution that did not prove as valuable. This positive reinforcement compensates employees, communicates gratitude to employees for their efforts, and sends a message regarding expectations to other employees. It seems likely that employees who are *not* rewarded for being creative are likely to feel that they are not being treated fairly and may subsequently withdraw from being creative at work.

Lastly, as mentioned above, rewards should also be offered for experimentation and risk-taking – even when individuals' attempts result in failure. Managers and educators should realize that much of being creative results in false starts. It is by taking risks, experimenting with new ideas of uncertain value, and forging into uncharted territory that people may eventually produce the most creative ideas, products and processes. For this reason, rewarding only creative ends – and failing to reward creative effort – is unlikely to sustain creative behavior. Managers and educators should thus tolerate mistakes and view them as a necessary part of the creative process.

Conclusion

The issue of whether reward increases or decreases creativity has been marked by considerable controversy, with substantial data marshaled for both views. In the present review we have considered how the behaviorist view of human nature has led to a predisposition to view reward as increasing creativity while the romanticist view has promoted the view that reward decreases creativity. Our analysis of the methodological differences in studies reporting these two kinds of outcomes and the results of a meta-analytic review begin to bring clarity and order to the research literature on rewards and creativity.

Our major conclusions are that reward for creativity increases creativity when recipients clearly discriminate the necessary contingency. Rewards for high performance, not specifically creative performance, increases creativity to a lesser extent. In contrast, noncontingent reward generally reduces creativity. We need more and better theory concerning why and how these effects take place rather than a continuation of the ongoing disagreement concerning whether reward generally increase or decreases creativity.

See also: Behavioral Approaches to Creativity; Risk-Taking; Teaching Creativity.

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Relevant Website

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Risk-Taking

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Glossary

Problem framing Refers to whether a situation is presented to an individual in a positive or negative light.

Risk perception An individual's estimation of the risk inherent in a situation.

Risk preferences An individual characteristic that influences individual actions. Those who take pleasure in facing challenges are more likely to take risky actions and vice versa.

Risk propensity An individual's risk taking tendencies.

Risk taking Actions taken when the consequences or probability of the outcomes are unknown or partially known.

Risky shift On average, individuals will privately recommend a greater degree of risk taking after group discussion than these same individuals had privately recommended before.

Introduction

Twenty years from now you will be more disappointed by the things that you didn't do than by the ones you did. So throw off the bowlines. Sail away from the safe harbor. Catch the trade winds in your sails. Explore. Dream. Discover.

Mark Twain

Risk taking in its simplest form may be defined as involving actions taken when the consequences or probabilities of outcomes are unknown or only partially known. Risk taking interacts with creativity. Creativity involves generation of novel, original, and unique ideas for procedures and processes that are appropriate and significant to the problem or opportunity presented. Thus, both creativity and risk taking greatly influence building a climate of idea generation. Creativity involves taking chances and risks. Although risk taking may or may not be creative, both share a common domain of factors that affect them (see [Figure 1](#)). Although creative people are risk takers, not all risk takers are creative.

A review of the extensive literature reveals numerous references to the risk-taking nature of creative persons. There are now several validated scales which measure risk taking and various forms of the construct such as global risk taking, risk orientation at work, risk attitude, and domain specific risk taking. Studies have provided empirical evidence that risk taking is an important predictor of creativity in different domains including entrepreneurship and difficult sports such as rock climbing. What follows is a brief description of the role played by risk taking in entrepreneurship which is closely associated with creativity and decision making.

Risk Taking and Entrepreneurship

The importance of creativity in the corporate world can hardly be overemphasized. The words of Joseph Anderson seem quite appropriate:

Creativity is the gift and discipline that provides the competitive edge – in marketing, production, finance, and all of the other aspects in an organization. Firms and managers crave it. Awards are given

for it. Incentives encourage and cajole it. But it's still the most elusive weapon in an executive's arsenal. (p. 40)

There is sufficient evidence to prove that creativity and entrepreneurship are inseparably linked – creative endeavors by individuals result in more entrepreneurial activities and novel and higher quality products, resulting in long-term success. According to John Burch: "The antithesis of the entrepreneur is a person who never loses because he or she never puts himself or herself at risk" (1986: 34). Venturing into the unknown is preferred by most entrepreneurs, which propels them into starting their own organizations rather than enjoying secure, risk-free contractual employment. Entrepreneurial functioning involves working with a less structured, more uncertain set of possibilities and being solely responsible for major decisions. Hence, more risk-tolerant individuals are likely to 'self-select' into entrepreneurial careers.

Victor Kiam, an American entrepreneur said:

Entrepreneurs are risk takers, willing to roll the dice with their money or reputation on the line in support of an idea or enterprise. They willingly assume responsibility for the success or failure of a venture and are answerable for all its facets.

Risk Taking and Decision Making

The success of most enterprises depends on the capability of their leaders to evaluate risks and decide which path to pursue. Uncertainty has two components, risk and ambiguity, and decision makers' ability for tolerance of ambiguity and risk influence their choices. Successful high risk decision makers consistently tend to see more opportunities in risky situations and higher risk preference manifests itself in greater confidence in their decision.

In 1992, Sim Sitkin and Amy Pablo identified three groups of factors that influence a decision maker's choice of a more or less risky response to a problem: characteristics of the individual decision maker, characteristics of the organizational context, and characteristics of the problem itself. Specifically, they discuss nine key predictors of risk behavior – three individual characteristics: risk preferences, risk perceptions, and risk propensity; four organizational characteristics which directly have

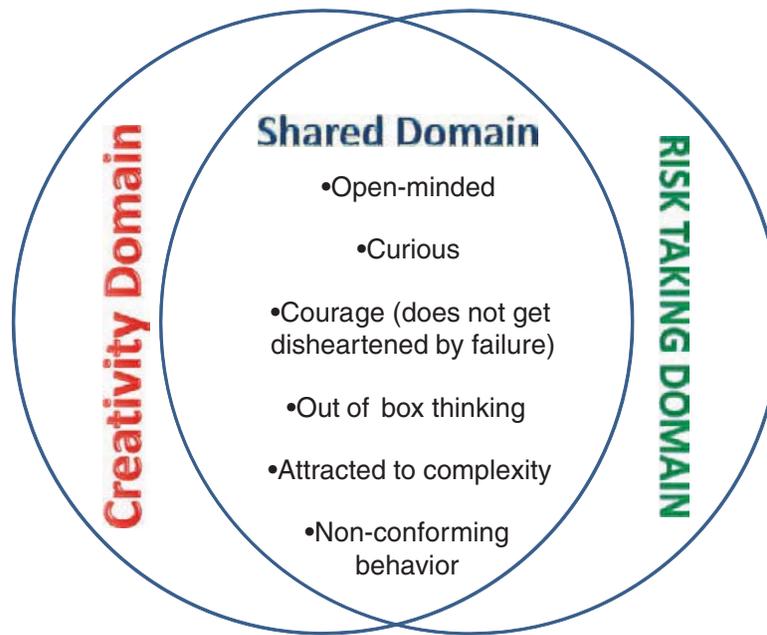


Figure 1 The common factors affecting both creativity and risk taking. (Note: This is not a conclusive list.)

an impact on individual behavior: group composition, cultural risk values, leader risk orientation, and organizational control systems; and two problem-related characteristics: problem familiarity and problem framing. Decision makers are strongly encouraged to take calculated risks, as incorrect decisions may bring a corporation or the entire economy tumbling down, as occurred in the high leveraged risk-taking decisions made at bankrupted companies such as Lehman Brothers and American International Group Inc. – the latter being bailed out by the US government.

To foster risk taking it is of pivotal importance to understand the various factors that have an effect on this construct. Let us begin with the basic debate about whether risk taking is situational or a trait, followed by a brief review of internal factors such as intrinsic motivation, demographics, and external factors such as culture, group dynamics, etc.

Risk Taking – Situational or a Trait?

Scholars have debated whether risk taking is situation-based or a disposition. Some strongly supported the view that it is the situation that determines a person’s risk-taking behavior. Daniel Kahneman and Amos Tversky’s influential Prospect Theory suggests that how a situation is framed will determine individual risk behavior. Another major component of the amount of risk individuals will take is their perception of their abilities in the situation. The greater the ability, the greater the level of risk the individual can reasonably tolerate.

Other scholars, however, have long acknowledged that risky decisions are not based exclusively on rational calculations, but are also affected by individual predispositions toward risk. Thus, a stream of research suggests that risk taking is predispositional rather than simply situational. This position is consistent with the Big Five personality theory (openness to

Table 1 Factors affecting risk taking

<i>Direction</i>	
<i>Positive</i>	<i>Negative</i>
Openness	Neuroticism (emotional instability)
Extraversion	Conscientiousness
Flexibility	Agreeableness
Curiosity	Lack of ability to regulate the self
Courage	Anxiety
Attraction to complexity	Social anxiety
Nonconforming behavior	Irrationality
Intrinsic motivation	Fear
Internal locus of control	Stress/worry
Anger	High importance for security
Thinking outside the box	Elaboration
Originality	Depression

experience, conscientiousness, extraversion, agreeableness, and neuroticism), which suggests that risk propensity is a facet of the trait of extraversion.

Although it may be referred to as a trait, research is still not conclusive and the question remains whether risk taking may be a multi-dimensional construct. There is evidence that other traits and emotions have a positive (increase) or negative (decrease) effect on a person’s risk-taking behavior. As shown in **Table 1**, personality variables such as extraversion and openness have a positive impact on risk taking, while neuroticism (emotional instability) agreeableness and conscientiousness make an individual more risk-averse. Additionally, individual differences in trait anxiety, worry, and social anxiety were each associated with risk avoidance. There is burgeoning interest in understanding the role played by sensation seeking and some emotions which affect risk taking.

Sensation Seeking and Emotions

Researchers identified higher sensation seeking as a personality factor that differentiates risk takers from nonrisk takers. Sensation seeking is defined as the need for varied and new experiences, and incorporates willingness to take risks for the sake of those experiences.

Emotions also play a role in risk-taking behavior. They act as relevant forms of information, indicating the presence of specific threats to be avoided or benefits to be acquired. Affective states are a temporary experience of mood or emotion, while affective traits are dispositions to have such experiences (positive and negative affect). Positive affect and negative affect increase and decrease risk-taking propensity, respectively. Counter-intuitively, an interesting study found that emotions such as fear and anger have opposite effects on risk perception. Jennifer Lerner and Dacher Keltner showed that while fearful people tend to be pessimistic and consequently make risk-averse choices, angry people demonstrated optimistic risk-seeking choices.

Effect of Intrinsic Motivation, Need for Achievement and Self-efficacy

An individual is said to be intrinsically motivated when he or she performs a task due to the sheer fascination of the task itself rather than simply because of its outcomes. Intrinsic motivation is a key ingredient in creativity that has been associated with increased risk taking, which in turn is linked to creativity.

There is a close relationship between risk taking and need for achievement. High need achievers prefer intermediate levels of risk, while low need achievers are more likely to choose extremely low or high levels of risk. Research linking the two constructs can be summarized as follows: Persons high in need for achievement set challenging goals of moderate difficulty, accomplish these goals through effort and skill, take personal responsibility for decisions, and are moderate risk takers.

Self-efficacy refers to an individual's belief in his or her own ability to achieve the task at hand and produce the desired result. People with high self-efficacy are likely to fear failure more and take calculated, as opposed to reckless risks. They are more likely to set themselves challenging goals, expend effort, and persist in the face of adversity.

Other Factors Affecting Risk Taking

Research has confirmed that factors such as gender, age, groups, and culture affect an individual's risk-taking behavior.

Risk Taking Across Gender and Age

Historically women were stereotyped as conservative and risk-averse, as opposed to males who were considered to have higher risk propensity. One of the reasons was that women were forced to fit into the social typecast of being more conservative than males. However, in the late 1980s the social outlook changed with the number of female employees increasing dramatically and a sizeable increase in the number of female entrepreneurs. Consequently, gender differences in risk-taking behavior are assumed to have been comparatively reduced.

The relationship between risk taking and age has received rather less attention, particularly in mature adults. Michael Wallach and Nathan Kogan evaluated risk-taking behavior in college age and older men and women and found that in the older sample both males and females were comparatively more risk averse than their younger counterparts. One of the explanations could be the considerable increase in responsibilities as people get older – marriage, children, and financial problems. These responsibilities deter an individual from taking risks that would have been taken earlier in the person's development. Older individuals were found to have lower achievement motivation compared with younger people. Specifically, in an early study carried out by Heinz Heckhausen, a significant drop in many individuals' level of achievement motive appears to occur only around or after age 50. As was shown earlier, risk taking is closely associated with need for achievement, which shows a steady decline with age. However, stereotyping should be avoided because there are examples of older individuals taking great risks, including Walt Disney who mortgaged his house in order to finish Disneyland.

Risk Taking by Groups

An overwhelming majority of studies provide evidence for understanding the risky shift phenomenon – on average, individuals will privately recommend a greater degree of risk taking after group discussion than these same individuals had privately recommended before the discussion. Roger Brown suggested that group discussion leads the participants to change their individual decisions in the direction of the relevant social-cultural value. This change is explained by the self-image maintenance mechanism, that is, people tend to consider their own decisions to be more consistent with widely held values than the decisions of similar others. When they discover that some other people's decisions are more consistent with these values than their own, they try to maintain their self-image by changing their decision towards the extremes.

Risk Taking Across Culture

Risk taking is a relatively stable attribute of personality that is learned early in life. Research has highlighted the role played by cultural differences that are apparent in the various assessments of risk made by different individuals and groups. For example, in 2000, Melissa Finucane found that among various American groups, whites in general, were less apprehensive about a set of nominated risks compared with nonwhites, with white men being the least apprehensive and nonwhite women the most apprehensive. This disparity could be attributed to the socio-economic advantage experienced by white men making them less risk-averse compared to nonwhites. Another study found that Chinese people were less risk-averse than Americans. This could be attributed to the fact that China and the USA are very different in the individualistic–collectivistic continuum, with China exhibiting a very collectivistic culture and the USA a highly individualistic country. Collectivism refers to a society where social and individual ties are strong, with people being part of strong cohesive groups,

while individualism entails looser ties between individuals, so independence is stressed. Elke Weber, Christopher Hsee, and Joanna Sokolowska explained “collectivism acts as implicit mutual insurance against catastrophic losses” (1998: 174). Furthermore, they pointed out that although people from collectivistic cultures may be less risk-averse to material or financial risks, this will not be true for social risks, as social networks are given immense importance in such cultures.

Another study conducted by Larry Cummings, Donald Harnett, and Owen Stevens, compared risk-taking behavior in five regional clusters with reported scores on a scale of 16–48 (with lower scores indicating risk taking and higher scores depicting risk aversion). Americans exhibited the highest tendency towards risk taking, with the lowest score (31.9) followed by Spain (33.4), Greece (35.6), Scandinavia (35.7), and Central Europe (35.8). In addition to culture, risk taking may be affected by situational differences such as the countries’ present economic, social, and political environment.

Further research is required in the field of risk taking. Researchers have traditionally focused on the psychological and demographic characteristics that discriminate between risk takers and controls; however considerable heterogeneity may exist within risk-taking populations. Moreover, it is important to note that people may not be exclusively classified as risk takers and nonrisk takers but may be selective risk takers, either depending upon the goals’ value or some other factor affecting their choice.

Calculated Risk or Risk Taken on a Whim? A Cautionary Note

Every coin has two sides – hence it is important to understand the flip side of risk taking. Undoubtedly risk taking has its benefits, but there are several factors which must be taken into account before leaping into the unknown. First, the decision should be based on accurate information; past knowledge or prior experience, if any, can be extremely useful in gathering more information. Based on this information time should be spent preparing for the worst case scenario. Other factors include, but are not limited to, the risk-to-benefit ratio, magnitude of impact, whether the effects/consequences of the risk will be experienced by an individual, group, organization or the public, long term and short term impact, etc. When a risk taker takes into account all these factors, basically acknowledging the potential risks of failure, it can be referred to as a calculated risk, as opposed to a complete lack of knowledge of these factors – taking risks on sheer whim.

There are times when risk takers may become the victims of what is known as a ‘halo effect’ – when one characteristic or just one factor dominates all other factors or the person even unknowingly ignores other factors and focuses on only one factor. For example: the enormous size of the Quebec forest, in Canada, was so strong a factor that it seduced the International Telephone and Telegraph (ITT) management into deciding to build a multi-million dollar chemical cellulose mill there without carefully analyzing factors such as political and labor risks in French-speaking Quebec. Lack of formal analysis resulted in a loss of \$600 million on the project.

Additionally it has been found that: (a) past success leads to a willingness to take risks; (b) individuals focus on highly favorable outcomes even if there is less probability of them occurring; and (c) risk-taking propensity is negatively associated with both the time required to reach a decision and the amount of information upon which the decision was based. With respect to risk-taking propensity Ronald Taylor and Marvin Dunnette found that high risk takers make more rapid decisions based on less information, but tend to process each item of information slowly.

Conclusion

In the literature on creativity, one of the most important tasks has been the identification of those personality traits which are characteristic of highly creative people. Risk taking is a distinguishing factor of creative individuals – they are not afraid of the unknown – in fact it is the unknown that arouses their curiosity. They are open to implementing ideas which may have uncertain outcomes. Because of the sheer pleasure of doing things in a unique way the creative individual perseveres and meets challenges head on. A creative individual views the world through the lens of curiosity about the unknown, which frames perception of situational risks, sometimes overemphasizing or underemphasizing them. As George Bernard Shaw aptly said – “The reasonable man adapts himself to the world; the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.” In today’s world, the risk takers can be regarded as the unreasonable people, who undoubtedly play a crucial role in the progress of humankind. Theodore Roosevelt best answered the question of whether people should be risk takers:

It is far better to dare mighty things, to win glorious triumphs, even though checkered by failure, than to rank with those poor spirits who neither enjoy much nor suffer much, because they live in a gray twilight that knows not victory nor defeat.

Acknowledgment

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See also: Gender Differences.

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Schizophrenia and Psychosis

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Glossary

Delusions False beliefs, including delusions of being controlled by an alien (or, outside) entity and delusions of being persecuted (paranoia).

Executive functions Higher order cognitive functions related to the control, management and allocation of resources such as attention and working memory, and the ordering and completion of tasks, such as in planning and prospective memory.

Negative symptoms Behavioral deficits, including flattening of affect, social withdrawal, poverty of speech, and lack of will.

Positive symptoms Bizarre experiences and beliefs, including hallucinations and delusions.

Psychoticism One of the 'psychosis-prone' personality dimensions, and the third major personality trait (after Extraversion and Neuroticism).

Schizophrenia and Schizophrenic Thinking

Readers of this article – especially those interested in their own creativity – face the uncomfortable prospect that creativity is intricately related to psychopathology. This includes the potential relationship of mathematical creativity with autism, artistic creativity with bipolar disorder, and general creativity with schizophrenia. Such a notion appears in various guises in both the literature and the media: the 'madman in the attic,' the 'mad genius,' the 'sensitive artist,' the 'troubled artist,' the 'deranged scientist,' and so forth. Biographical studies of various eminent individuals – artists, poets, musicians, scientists, explorers – discuss their creativity and their pathology, implying that their productivity comes at a personal price and that there is a genetic basis to both creativity and 'madness.' Thus, from the very outset, one has to consider such Romantic ideas concerning the 'troubled artist,' the notion of deviance – in both the positive (creativity) and negative (schizophrenia) senses – and whether there is a continuum relating these different forms. The present article addresses schizophrenia, psychosis, and creativity. It should be stressed that there are mixed views here: some writers have suggested that schizophrenia and creativity might very well be related, especially given the apparent similarity between schizophrenic thinking and creative thinking; other writers have rejected the notion, arguing that schizophrenics are inherently dysfunctional, and thus cannot be 'creative' in the conventional sense. This article will provide the reader with an overview of the schizophrenia-creativity relationship.

So, what can be said about the notion of the 'troubled artist'? Arnold Ludwig has devoted a book to this issue, based on a sample of roughly 1000 'eminent people,' for whom

extensive biographical information was available. For present purposes, let us consider the incidence of schizophrenia, or rather 'schizophrenia-like psychoses' amongst these, namely "at least one sustained psychotic episode, characterized by auditory or visual hallucinations, delusions of persecution, inappropriate affect, extreme suspiciousness, incoherent communication, bizarre behaviors, or impaired ability to care for oneself while clearly conscious," or being formally diagnosed as suffering from schizophrenia. Schizophrenia, having a prevalence of 1–1.5% in the general population, is reported to appear in 5% of this elite group. If the 'troubled artist' is a poet, then the prevalence rate (17%) is certainly supportive of this notion. This is also the case with respect to composers (10%), but also with respect to athletes (11%) – who can hardly be associated with the Romantic notion. Furthermore, note that if 5% of an elite group are found to be schizophrenic, the reverse side of the issue should surely also be considered: What could the prevalence of creativity amongst schizophrenics possibly be? As Marvin Zuckerman writes:

I believe that anyone who has worked with schizophrenics would dispute the assumption that they are creative. Schizophrenics who have made contributions to the literary or visual arts are rare. The argument hinges on the meaning of the term 'creativity' ...

One must therefore consider whether a definition of creative thinking is homologous with that of schizophrenic thinking. **Table 1** provides a useful comparison of the two. There is certainly a substantial degree of overlap in various qualities of thought, broadly defined. Nevertheless, given that creativity has as a prerequisite the need for sustained logical thinking, and that schizophrenics exhibit a deficit in logical thinking, the

Table 1 Comparison of creative thinking with schizophrenic thinking

<i>Creative thinking</i>	<i>Schizophrenic thinking</i>
Inspiration (i.e., ideas being suggested by 'otherworld' beings)	Thought insertion (i.e., alien thoughts enter one's mind)
Unusual (or, remote) word associations	Tangentiality (i.e., digressing from one idea to another by association)
Bisociation (i.e., joining seemingly unrelated information or thoughts)	Derailment (i.e., unrelated ideas compromise logical thought)

degree to which they can be creative must surely be impaired. The deficit in logical thinking that one encounters in schizophrenia (which some authors have referred to as 'paralogical' or, 'paleological' reasoning), is based on the *pars pro toto* rationale. Thus, consider the following familiar example of the schizophrenic who claimed that she was the Virgin Mary. When asked why she thought that that was the case, she reasoned that that was because she was a virgin. This deficit in logical thinking is in many respects similar to the notion that schizophrenics exhibit a frontal-lobe, or dysexecutive, syndrome, with characteristic inflexibility and perseveration, and a problem in judgment. While faulty logic would certainly impede making progress in *linear* problem solving, one should also consider the notion that by generating a similarity between two entities, there is a transition to nonlinear or bidirectional metaphoric thinking – which is certainly of value in creativity.

Consider the following proverb: *When the cat's away, the mice will play*. The proverb was first coined in the fourteenth century (in French, *ou chat na rat regne*), and one version appears in Shakespeare's *Henry V* (*Playing the mouse in absence of the cat*). What does the proverb mean? One can try to provide a singular interpretation, thus exemplifying *convergent* thinking (e.g., *When no one in authority is present, the subordinates can do as they please*). One could also try to provide as many different interpretations as possible, thus exemplifying *divergent* thinking (e.g., one relating to extramarital affairs, another relating to illegal financial transactions, etc.). While proverbs can thus be used to study creativity they have primarily been used to understand schizophrenic thinking. Consider the following responses made by schizophrenics, appearing in a chapter from more than 60 years ago, wherein the author advocates the use of proverbs for studying schizophrenic thinking: (1) *When there's nobody watching, they do things they wouldn't if the cat were there* (an example confined to a *literal* or *concrete* understanding, indicating an 'impairment in thought' – but one also seen among normal controls). (2) *The last supper of Jesus, all those that kissed the novitia, the covitia. The political world is too much, we can't fight it, we can't see murder* (an example of *disordered* thought: bizarre content, 'complex-determined sexual and religious preoccupations', though one not really concerned with interpreting the proverb, as the author notes). (3) *That means feline absence and rodential job, which has its sources in the nature of the Saviour; divine forgiveness, Heaven and Hell, inscrutability* (which combines a *literal* interpretation with a religious preoccupation).

What is this thought disorder that is characteristic of schizophrenia? As Norman Cameron has suggested, "the schizophrenic patient may reach a level of verbal discontinuity at which his talk becomes useless as an instrument of communication." Schizophrenic thought has been characterized by overinclusion, namely a dedifferentiation between the personal and the general in conceptualization. There seems to be a wider 'sphere of meaning,' a 'fluidity' or 'looseness' of thought – one that certainly indicates ideational fluency, but not focused problem solving that would result in something useful or appropriate to the situation. If one's definition of creativity requires some tangible accomplishment, or novel product having practical relevance, then schizophrenic thought falls far from the target. On the other hand, if one focuses on fluency and flexibility of thought, then schizophrenia remains relevant. As one author has suggested, "creative thinking is distinguished from schizophrenic thinking by a more critical assessment of the products of such thinking."

One recent study has indicated that the *positive* symptoms of schizophrenia (e.g., hallucinations) may be similar to creative production, whereas the *negative* symptoms (e.g., flat affect) may be negatively related to verbal fluency. The term 'schizophrenia' covers various forms of pathology – one major subdivision being that differentiating between paranoid and nonparanoid schizophrenia. Various studies have supported a distinction between paranoid and nonparanoid schizophrenics in cognitive functioning in general, and with respect to creativity in particular. For example, one study reported that paranoid schizophrenics had significantly better verbal IQ, executive functioning on the Wisconsin Card Sorting Test (WCST), and memory for spoken language as compared to nonparanoid schizophrenics. Nonparanoid schizophrenics seem to be more creative than paranoid schizophrenics – at least with respect to one familiar test of divergent thinking, the Alternate Uses Test, assessing fluency, flexibility, and originality of thought. Nonparanoid schizophrenics seem to exhibit divergent thinking, whereas paranoid schizophrenics seem to exhibit convergent thinking.

Note that if paranoid schizophrenics have more 'preserved' cognitive functions (i.e., executive functioning, convergent thinking), then they should not be as impaired in logical thinking as nonparanoid schizophrenics. To investigate this, the authors of one recent study employed a logical reasoning task, comprising two parts: in the first, the participant was presented with five syllogisms, and had to decide for each of these what would be the valid inference; in the second part, the participant was presented with five syllogisms, and had to decide for each whether the inference was logically valid. An example from the first part is the following:

All men are mortal
Socrates is a man

An example from the second part is the following:

All birds have wings
No winged creature is a mammal
No bird is a mammal

The participant's score here is the number of correct answers, ranging between 0 and 10. A group of 12 paranoid

schizophrenics was compared with a group of 12 nonparanoid schizophrenics. All patients were on medication at the time of testing. Exclusion criteria were evidence for dementia and current acute psychosis. The two groups significantly differed in line with expectation, the mean score for the paranoid schizophrenics being five, while that for the nonparanoid schizophrenics was slightly above three.

There is another side of the coin to creativity, and this refers to *rigidity* of thought, namely the tendency to perseverate in the use of mental and behavioral sets (as assessed using, e.g., the WCST). If rigidity and creativity are polar opposites, by definition, then how can schizophrenics be creative, on the one hand, when it is also acknowledged that schizophrenics are more rigid than nonschizophrenic siblings and normal controls? Could they exhibit both forms of thinking? One line of thought suggests that apparently healthy adolescents, who will later on manifest schizophrenia, nevertheless have cognitive abnormalities such as increased variability across intellectual tasks, possibly related to frontal-lobe abnormalities. Such increased variability could reflect a tug of war between rigidity and flexibility of thought during adolescence.

A major issue to consider in studying the relationship between schizophrenia and creativity is that schizophrenics will probably be on medication at the time of testing. How does this impact their test performance? As one author has argued, "in the event of medication, one would expect 'truncated' performance. Free of medication, schizophrenic performance might be considerably more extreme ... with schizophrenics not using the 'same' strategy as normals but employing an extreme form of that strategy." Is there an option of examining schizophrenia-like thought in a normative, non-medicated population? The answer is to be found in the construct of *schizotypy*.

Schizophrenia and Schizotypy

Given the problems inherent in studying creativity amongst schizophrenics on medication, it is natural to consider other phenomena related to the pathology, that are more amenable to experimental research. This is the same line of thinking that one finds in research on normative psychopathy (i.e., 'normal' individuals who might be predisposed to psychopathic behavior, without actually being characterized as being psychopaths). So-called 'psychosis-prone' individuals (i.e., those individuals who might be prone to developing schizophrenia, given the necessary stressors in the environment, who score relatively high on psychosis-related, though normal personality dimensions, such as *Psychoticism* or *Schizotypy*) are of present concern. Common to all such endeavors is the reliance on a *diathesis-stress* concept of the development of psychopathology, namely that the predisposition interacts with environmental stress to result in the behavior and symptomatology observed. The normal personality dimension most clearly affiliated with the construct of schizophrenia is that of schizotypy (which has been viewed as comprising a latent personality dimension – or, rather *dimensions* – for schizophrenia). Before continuing to read, answer the following three questions ('true' or 'false') to get a feeling for the type of personality trait implicated by schizotypy:

1. "Now and then when I look in the mirror, my face seems quite different from usual";
2. "People tell me a lot of lies";
3. "The sound of rustling leaves has never pleased me."

The article on schizophrenia coauthored by David Schulberg and Louis Sass for the first edition of the *Encyclopedia of Creativity* is one of the items appearing in the bibliography to the present article, and provides a useful resource for the literature up to 1999 (Schulberg and Sass, 1999). Research interest since then has been split between that looking at creativity and schizophrenia, and that looking at creativity and schizotypy.

Schizophrenia and schizotypy are both characterized along the same two dimensions – one referring to the positive symptoms (e.g., delusions, hallucinations, etc.), the other to the negative symptoms (e.g., anhedonia, flat affect, etc.) of these phenomena. What do we know about the relationship between schizophrenia and normative (or, dimensional) schizotypy? And what do we know about that between schizotypy and creativity that can shed light on the schizophrenia-creativity relationship? A number of studies have reported a relationship between the positive and negative symptoms of schizophrenia, and their counterparts in nonpsychotic relatives. One study indicated that the relationship was stronger for the negative symptoms than for the positive ones. Other studies have found that positive schizotypy is associated with better performance on measures of creativity (in particular, measures of divergent thinking), while negative schizotypy is associated with better performance on measures of convergent thinking, and with decreased verbal fluency. Visual artists have been found to score higher than nonartists on both positive schizotypy and divergent thinking. One should also consider a plausible difference between artistic creativity and scientific creativity. Thus, while artistic creativity has been related to both schizophrenia and divergent thinking, mathematical creativity has been related to neither (rather, to both autism and convergent thinking).

There is also evidence supporting the notion that schizotypal individuals exhibit right-hemisphere (RH) dominance, or bias, in various cognitive tasks, at the expense of the left hemisphere (LH). This finding comes to further support an argument suggesting that schizophrenics have an impaired left hemisphere – hence have little LH dominance over the primarily verbal products of thought, which flow in a very loose manner, in line with their RH bias. Schizophrenic thought disorder results. Given the affective tone of the RH, the resulting thought is affect-laden, and the schizophrenic experience is essentially *syncretic*. One author has suggested that both the positive symptoms of schizophrenia and positive schizotypy are indicative of impaired LH functioning, while both the negative symptoms of schizophrenia and negative schizotypy are indicative of impaired RH functioning. The RH bias noted for both schizophrenia and schizotypy is seen in imaging studies when such individuals are engaged in a task of divergent thinking (e.g., Alternate Uses). It is a specific right prefrontal cortex (PFC) activation that has been found to be associated with enhanced divergent thinking.

Schizophrenics are more impaired than controls on practically any test of cognitive or neuropsychological functioning employed. Negative symptoms, but not positive symptoms, are

associated with poor cognitive test performance in schizophrenia, particularly on tests of executive functioning (e.g., the WCST) and convergent thinking. One study has found that in contrast with schizophrenics, high-schizotypal adults were just as capable as low-schizotypal adults of identifying appropriate metaphors, suggesting, as the authors indicate, a discontinuity between schizophrenia and schizotypy for the metaphor-recognition problem. This finding also contrasts with those indicating poor proverb comprehension in these individuals (both schizophrenics and schizotypal individuals), which may be interpreted in terms of the difference entailed in recognizing and interpreting metaphors (proverbs).

As with respect to schizophrenics, schizotypal individuals exhibit poor performance on tests of executive functioning. One study has revealed that impaired performance on the WCST was associated with negative, but not positive schizotypy. Another study has indicated that individuals with both positive and negative schizotypy reported higher levels of 'cognitive slippage' than those individuals reporting only negative schizotypy. In other research, schizotypal individuals who were assessed on both verbal and nonverbal executive functions and on nonexecutive functioning exhibited deficits on the measures of executive functions but not on measures of nonexecutive functions. Schizotypy is one major psychosis-related, normal personality dimension(s). The other is psychoticism.

Schizophrenia and Personality

The two primary traits of personality, namely extraversion (E) and neuroticism (N), have been studied with respect to schizophrenics, who seem to score low on E and high on N. They also exhibit, as stressed above, a peculiar or bizarre form of thinking, which might well implicate the third major trait of personality, namely psychoticism (P). A major contribution to the study of schizophrenia and personality has been made by Hans J. Eysenck (1916–1997), who designated P as a 'psychosis'-prone dimension. In Eysenckian theory, P is a dimension along which the various psychoses may be mapped; as Eysenck writes, "close to psychosis [schizophrenia] . . . are behaviours variably diagnosed as schizoid, 'spectrum', or psychopathic . . .". P has been placed at the forefront of contemporary research looking at personality and psychopathology, but also at that looking at personality and creativity. Manic-depressives, for example, who have a clear propensity for creativity, seem to score high on E and, more importantly, high on P.

Eysenck's theorizing regarding P suggests that this is the common underlying continuum for affective disorders, schizophrenia and creativity. A second line of thought suggests that schizophrenic thinking is part of a general continuum of thinking, on which creative thinking may also be mapped. Indeed, as Robert A. Prentky has written, "given the current state of knowledge, it seems highly untenable to conclude that creativity has a greater affinity for manic-depressive illness than schizophrenia or vice versa." The assessment of this major personality trait in schizophrenics should therefore be revealing. To what extent can P be the underlying continuum for both cognitive psychopathology and personality? It is important to stress that while Eysenck views P as indicating

proneness to psychosis, he also views P as indicating proneness to psychopathy. Other authors argue that P is more intricately tied to psychopathy and antisocial behavior than to psychosis. In fact, there is an interesting relationship between psychosis and psychopathy, as revealed by the fact that children born to schizophrenic mothers have elevated rates of psychopathy and elevated rates of criminal records. One author has argued that it might only be paranoid schizophrenics who would be characterized by high levels of P, while schizophrenics presenting negative symptoms should not score high on P.

Be this as it may, P should perhaps not be considered in isolation of another personality trait, revealed by the lie scale (L) of Eysenck's questionnaire, especially given some recent data indicating a negative correlation between P and L, amongst both 'normals' and schizophrenics. The L scale was explicitly incorporated in the measurement of personality within the Eysenckian system so as to assess the degree to which subjects attempt to 'fake good.' It was reported that the items comprised a scale; it was also suggested that in addition to measuring dissimulation, the L scale "also measures some stable personality factor which may possibly denote some degree of social naiveté." A conundrum therefore exists here. If the L items comprise a scale, then how can the same scale measure two separable factors of dissimulation and social naiveté? Further, how can one distinguish these two functions in a given setting? More importantly, given that both factors are, at least partially, situationally dependent, how can one disentangle person and situation in what is evidently an interactive process? A negative correlation between L and P (~ -0.20) has been found. This negative correlation increases somewhat among prisoners (especially, female) and among neurotics (~ -0.30). The interpretation readily adopted by a number of authors here is that high P scorers tend to have low L scores, because they do not mind admitting their undesirable behaviour. High L scorers, in contrast, might "sincerely believe that their socially desirable answers parallel their true behavior. Presumably, these respondents are conscientious and law-abiding individuals." A recent study has further revealed a significant negative correlation between P and L among first-degree relatives of 'affective psychotic' patients ($r = -0.30$ for female relatives, and -0.32 for male relatives), but not for the relatives of schizophrenics ($r = -0.02$, and -0.05 , respectively).

It is worthwhile considering the P–L relationship with respect to both schizophrenia and creativity. One author has argued that "rather than being a sign of 'dissimulation,' the more usual interpretation of the higher Lie scores earned by psychotics is that psychotics, as a class and by definition, are unworldly, disturbed, and erratically functioning individuals no longer seeking or able to conform to societal standards." To this, Hans and Sybil Eysenck replied: "our explanation was that psychotics tend to have high Lie (L) scores, which lowers their P scores below what they would otherwise be, whereas the other groups . . . do not have such elevated L scores." And further on: "Combining scores to get better differentiation not only makes good psychological sense but also gives good differentiation (particularly when the poor replicability of psychiatric diagnoses is borne in mind)."

David Rawlings has commented on the fact that while high P is usually combined with low L, nevertheless schizophrenics

(as a group) tend to have high L (and are also hypothesized to have high P), and bemoans the type of explanation that ascribes such findings "to drugs, to hospitalization, or to other 'secondary' effects of the psychiatric breakdown. This type of explanation is unsatisfactory because it does not explain why the high Ps actually behave the *opposite* to expectation, and does not specify the conditions under which such a reversal is likely to occur." One recent study has indicated that while paranoid schizophrenics do have elevated L scores and corresponding low P scores, nonparanoid schizophrenics have elevated P scores and corresponding low L scores. It thus seems to be a wise strategy to avoid global characterizations, such as 'schizophrenia,' for a more specific category of psychosis, such as the distinction between paranoid and nonparanoid schizophrenia. Evidently, these two groups of schizophrenic patients, are diametrically opposite in the Eysenckian P-L plane.

Following an argument appearing in a recent study, it is of further importance to stress that while low L scores denote a degree of conventionality, it is also possible that part of the relationship between P and creativity is due to the need to be unconventional, or perhaps even to function outside the boundaries imposed by the law. As Eysenck has written, "The association of genius-creativity with P may also serve to explain what would otherwise be somewhat confusing – namely, the proclivity of genius to fraud and deceit ... The range of famous scientists who 'betrayed the truth' ... is immense, ranging from Ptolemy to Newton, from Mendel to Millikan. How can honest, upright citizens descend to such conduct, which would be criminal if indulged in by an accountant or tax inspector?" Personality and cognitive psychopathology are thus intricately related.

Schizophrenia and Creativity

Heinz Werner (1890–1964) marked one dimension of development as that moving from a syncretic level to a discrete one, that is, from a "state of relative globality and lack of differentiation to a state of increasing differentiation." Syncretic cognition entails a dedifferentiation of perceptual qualities in subjective experience, the most predominant example being synesthesia. But syncretic cognition, according to Werner, also refers to "the lack of differentiation between what one dreams and what one sees, as is found in psychosis." Schizophrenic thinking could thus be characterized in terms of this 'primitive' level of syncretic experience. In fact, both creative thinking and schizophrenic thinking could rely on, or have access to, this same syncretic level of cognition. On the creative side, this dedifferentiation would allow for flexibility of perception and thought, as categories or concepts dissolve, become entwined and in general interact. On the schizophrenic side, this would entail some 'prelogical,' 'paleological' or 'looseness' of thinking, which could suggest an incoherence of thought, an impaired mode of thought or a thought disturbance, as discussed earlier.

In one study, both syncretic cognition and symbolic cognition were investigated. Participants were drawn from three groups: schizophrenics, visual artists, and controls. The artists had no psychiatric history; the controls had neither a psychiatric history, nor were actively engaged in visual art. Both

schizophrenics and visual artists were hypothesized to exhibit a greater degree of syncretic cognition than normal controls. Turning to symbolic cognition, a distinction was drawn between metaphor production and metaphor comprehension. Metaphor production was assessed using the *Barron Symbolic Equivalence Test*, comprising 10 symbolic images (e.g., *Tall trees in the middle of a field*). For each item, the participant is required to produce three metaphors or 'equivalent symbolic images.' The number of admissible verbal responses (i.e., those that match structurally or functionally the given metaphors) provides a measure of ideational fluency. A second measure pertained to an evaluation of the participant's creativity (originality), whereby each verbal response was rated on a five-point evaluative scale, with a test score being the mean of these evaluations. Metaphor comprehension was assessed using Gorham's *Proverbs Test*, comprising 15 proverbs (e.g., *Don't cry over spilt milk*). For each item, the participant is required to choose one of three possible interpretations listed for each: a concrete one (rated 0), a second which is more abstract, but still not quite related to the conventional meaning of the proverb (rated 1), and the third which is both abstract and presents the conventional meaning of the proverb (rated 2). The participant's score is the sum of these 15 ratings.

Both ideational fluency and originality were found to be similar for schizophrenics and controls. Thus, metaphor production was not impaired amongst schizophrenics. In contrast, proverb comprehension was impaired in schizophrenia, as one would expect. Both schizophrenics and visual artists were found to exhibit a high degree of imagination and absorbed involvement. Visual artists, as opposed to the schizophrenics, were able to exhibit both a vivid imagination and a high degree of metaphor comprehension. Thus, schizophrenics simply do not have the tools to both constrain their thought and to enable successful hierarchic integration of their thinking within a coherent conceptual system. Nevertheless, given that they do not seem to be impaired in metaphor production (either in terms of fluency or originality), they could well exhibit creative thinking – though perhaps not one constrained to practical use.

Finally, one should consider the preoccupation of schizophrenics with metaphor. One notion in the literature is that the schizophrenic experience itself is 'permeated with metaphorical meaning.' If schizophrenics engage in metaphoric thinking to understand and describe their unusual experiences (positive symptoms), then their delusions might well conform to the following equation:

$$\text{Unusual Experience} + \text{Metaphoric Thinking} = \text{Delusion.}$$

As one author has written, "the patient is delusional because he or she is actually experiencing anomalies that demand an explanation." Other equations appearing in the literature are the following:

$$\begin{aligned} \text{Unusual Experience} + \text{Normal Logic} &= \text{Delusion;} \\ \text{Normal Experience} + \text{Abnormal Logic} &= \text{Delusion.} \end{aligned}$$

Each of the latter options has its problems. The notion that schizophrenics apply normal logic is contraindicated by their clear deficit on a logical reasoning task. The notion that schizophrenics apply abnormal logic is contraindicated by

the familiar fact that normal individuals also exhibit faulty logic in judgment, decision making, and reasoning. If the schizophrenic were able to become absorbed in solving a problem not intimately related to his or her own subjective experience, then an engagement with metaphoric thinking would certainly be predictive of creativity. This is worthy of further research.

To conclude: The present article has considered the relationship between schizophrenic thinking and creative thinking, providing an overview of the major views here. Positive symptoms of schizophrenia and positive schizotypy seem to be related to both creativity (divergent thinking) and an impaired LH functioning, while negative symptoms and negative schizotypy seem to be related to both convergent thinking and an impaired RH functioning. The role of metaphoric thinking in schizophrenia should be further considered in future research.

See also: Art and Aesthetics; Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Bipolar Mood Disorders; Brain and Neuropsychology; Divergent Thinking; Eminence; Families and Creativity; Mad Genius Controversy; Mental Health: Affective Disorders; Metaphors; Synesthesia.

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Robert Schumann 1810–1856

Composer and writer of 148 published works

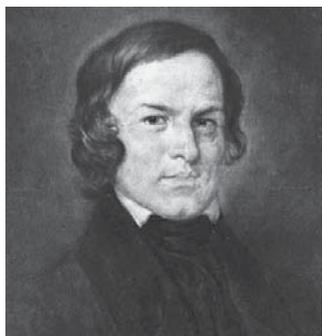
Works include compositions for piano: *Papillons, Carnaval, Fantasie*; piano and orchestra: *Concerto in A minor*; vocal music: *Liederkreis, Dichterliebe, Frauenliebe und Leben*; orchestral music: *Spring Symphony, Rhenish Symphony*; chamber music: *Quintet in E flat major for piano and strings*

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ROBERT SCHUMANN was a German pianist, founder and editor of the Neue Zeitschrift für Musik (New Journal for Music), a conductor, and a composer. His published works range from miniature pieces for piano to virtuoso works on a grand scale. He composed powerful symphonic works and song-cycles of great depth and beauty. He wrote compelling chamber music for various instruments, oratorio, and operas. Schumann was one of the great figures of the Romantic era, a contemporary of Mendelssohn, Wagner, Chopin, Verdi, and Liszt, composers of such diverse style yet all born within four years of each other in the German, Polish, Italian and Hungarian principalities. However, Schumann fought against serious mental problems all his life. While he experienced surges of creativity, both musical and literary, his recurring depressions, inner turmoil, and episodes of madness led to a suicidal attempt to drown himself in the Rhine and a final incarceration in an asylum near Bonn.



Robert Schumann. Used with permission from Scala/Art Resource, NY.

Background

Robert Schumann was born June 8, 1810, in the small town of Zwickau, Saxony, halfway between Dresden, the artistic court capital, and Leipzig, the scholarly center of Germany. Robert's mother, Johanne Christiane Schnabel, was the daughter of a military surgeon. His father, August Schumann, the son of a Lutheran minister, was a prolific author and founder of Schumann Brothers Publishing Company. The year Robert was conceived, 1809, was a stressful time as August was mourning the death of both his father and his newborn daughter. August and Johanne Christiane had a daughter

nine months after their marriage, then three sons in 1799, 1801, 1805, followed by a baby girl who was either stillborn or died soon after birth, a year before Robert was born. His mother, close to menopause and severely depressed by the loss of this infant daughter, may have wished for another girl. Schumann's father was also prone to melancholia and suffered from chronic abdominal problems.

In 1813, the province of Saxony experienced famine and devastation. A typhus epidemic broke out and eliminated 9% of the population. Schumann's mother was one of the survivors. As she had to be quarantined, Robert was separated from his mother for 2½ years and was placed with a surrogate mother. In his autobiography written at age 15, Schumann vividly recalled nights fraught with fear and nightmares.

Schumann began music lessons at age 7 with a church organist, Johann Gottfried Kuntsch (1775–1855). He soon assimilated all the rudiments of harmony and keyboard technique this teacher possessed. Schumann's creative awakening was manifest as early as 1817–1818 in both literary and musical compositions.

Florestan and Eusebius—Literature or Music

Schumann was an isolated child in a middle-class family with no tradition for musical professionalism. He was endowed with a wonderful talent for improvisation, which he used to capture people's manners and idiosyncrasies. Robert's education was enhanced by his father's private library, which contained approximately 4000 books, a definite stimulus to intellectual development. He discovered a passion for literature comparable to his love of music. It created a lasting conflict, trying to achieve verbal mastery to please his father while striving to communicate with his mother through musical sounds. This duality was later expressed when, at the age of 21, he created two imaginary companions, "Florestan" representing Schumann's masculine, outgoing self, and "Eusebius" the shy, withdrawn, and sensitive alter ego.

Two traumatic events contributed to Schumann's first serious depression at age fifteen, the death of his sister followed by that of his father. Schumann's sister, Emilie, 14 years older than Robert, suffered from a chronic skin disease as well as from emotional problems. It is believed that she either drowned herself or jumped from a window. This seems to have precipitated in Robert an inescapable "longing to throw

myself into the Rhine.” Later, in his early twenties, Schumann attempted to leap out of a fifth-story window, which led to a fear of heights as a possible self-protective mechanism. In August 1826, 10 months after the suicide of his sister Emilie, Schumann’s father died suddenly at the age of 53. As a way to alleviate his sorrow and emulate his father’s literary proficiency, Schumann began to keep daily records in his diary. He also wrote poetry and novels, but most of these adolescent works remained unfinished.

Jurisprudence and Debauchery—Student Years in Leipzig and Heidelberg

In 1828, Schumann decided to join his friend Emil Fleischsig at the University of Leipzig. After much inner torment, he chose to go into jurisprudence, despite thinking it cold and dry. In this setting Schumann, shortly before his 18th birthday, experienced his first dissociative attack. “I seemed to be losing my mind: I did have my mind, yet I thought I had lost it. I had actually gone mad.” This momentary disorganization could have been caused by overwhelming stress. At 18, he discovered the euphoric state of alcoholic intoxication and got “high” not only from alcohol but from other substances such as nicotine and caffeine. Schumann became aware of inner voices, or auditory expressions of diverse emotions often of a sensuous nature. Homosexuality is a frequent topic in his diary.

In Leipzig, Schumann wrote songs based on poems by Justinius Kerner (1786–1862). He was more and more drawn to music and to the charismatic piano teacher, Friedrich Wieck. This well-known pedagogue guaranteed his piano method, citing as best evidence his highly proficient 9-year old daughter, Clara, whom he wished to mold into the world’s foremost pianist. Clara was an unusual child who did not use words until the age of four. When she first encountered Robert in 1828, the childish 9-year old was obviously smitten by the handsome yet taciturn 18-year old pianist.

Schumann’s lessons with Wieck were not altogether satisfactory. Wieck was a demanding task-master who expected the aspiring pianist-composer to practice hours of technical exercises. The recalcitrant student’s strange way of composing is vividly described by his roommate Fleischsig, “He always puffed on cigars, and the smoke irritated his eyes . . . he liked to whistle the melody of the songs, or rather hum them through his lips, and whistling with cigar in mouth was just about impossible.” In 1829, Schumann’s most daring composition was a quartet for piano and strings, which he performed in weekly chamber music evenings. Discussions and animated conversations followed the performances, but Schumann did not participate. His lack of verbal communication often perplexed his colleagues.

To alleviate his restlessness and recurring bouts of depression, Schumann decided to move to Heidelberg. In letters to his mother, he expressed growing concerns, “My lodgings face the insane asylum on the right and the Catholic church on the left, so that I’m really in doubt whether one is supposed to go crazy or become Catholic.” Though he wrote glowingly about his law studies, in truth he was relying on drinking beer to cope with loneliness and frustration. Twice he fell asleep with a cigar, setting his bed on fire.

Early Piano Compositions—Return to Leipzig

After vacationing in Italy, Schumann’s motivation to study law seemed to have totally disappeared. Piano playing constituted his main occupation, and improvisation never ceased to elicit his peer’s admiration. Young Schumann did best as a composer of miniature pieces which he appropriately called “*Papillons*” (*Butterflies*). Tonal analogues between words and music will be found in several of Schumann’s later compositions. This work’s brilliant virtuoso style may reflect Schumann’s way of playing at the time. He may have changed the tonality of his “Tocatta” to make the double-notes and stretches easier, for he later acknowledged numbness in a finger of his right hand, a psychophysiological problem which would hamper and finally destroy his career as a piano virtuoso. Deeply perturbed, sounds haunted him during the night creating auditory hallucinations which would become an inherent part of his lifelong battle with madness. For the first time on March 18, 1830, he admits to hovering in a suicidal frame of mind, “longing to throw myself into the Rhine.”

Schumann, dissatisfied with his musical progress though recognizing his superiority over Heidelberg pianists, wished to renew contact with his former teacher Friedrich Wieck. He pleaded with his mother to intercede with Wieck on his behalf. Music seemed his only mode of salvation. The response from Wieck not only surprised Schumann’s mother but added to her confusion as to her son’s chosen career, “I give my pledge to make your son Robert, with his talent and his fantasy, into one of the greatest living pianists within three years.”

With limited means, Schumann relocated to Leipzig, where Wieck rented him space in his large house and placed him on a 6-month probation. Schumann diligently practiced 6 to 7 hours a day, although he felt depressed and constrained in this environment. Wieck’s alternating crude contempt and exorbitant praise toward Schumann and his cruel behavior to his children were most disturbing.

Music Critic—Hand Problem

Schumann’s two imaginary friends, Florestan and Eusebius, gave voice to musical as well as literary ideas. A product of his vivid imagination, they are suggestive of a latent psychotic tendency. As he neared his 21st birthday, music was relegated to second place and literature absorbed him more and more. He relished the works of E. T. A. Hoffman, and wrote poetry in the style of Schiller and Petrarch. Schumann began his career as a music critic with a startling and now famous review of Chopin “Hats off, Gentlemen, a Genius!” which was published by the *Allgemeine Musikalische Zeitung* in December 1831. His novel approach to music criticism aroused much attention from his readers while composers gained publicity and greater recognition from Schumann’s writings.

Though Schumann made progress in his creative work—studying counterpoint, publishing his writings—a regressive pull toward states of terror and confusion held him back and contaminated his level of interaction with people. His speech was scant and constrained. It is interesting to note that Schumann’s hand problem coincided with the rising fame of his young

friend, Clara Wieck. Schumann possibly had a case of tendonitis, and perhaps nerve entrapment, a result of long hours of strenuous practice, known as overuse injury which often afflicts musicians who overtax their musculature. This resolved his conflict between becoming a pianist or a composer. As his state of mind improved, he composed a set of *Intermezzi* (opus 4), published in 1833. While improvising at the piano he kept playing with a four-note sequence, C F G C, a theme suggested by Clara which he incorporated in his *Impromptu on a theme by Clara Wieck* (opus 5). This marked the first of many musical references to Clara in his compositions.

Acute Breakdown

In July 1833, Schumann contracted malaria, had to be quarantined, and lost a good deal of weight. His letters show an unmistakable yearning for Clara, “a chain of sparks now attracts us.” This was the beginning of a long, romantic, and stressful relationship for both Schumann and Clara. It alienated Schumann from Wieck for years to come. While Schumann lay ill with malaria, his brother Julius was dying from tuberculosis. Schumann could not overcome his fear of death and did not even go home when his brother died, in August 1833. He withdrew into social isolation, immersing himself in creative work. In a selftherapeutic manner, he decided to consolidate all his previous writings in what would become a New Journal for Music, *Neue Zeitschrift für Musik*. Instead of the usual introspective entries in his diary, he began writing for the public at large. This journal gained universal recognition.

Two months later the death of Rosalie, his favorite sister-in-law, shattered his precarious equilibrium and caused an acute breakdown. Suicide and madness were his constant thoughts. Fortunately, another regenerating idea lifted him out of his depression, the founding of the Davidsbund, a fraternity of artists and musicians.

Romantic Relationships

As Clara Wieck’s devotion to Schumann intensified, her father’s vigilance escalated. He sent his daughter to Dresden for 6 months to study composition. Meanwhile, Schumann was ostensibly attracted to another of Wieck’s students, Ernestine von Fricken. Clara took notice of this affair when she returned from Dresden, feeling sad and disheartened. Ernestine’s father, Baron von Fricken, was an amateur flutist, and sought Schumann’s advice on a *Theme and Variations* he had written. Schumann gallantly incorporated the Baron’s theme in a magnificent piano work which he called *Etudes Symphoniques* (opus 13). This simple theme, beautifully harmonized, is succeeded by numerous etudes or variations suggesting orchestral instruments. The scope and texture of this gigantic work is reminiscent of a large orchestra, and the tonal resources of the piano are used by Schumann in ways previously unheard of. It remains one of the most astounding musical compositions of the 19th century.

After introducing Ernestine to his mother in Zwickau, and even though Frau Schumann clearly favored Clara, Schumann gave an engagement ring to Ernestine. However, when the

Baron approved the wedding plans, Schumann bluntly rebuked her. This was another manifestation of his ambivalence toward the women he loved. It has often been thought that Robert rejected Ernestine after the disclosure of her illegitimacy. In reality, Schumann abandoned Ernestine long before he found out that she was an adopted, illegitimate daughter, and might not become the baron’s heiress. She remained a loyal and helpful friend during Schumann’s subsequent legal battle over another woman, five years later.

Schumann became the sole proprietor and main contributor of the now biweekly publication *Neue Zeitschrift für Musik*. During this period he created some of his most important musical works including his *Carnaval* (opus 9), a work of impressive originality and immediate appeal. Schumann had hoped that Clara would love and play his *Carnaval*, but she maintained a cool distance until his affair with Ernestine ended. Schumann noted in his diary, “disengagement from Ernestine, beautiful hours in Clara’s arms.”

Separation and Creativity

Deeply alarmed by Schumann’s change of affection, Wieck hurriedly dispatched Clara to Dresden in early 1836. An exchange of letters was futile, as Wieck intercepted and eliminated all of their correspondence. Shortly after his mother died, Schumann went to visit Clara during her father’s absence, and both declared their loyalty and desire never to be separated from each other. Schumann began to picture Wieck as a future benevolent father-in-law. This was not a role Wieck intended to assume. On the contrary, he threatened to shoot Schumann if he came close to his daughter. Clara, the submissive child-pupil not yet 17, obeyed her father for a year and a half. She did not perform Schumann’s works in her recitals, and there was total silence until August 1837. Schumann, deeply hurt, intensified his allusions to her in his compositions, quoting her own themes, using letters of her name in descending patterns, transforming thoughts into tones. This resulted in the birth of four transcendental works conceived in a period of great upheaval, the *Sonatas* (opus 11 and 22), *Fantasie* (opus 17), and *Grand Sonata* (opus 14).

Sustained by his faith in the value of these last works, Schumann hoped that Wieck would finally acknowledge his merit as a composer and potential son-in-law. On Clara’s 18th birthday, September 1837, Robert gathered the courage to send his marriage proposal to her father who responded in negative and cruel terms. At the height of despair, Schumann produced another masterpiece, his most autobiographical composition, the *Davidsbündler Dances* (opus 6), which are individually signed Florestan, or Eusebius, or both. Schumann attached a motto on the title page:

At all times
Pleasure and grief go together
Keep faith in pleasure, and
Meet grief with courage.

At age 27, Schumann finally entered the road to maturity, and now he wished to pursue this road with his betrothed. During Clara’s absence, Schumann reviewed as music critic no less than 81 compositions for his *Review of Leipzig’s Musical Life in*

the *Winter of 1837–1838*. His *Phantasiestücke (Fantasy Pieces)* (opus 12), for piano, have a remarkable structural symmetry and soon became favorites of Clara who often performed them to great acclaim. After which Schumann created *Humoresque* (opus 20), *Novelletten* (opus 21), *Kinderszenen (Scenes from Childhood)* and *Kreisleriana* (opus 15 and 16), *Faschingsschwank aus Wien (Carnival of Vienna)* (opus 26), and *Nachtstücke (Night Pieces)* (opus 23). He left Vienna on April 5, 1839 and arrived in Zwickau four days after his brother Eduardo's death.

Legalistic Dissentions—The Fight for Clara

Friedrich Wieck, writing secretly to a good friend of Clara in Paris, disclosed plans to instigate legal proceedings against Robert and Clara. Using his legal background, Schumann prepared an affidavit. He would request legal permission to marry Clara if Wieck persisted in his refusal to settle out of court. After unsuccessful attempts to negotiate, Schumann filed his complaint on July 16, 1839.

In the courtroom, Clara was quite distraught and rather sympathetic to her father. Schumann escalated his defense, and obtained documents from the town council and local police asserting his good, honorable and decent citizenship. When the court reconvened, all charges were dropped except that of drunkenness.

Songs and Poetry

After a decade of writing essentially music for piano solo, Schumann embarked on a year of song writing of the highest caliber, placing him alongside his revered Schubert. The literary skills Schumann acquired from his father could flow comfortably with the sensitivity for vocal sounds nurtured by his mother. Schumann continued to express both his romantic genius and his emotional disturbances through his *Lieder*.

His first *Song-Cycle Liederkreis* (opus 24), reflect Schumann's fears, dreams, and melancholic state. The next cycle *Myrthen (Myrtles)* is a collection of 26 *Lieder*, one for each letter of the alphabet, mostly dealing with brides, grooms, flowers and marriages, intended to be a wedding present for Clara. After a brief reunion in Berlin, where Mendelssohn sang Schumann's songs accompanied by Clara, another lengthy separation from Clara gave birth to the most celebrated songs, the sublime *Liederkreis* (opus 39) and the *Dichterliebe* (opus 48), written in isolation. While Schumann's pen continued to produce an array of incredible songs, such as *Frauenliebe und Leben (Woman's Love and Life)* (opus 42), Wieck was on the verge of capitulating. When he finally renounced further legal proceedings, Schumann was jubilant.

Marriage and Symphonies

Awaiting the verdict of the high court in Dresden, Schumann chose the day before Clara's 21st birthday, September 12, 1840 for their marriage in the village church of Schöenefeld, near Leipzig. They began writing a household and marriage diary together and collaborated on *The Springtime of Love* (opus 37).

Soon Clara became pregnant, and this incited Robert to a flurry of creative activity. In four days he wrote the first draft of his *Symphony in B-flat major (Spring)*, (opus 38). A month later, the score was completed. The premiere of this exultant symphony, March 31, 1841, was an immediate success and later that year, their daughter, Marie, was born on September first.

In 1842, Schumann began composing three string quartets in a frenzy of enthusiasm. Clara followed suit by becoming pregnant again. This may have inspired Schumann to create one of the pivotal chamber music works of the 19th century, the grand *Quintet for Piano and Strings in E-flat major* (opus 44), followed by *Quartet for Piano and Strings* (opus 47).

Looking back on Schumann's productivity since his marriage, the years 1840 through 1843 are most impressive for their musical creations, notwithstanding other significant responsibilities such as a newspaper to publish, and a family to provide for. On July 24, 1843, Elise, their second daughter was born. She was christened on the day that Schumann started teaching at the new Conservatory of Music, founded by Mendelssohn in Leipzig. His teaching was unsuccessful and lasted less than a year. The end of 1843 also marks the invitation from Wieck for a reconciliation in Dresden.

Travels to Russia—Relocating in Dresden

In 1844, Schumann and Clara embarked on what would be a triumphant concert tour of Russia for Clara, but a demeaning experience for Schumann. He was mainly acknowledged as Clara Schumann's husband. At social events, he remained silent and reserved. Schumann was a poor traveler and 4 months of horrendous schedules soon affected his moods. He was incapable of working under those stressful conditions. Following the trip to Russia, Schumann experienced one of his most severe depressions. A move to Dresden seemed advisable and Schumann, no longer interested in publishing his *New Journal*, decided to sell it. In December 1844, the Schumann household moved to Dresden. Schumann consulted a physician to treat his "violent nerve attacks," also his blurred vision and nearsightedness.

A third daughter, Julie, was born on March 11, 1845. As the voices increased in his home, Schumann wrote more and more contrapuntal music, including six "Fugues" based on the name of Bach (opus 60). Though Schumann lived only five years in Dresden where he had to endure daily visits from "the old man" (Wieck), and despite a massive depression, this was one of his most productive periods. His social demeanor, however, was deteriorating and he became more and more withdrawn. There was a halt in musical inspiration until shortly before Christmas when new ideas surfaced in Schumann's mind with great speed and intensity. In three days he completed the first movement of his C major *Symphony*. Afterward, Schumann felt much better.

In February 1846 Schumann's first son and fourth child, Emil, was born. Four days later, Schumann attempted to orchestrate his symphony; it progressed at a snail's pace. The full score was completed by the end of the year, despite a constant ringing in his ears. Concerts in Vienna, Prague, and Berlin were poorly attended and Schumann's conducting was so frustrating for the musicians that Clara rehearsed them from the piano.

Upon returning to Dresden in 1847, Schumann's creative thoughts turned to opera. The orchestral overture to *Genoveva* is one of Schumann's most successful works. However, the death of their 16-month-old son, the fatal collapse of Mendelssohn's sister while playing the piano, followed by the loss of their friend and mentor, Felix Mendelssohn, plunged both Schumann and Clara into a deep state of mourning. Nevertheless, Schumann was able to compose two *Piano Trios* (opus 66 and 80), interrupted by the birth of another son, Ludwig, on January 20, 1848.

In 1849, an abundance of works emerged from Schumann's creative genius, instrumental works for clarinet and piano, horn and piano, horns and orchestra, violoncello and piano, vocal works for chorus, women's voices, vocal quartet and piano, and *Song Album for the Young* (opus 79), a counterpart to his pianistic *Album for the Young*.

Political Upheaval—Escape from Dresden

In 1848 and 1849 political uprisings in Germany aroused Schumann's feelings and may have contributed to what was a most prolific period. He wrote many patriotic songs for chorus and organized a choral society. When the revolution broke out in Dresden, Schumann and Clara were forced to hide in the house until they managed to escape through the garden gate with only their eldest daughter. Later, Clara, 7 months pregnant, walked several kilometers in open fields during the night to rescue the other children. Concealed from the upheaval, Robert composed *Five Hunting Songs* (opus 137) for double male chorus and four horns, and "Motet" (opus 93).

On June 12, the Schumann family headed back to Dresden where soon Schumann wrote sketches for the *Requiem for Mignon* (opus 98b) from poems by Goethe. July saw the completion of three scenes for his Faust opera and the birth of their sixth child, Ferdinand, and in August Schumann completed *Four Songs for Soprano and Tenor* (opus 78), which included a tender lullaby. In September, Schumann wrote *Twelve Four-Hand Piano Pieces for Little and Big Children* (opus 85) closing with Schumann's favorite, a hauntingly beautiful and hushed expression of nocturnal repose, "Evening Song."

As this incessant flow of lyrical and powerful music continued, Schumann's fame was on the upsurge.

Düsseldorf—The Declining Years

In November 1849 Schumann was offered and accepted the post of music director in Düsseldorf. The Schumann family was warmly welcomed to Düsseldorf and serenaded by the Choral Society. In the midst of directing orchestral and church concerts, Schumann managed to write one of his most compelling works, the *Concerto for Violoncello and Orchestra* (opus 129), followed by his *Rhenish Symphony no. 3* (opus 97). Perhaps as an antidote to his unrewarding work with his orchestra, his interests shifted to chamber music. In 1851 he wrote *Fairy-Pictures for Viola and Piano* (opus 113), *Sonatas for Violin and Piano* (opus 105 and opus 121), and *Trio for Violin, Cello, and Piano* (opus 110). He also produced new music for

the piano, five four-handed pieces for children, and wrote 23 songs plus a number of longer choral works. If these were declining years, they were far from unproductive as Schumann created one-third of his total compositions in Düsseldorf. His ineptness as a conductor became more apparent, and the musicians began voicing their discontent. Another daughter, Eugenie, was born on December 1, 1851.

While vacationing in the Rhineland, and following a strenuous walk in the mountains, Schumann fainted, and a physician was consulted. Dr. Müller, also a director of the Music Society, advised Schumann to restrict his conducting and allow his assistant Julius Tausch to direct more concerts. He recommended 18 riverbath treatments in the cold Rhine. In mid-September 1852, the Schumanns moved into a spacious townhouse, the last residence they shared in Düsseldorf.

Brahms, Joachim, and the Schumanns

On September 30, 1853, a young man of 20, blond and blue-eyed, stood like an apparition on the threshold of the Schumann home. His name was Johannes Brahms, and he came from Hamburg for a brief visit that extended to 1 month. Schumann and Clara were both immensely taken by the angelic young man and his creative talent. In November 1853, Schumann, exhausted and demoralized, relinquished all of his responsibilities as music director. On the brink of a breakdown he was able to produce the *FAE Sonata* for Joachim, a set of *Fairy Tales* (opus 132), and *Songs of Early Morning* (opus 133), inspired by Brahms.

On their last journey together, in Hanover, the Schumanns wanted to visit their "two young demons" Joachim and Brahms. While Clara had great success playing at the court of George V, Schumann's new works for violin, the *Fantasy* and the *Sonata*, were badly criticized and contributed to "anger and restless nights." They were back in Düsseldorf in February 1854. On February 12, constant hallucinations of glorious and unearthly music threatened to "destroy his mind," wrote Clara. In his psychotic delirium Schumann wrote variations on a theme that he believed Schubert had sent him.

Descent into Madness

On February 26 Schumann, fearing he might harm Clara, suddenly announced that he had to go to the insane asylum. The next morning, a worried Clara pleaded with Schumann not to leave her. While consulting with two physicians, she asked their 12-year-old daughter, Marie, to sit with her father. The child, not realizing how sick her father was, let him leave for his bedroom. Schumann slipped out of the house unnoticed, threw himself into the Rhine River. The disoriented and water-soaked Schumann was forcibly brought home and five days later, on March 4, 1854, Schumann entered a private asylum in Endenich, near Bonn. This separation from home and family would last 2½ years until his death. Clara, who was in the late stage of her ninth pregnancy, gave her husband a bouquet of flowers for this last journey. She never saw him again until two days before he died.

Obscurity and Darkness

Few friends visited Schumann at Endenich except for Joachim and Brahms. While Schumann was hospitalized, Clara gave birth to their eighth and last child, a boy called Felix in memory of Mendelssohn. Missing the stimulating presence of his family, Schumann hallucinated an imaginary community of his own. In a deplorable psychotic state, Schumann declined rapidly. He became bedridden and refused to eat, and was unable to control his twitching limbs. On July 29, 1856, Schumann took leave of this world.

An autopsy was performed by Drs. Richarz and Peters with inconclusive findings. The limitations of brain dissecting technique in 1856 made it difficult to affirm if Schumann suffered from temporal lobe epilepsy, syphilis, or some other organic disease. However, no inflammatory cells are mentioned. The medical reports of Schumann's last years in the mental institution, previously thought to have been lost or secretly guarded, have been made available in January 1994 by Professor Reimann. The notes written by Dr. Richarz emphasize the decline of Schumann, his violent behavior and loss of control. The report mentions the composer's belief in the destruction of Düsseldorf, his ordained burning in hell, his being poisoned and his infection with syphilis in 1831. Delusions, hallucinations and lucid observations were noted by Dr. Richarz, as well as the

patient's burning of letters from his wife, which he denied. According to the research of Dr. Peter Ostwald, the most comprehensive diagnosis for Schumann's psychiatric illness is that of "a major affective disorder." His extreme mood fluctuations stemmed from hereditary as well as environmental factors. A "narcissistic personality" describes other aspects of his disturbance—isolation, divided self, and withdrawal. In analyzing the problems leading to his hospitalization, the *schizo-affective disorder* is most probable. These are simply words to describe an illness, but we must look to the sublime music of Robert Schumann to do justice to the 19th century's greatest tone-poet, a quintessential romantic who transcended the tragic events of his life.

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Clara Wieck-Schumann 1819–1896

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Hearing is said to be the first sense to emerge during embryonic development, while sounds are the first sensory stimuli to permeate the small child's perception of its world. A like process apparently unfolds each morning when we ascend from sleep to wakefulness. Before sounds surface into conscious awareness, they are perceived as vague physical-emotional sensations. Thus, ascending one morning from a night's sleep and dreams my first impression of the outside world was music. It conveyed a pleasurable sensation of solidity and yet stimulating freshness. A moment later a voice from the wireless at my bedside table revealed the name of the composer: Clara Schumann. It was the first movement of her piano concerto, opus 7. I pondered on the seemingly incompatible elements of the music, conveying at the same time order and novelty: creativity anchored, as it were, on firm ground whilst roaming unknown territory.

Clara Schumann's entire production comprises about 60 works. She composed mainly for solo piano – about 20 pieces – and lieder – about 25 pieces. A piano concerto (opus 7), three preludes and fugues (opus 16), one trio for piano, violin, and cello (opus 17), and three romances for piano and violin (opus 22) add to the picture. She never ventured to write larger compositions, like symphonies; this was left for her husband Robert Schumann to accomplish, even though they started out together, inspiring and encouraging one another. Soon, however, her reputation as a concert pianist surpassed that of her standing as a composer. After her death in 1896 her compositions were generally ignored whereas Robert Schumann became one of the leading composers of Romanticism. Nonetheless, in our time Clara Schumann's compositions are held in high esteem; her piano concerto, for instance, being evaluated in *The New Grove Dictionary of Music and Musicians* (2001) as "... a dramatic, innovative work, a record of her ... virtuosity and independent musical thinking" and her compositions generally as "creative." An interest in her work was revived in the 1970s and has grown steadily thereafter as have broadcasts, concert performances, and the discography of her works.

Recently, there has been an increasing interest in Clara Schumann's life and work, particularly by musicologists interested in gender issues. To what extent, if any, they ask, have the musical talents of gifted women been stifled by the conventional expectations of their time of what women could accomplish, by family demands, or by those women's internalized limitations, having accepted society's constraints as their own? There are a number of women whose life and work provide fertile ground for analysis of this question. Besides Clara Schumann, there are women such as Maria Anna Mozart (Mozart's older sister), Fanny Hensel (Felix Mendelssohn's sister), or Alma Schindler (whose first husband was Gustav Mahler). Clara Schumann's life is of special interest to researchers because there is extensive documentation of her life and career (see Reich's publication of 2001). An essential source

of information are the large number of letters available, of which the most informative are those exchanged between herself, her father, her husband, and Johannes Brahms, a close friend and supporter for more than 40 years. Even a superficial examination of these letters is revealing as to how her relationships with those close to her, particularly her father and her husband, influenced her development as child prodigy, woman, concert pianist, and composer.

In the nineteenth century, musical education was a normal part of many middle-class women's upbringing. Being able to play the piano and sing at dinner parties was considered particularly appropriate since it agreed so well with that virtuous and modest appearance supposed to befit the female sex in general and a refined woman in particular. This view of the educated woman included the position, or predicament, of being under her father's or husband's custody. The question arises whether a woman raised to take on a subservient role would be inclined to compose music of any originality, an endeavor that would seem to require some assertiveness and autonomy of mind.

Clara Wieck was born in 1819 in Leipzig, which was at that time an important musical center. She spent her first years in a family torn by conflicts between her parents, who divorced when she was five. Her mother, Marianne Tromlitz, was a soprano soloist and skilled pianist. Her father, Friedrich Wieck, was a piano teacher and dealer. After the divorce, Clara and her two younger brothers lived with her father. Her father was known as a competent and innovative piano teacher but also as a man prone to tantrums. He was self-centered, relentless, and uncompromising. Wieck insisted that his pupils devote several hours daily to their piano practice and that they learn everything by heart, so as not to be distracted by looking at notes. He emphasized the importance of "a pure, precise, smooth, clear and elegant touch" aimed at making the keyboard "silent" in itself, so that the music should materialize, much like the artist's brush not being evident when one views a painting, one would assume. Wieck also required his pupils to write small compositions from an early age; at the time, this practice was quite unorthodox. He was determined to make Clara his top pupil, a virtuosa, proof of his outstanding capacity as a teacher. From the time she was five years old, playing the piano was Clara's main occupation, with little time left for anything else. It is rather an understatement that she was deprived of a normal childhood and youth.

When Clara had learned how to write, her father gave her a diary where he used to insert entries in her name – usually about her (alleged) views on musical issues. It should be added that, as a child, Clara was described as a very taciturn kind of a person; one would guess she was silenced by her domineering father. Owing to her remarkable talents, early recognized by her father, playing the piano for her apparently became a way of life, a haven where she felt safe and competent. Playing may have served as an emotional outlet as well. It is telling that if

she misbehaved, her father punished her by withdrawing lessons. This was a punishment she tried very much to avoid.

After a few years of instruction at home Clara received lessons in composition, harmonics, and counterpoint from the best teachers available. She made her official debut at nine years of age, when she was technically adroit and, more noteworthy, already a talented interpreter. In this respect she clearly differed from other child prodigies of the time, who first and foremost exceeded in, and were admired for, their technical skills. A possible explanation of Clara's interpretative capability at this early age is that playing the piano was a means for her to give voice, not only to the piece of music at hand, but also to her inner life, which she had no other means of expressing. For her, playing and living were closely related. Her ability to concentrate on the piece she played had the rather paradoxical effect that when she first starting performing in front of an audience, she did not suffer from stage fright but was instead terror stricken by the applause after the performance.

Clara Schumann's gift for sensitive interpretation was a hallmark of her 60-year career as a concert pianist. In playing music composed by others, she dedicated herself to conveying not just the composer's music as noted in the score, but the composer's spirit and intent. She specifically abhorred the idea of using other's music to show off as a piano virtuoso (*... I hate the whole world of mechanical virtuoso showpieces*). Robert Schumann and Johannes Brahms particularly testified to her perceptive interpretations of their works. For many years, Brahms – who was known for his unrelenting critique of his own works – used to ask Clara Schumann for her opinion of new pieces he wrote before sending them to his publisher. He continued this practice even after he had become a widely esteemed composer. Reviewers even used to call Clara Schumann 'the priestess,' referring to her refined manners and to her ability to entirely devote herself to her role as interpreter.

Interpretation is one thing, composing another. How did Clara Schumann manage to do both?

As already noted, Friedrich Wieck had required his daughter, from an early age, to write compositions of her own. His goal was to bring forth a first class concert pianist and incipient composer, proof of his superior pedagogical technique. Furthermore, being her father, we may take it for granted that he expected her to mature to become a refined woman by the standards of that day – meaning that he expected her to be both virtuous and unpretentious. Friends of the family attested that as a child and a young teenager, she was conscientious and restrained. However, they also remarked on her wistful smile; it seemed that perhaps she looked at her situation with a degree of irony.

Then, at the age of 16, Clara Wieck fell in love with Robert Schumann, who was then 25. She and Robert had in fact known each other since Clara was 11 years old, when Robert became one of her father's students for a year; as was customary at the time, he lodged in their home. Friedrich Wieck was furious at this development and did everything he could to keep Clara and Robert apart. He sent Clara on extended concert tours where he was her factotum and chaperone as well. However, with some help from friends, the young couple were able to exchange letters from time to time. Robert proposed formally when Clara was 18 but was emphatically turned down by her father. Clara vacillated between opposing

her father and trying to appease him; her father remained adamant in refusing to accept her leaving his household. Finally, Clara and Robert went to the court in Dresden to request permission for Clara to marry without her father's consent. This was granted in 1840, the day before Clara's 21st birthday.

In sum, very little in Clara Schumann's home environment appears to have fostered or encouraged the independent attitude one would have thought necessary for a creative talent to grow and progress (discussed by Smith and Carlsson in 1990).

Interestingly, Clara Schumann's compositions during a short period of time, when she carried through a concert tour on her own and against her father's wishes, differ conspicuously from those compositions that she wrote both before and after the tour. She was 19 at the time and wrote three piano pieces characterized as audacious, spirited, and technically demanding to the extent that it takes a virtuoso to play them – quite against her conviction not to show off on stage. These three pieces invariably brought down the house at her concerts. Opus 8 comprises variations on a theme from Bellini's opera *The Pirate*, opus 9 is an impromptu on Haydn's *Emperor's Hymn* and opus 10, a scherzo of her own invention. Besides confronting her father for the first time, she had recently been awarded the decoration *Königliche und Kaiserliche Kammervirtuosin* (Royal and Imperial Chamber Virtuoso), and been acclaimed *Wundermädchen* (wondergirl) by the emperor Francis II. It does not seem far-fetched to consider this creative outburst an effect of her break with her father leading to a sense of greater autonomy and self-confidence. What about her subsequent development as composer?

Writing music to already existing lyrics constitutes an intriguing two-faceted creative activity. The accompanying music is meant to serve as a congenial illustration and complementary expression of the theme portrayed in the poem and thus contains an element of interpretation. At the same time, it is an independent piece of art, showcasing the composer's temperament and creative powers. Clara Schumann's emphatic and interpretative mastery is evident in the piano settings she wrote to lyrics by Friedrich Rückert, Heinrich Heine, Johann Wolfgang von Goethe, and Robert Burns, most of them between 1840 and 1845. Her settings emphasize and give voice to the essence of the poems. They are harmonically audacious, emotionally outspoken, and musically refined, excellent proof of her capacity to combine creativity and interpretation, as it were. In the preludes the mood of the lyrics are set and the postludes finalize their theme either by letting a prevailing tension burst out in a crescendo or by allowing a tragic atmosphere to attenuate and fade out. Several of her songs were performed by the leading artists of the time.

Since Clara Schumann was not particularly well-read – a result of the very narrowly focused education that her father had given her – it was Robert Schumann, as the lettered party, who selected the 26 poems that Clara Schumann set to music. Most of these poems picture love in various shapes. This is not surprising in view of their recent marriage and the then current fashion of Romanticism. Moreover, composing lieder allowed Clara Schumann to manifest her musical gift in a way that was well in agreement with the roles allotted to women at this time, such as being perceptive and caring *vis-à-vis* the needs of one's

fellow human beings. Further, it allowed her to marry her gifts for creativity and interpretation.

Overall, Clara Schumann's compositions received praise by the public and reviewers alike, among them the most influential critic at the time, Eduard Hanslick and the composer Hector Berlioz. They judged her works as showing competence and craftsmanship as well as power of expression. At the same time, there is a striking difference between her opus 8–10, described above, and the remaining part of her production that, in comparison, contains an element of moderation and self-discipline that sometimes reins in the expression of genuine originality, like a stream in the Alps that remains in its trench even on steep hillsides, as it were. It does not make them less valuable pieces of art – artistry is not equivalent to unexpectedness – but may indicate a restrained creativity.

There is ample evidence that Clara Schumann had a very conflict-ridden understanding of herself as a composer. Both before and after they were married, Robert and Clara inspired each other as composers. Gradually, their life in common as composers became intertwined to the extent that it is possible to trace mutual interdependence in almost everything they wrote. In the 1840s, both wrote pieces for the piano and songs, lieder, a musical form that arose during the romantic era. They studied scores by Bach, Beethoven, and Mozart and played their music together. Robert often encouraged Clara to compose, and he saved everything she wrote. He used his contacts with publishers to have her compositions printed. Yet, she became more and more diffident and reluctant to compose, and her productivity ceased entirely at Robert's death in 1856. Perhaps her creative powers were most genuinely expressed during her teens – when she surprised her father by defying him – and in her congenial yet personal piano settings to lyrics written by the most celebrated poets of her time.

No matter how eager she might have been to compose, Clara's life was filled with other competing and tremendous demands. Particularly after 1840 her duties as wife, mother, and concert pianist took all her strength and time. Between 1841 and 1854, she gave birth to eight children. She spent months on concert tours and also had pupils, to be able to support the growing family. It was a matter of fact, disputed neither by her or her husband, that his time and composing had priority over hers. On top of all this, Robert Schumann suffered from extreme emotional lability, oscillating between periods of exaltation and depression. Over the years his mental state deteriorated and he became suicidal. He had to be hospitalized in 1854 and died two years later.

Thus, it may seem obvious that Clara Schumann's responsibilities as wife and mother were incompatible with a career as composer for purely practical reasons. However, there is evidence that she was literally torn between an urge to compose and succumbing to a lack of self-esteem, sometimes referring to her sex in belittling terms. Before she got married, in 1839, Clara wrote in her diary: *I once believed that I had a creative talent, but I have given up this idea; a woman must not wish to compose – there never was one able to do it. Am I intended to be the one? It would be arrogant to believe that. That was something with which only my father tempted me in former days. But I soon gave up believing this. May Robert always create: that must always make me happy.* On the other hand, composing brought her

deep satisfaction. After having completed the six songs of opus 23 in 1853, she wrote: *There is nothing that surpasses the joy of creative activity, even if only for those hours of self-forgetfulness in which one breathes solely in the realms of tones.* And when she had finished her Trio (in 1846): *There is really no greater pleasure than having composed something and then to hear it.* Yet, later she said about the same piece that it was *women's work, which always lack force and occasionally invention and once described it as effeminate and sentimental.* Her correspondence with Robert about her *Trois Romances* (opus 22) in 1839 is even more revealing with respect to her ambivalence about her creative powers: *I have a peculiar fear of showing you my compositions; I am always ashamed.* She asked him for criticism but objected strenuously when he returned her work with alterations and suggestions, at the same time adding: *You are not angry with me, are you?*

Another factor that may have led to doubts on her ability to compose was that she realized before anyone else that her husband was going to be one of the great composers of his time and that her works, in comparison, might be judged as mediocre or insignificant. He was nine years older than her and well educated which made her feel inferior to him. It goes without saying that male composers also may have doubts on their talents – Johannes Brahms is a telling example – but they were, and still are, urged forward by expectations related to being a man, such as making one's own way. A woman with special gifts, on the other hand, is always reminded of the limits supposedly fallen on her sex.

Clara Schumann, like many other composers who are also performers, maintained that there is an inherent conflict between reproducing and creating music: *For the creative artist it is difficult during any longer time to devote oneself to reproducing. This form of life is rather paralyzing.* This is an interesting comment in view of her profound commitment in interpreting, that is reproducing or recreating, music which – on her level of mastery – requires being able and willing to identify with, relive as it were, another person's intentions.

Composing, like other acts of creativity, on the other hand, implies a rather opposite orientation, that of actualizing and subsequently materializing in one form or another latent, often emotionally laden themes, originating within oneself. Such self-centered activity in creative individuals is coupled with an ability and inclination to assert oneself in relation to other people, that is to defend a space of one's own (discussed in 1986 by Smith and Carlsson). Composing and reproducing music are thus inherently incompatible activities; devoting oneself to one holds back the other. Furthermore engaging in one of them can be expected to result in the other being undernourished and gradually fading out. Clara Schumann had to constantly give concerts in order to support her family. Nevertheless, when Johannes Brahms once suggested that she should give up the strenuous life as a performer, she answered that earning money was not all there was to it. *I feel a calling to reproduce great works, above all, those of Robert, as long as I have the strength to do so. The practice of art is, after all, a great part of my inner self. To me, it is the very air I breathe.*

To sum up, Clara Schumann composed some 60 works, which were positively received by leading critics at the time. At the same time, from the very start of her career, she was known as

a talented interpreter – holding herself back on the stage – which is all the more noteworthy at a time when child prodigies were featured as technical wonders. She rejected superficial brilliance and devoted herself to recreate, that is create anew, the pieces she performed. Robert Schumann and Johannes Brahms have attested to her congenial understanding and performance of their works. Deeply ambivalent about her talents to compose, doubts that coincided with the submissive role allotted to women at the time, she invested her musical ingenuity in presenting compositions written by composers she held in high regard. As for herself: *a woman must not wish to compose – there never was one able to do it.*

See also: Gender Differences; Music; Women and Creativity.

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Self-Actualization

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Glossary

Intrapersonal intelligence One specific domain of talent, increasingly recognized in creative studies, which in many ways parallels self-actualization.

Self-actualization Openness to and acceptance of one's true self. Leads directly to openness to experience and creativity and epitomizes psychological health.

Theories of Self-Actualization

Self-actualized individuals are thought to be creative. Abraham Maslow, for example, felt that self-actualization and creativity are interdependent. He described how creativity facilitates self-actualization and self-actualization facilitates creativity. In 1971 Maslow even concluded that creativity and self-actualization "may turn out to be the same thing" (p. 57).

Carl Rogers, another leading humanistic psychologist, argued that:

the mainspring of creativity appears to be the same tendency which we discover so clearly as the creative force in psychotherapy – man's tendency to actualize himself, to become his potentialities ... the individual creates primarily because it is satisfying ... because this behavior is felt to be selfactualization. (1961, pp. 351–352)

Empirical Research on Creativity and Self-Actualization

Rogers and Maslow developed their theories of self-actualization by drawing from their experience conducting psychotherapy. Such work gave them extensive information about individuals; however, generalizations from clinical observations are often questioned. This is because (a) generally a small number of persons are observed, and (b) those observed may be atypical in many ways – after all, they are involved in psychotherapy. Fortunately, other more rigorous research has also examined the relationship between self-actualization and creativity.

Some of this research has failed to support the relationship between creativity and self-actualization. For instance, nonsignificant (and low) correlations have been found between four measures of creativity and self-actualization, the former operationalized with the Remote Associates Test (RAT), and the latter with the Personal Orientation Inventory (POI). The RAT may, however, be verbally biased. Moreover, its reliability was in the range between 0.51 and 0.67, which is marginal at best. Convergent validity coefficients were similarly marginal ($0.01 < r_s < 0.48$), which can be indicative of dubious construct validity. The point is that the lack of a relationship between creativity and self-actualization may reflect the measures employed.

Some researchers have operationalized creativity with the Torrance Tests of Creative Thinking (TTCT), which is quite

widely recognized as a reliable estimate of the potential for creative problem solving. Note the emphasis on potential; no test of divergent thinking guarantees actual creative performance. Divergent thinking tests are predictors rather than criteria of creativity. Note also the emphasis on problem solving. Some creativity may be more self-expression than problem solving – and this may be especially true of the creativity that is related to self-actualization. Creativity was also operationalized with the Similes Preference test.

Murphy and colleagues found that POI scores were significantly and positively correlated with the elaboration index from the TTCT. They did not provide the actual correlation coefficient, so it is impossible to really interpret the relationship. POI scores were unrelated to the originality fluency TTCT scores, and were unrelated to performances on the Similes test.

Mark Runco and colleagues suggested that the relationship between creativity and self-actualization could only be accurately assessed if creativity was operationalized in terms of personality and process. These reflect two common perspectives on creativity. The personality approach posits that there are core characteristics or traits that are functionally associated with creative behavior. The process orientation posits that creativity may not result in tangible products but should be understood as a perspective on life.

Maslow was explicit about the distinction between personality and product. In his words, SA creativeness stresses first the personality rather than its achievements, considering these achievements to be epiphenomena emitted by the personality and therefore secondary to it. It stresses characterological qualities like boldness, courage, freedom, spontaneity, perspicuity, integrity, self-acceptance, all of which make possible the kind of generalized SA creativeness, which expresses itself in the creative life, or the creative attitude, or the creative person. I have also stressed the expressive or Being quality of SA creativeness rather than its problem-solving or product making quality (1968, p. 145).

Maslow gave these traits when defining self-actualization: acceptance of self, others, and nature; detachment; a desire for privacy; autonomy; resistance to enculturation; problem-centering; and democratic character structure. Most of these are also characteristic of the creative personality.

In their research, Runco and colleagues used two well-respected measures of the creative personality: the How Do You Think Test (HDYT) and the Adjective Check List, which has a Creative Personality scale. They also administered the

Self-Actualization Scale (SAS). Four scores were derived from the HDYT responses, and each was significantly and positively correlated with the SAS scores. It thus appears that the relationship between creativity and self-actualization does indeed depend on the measures employed. Importantly, although the findings of Runco and colleagues were contrary to the other two empirical studies on this topic, the findings were consistent with the observations of Rogers and Maslow. This suggests that the findings are trustworthy because they were predicted first by theory and then confirmed with empirical tests.

Lynne Buckmaster and Gary Davis also reported a positive and significant correlation ($r=0.73$) between creativity and a measure of creative personality traits. In particular, Buckmaster and Davis uncovered a creativity factor that accounted for a significant portion of variance in an eight-factor factor analysis. This analysis included the Reflections of Self and Environment (ROSE) measure, which is a self-report focusing on self-actualization. There are two questions with this factor analysis: First, the creativity factor accounted for only 18.9% of the variance in the scores, perhaps because it was a fairly select sample of subjects. The subjects were all students in a creativity course. This may have restricted the range of scores. It was also a relatively young sample of subjects, which is an issue because self-actualization might require some experience and maturity. There is a debate in the psychological literature about the possibility of self-actualization in young persons. The second question concerned the ROSE index, which was more correlated with the creativity scores than it was with the POI scores ($r=0.26$).

The low correlation with the POI raises the issue of construct validity. Still, by and large these results were consistent with those of Runco and colleagues. Thus in the two studies that relied on personality measures a positive and significant correlation was found between creativity and self-actualization.

Runco and colleagues used the Adjective Check List. This is a self-report containing 300 adjectives. Respondents indicate which are self-descriptive. The vast majority of persons whose SAS scores were in the top 25% of the sample used these adjectives to describe themselves: Adventurous, Alert, Appreciative, Clever, Dependable, Friendly, Helpful, Honest, Loyal, Active, Adaptable, Capable, Easy-Going, Formal, Humorous, Intelligent, Interests Wide, Kind, and Mature. None of them described themselves as Commonplace, Conceited, Cruel, Despondent, Distrustful, Dull, Gloomy, Queer, Slipshod, Stolid, Sulky, Unintelligent, Unkind, or Unstable.

Creativity and Health

Both creativity and self-actualization are indicative of psychological health. As is the case with most signs of health, however, it is not easy to determine which comes first. It is possible that self-actualization allows the individual to be creative, or that the creative tendency supports self-actualization. It is also

possible that both are results of a third variable. This third variable might be the capacity for effective coping, adaptability, or intrapersonal intelligence. Recall here that Rogers said, in the quotation earlier, that self-actualization and creativity both reflect an underlying motivational force.

It does appear that some creative persons are not self-actualized. Some are certainly not healthy. In fact, creativity can be downright destructive. The dark side may be seen in creative but destructive discoveries and inventions, such as thermonuclear weapons, and in the not uncommon self-destructive behaviors of creative persons. This self-destruction may take the form of suicide or alcoholism.

Conclusions

There is evidence that creativity and self-actualization are related. This relationship follows from the theories of Carl Rogers and Abraham Maslow, and was apparent in both clinical observations and some correlational studies. As is the case with all correlations studies, however, there is some uncertainty about the direction of effect. Creativity may lead to self-actualization, or self-actualization may support creativity. They may both reflect a third variable, such as coping or adaptability. And neither guarantees the other. There are many cases of unhealthy creative persons. This is not much of a surprise, if we keep in mind that there are different ways to be creative. Some individuals are creative in their work, and some in their leisure. Some are creative when they solve problems; others are creative only when they are not threatened by problems.

Although some creative persons may be self-actualized, and that self-actualization may in fact be necessary for their creativity, other individuals may be creative without self-actualizing. Both creativity and self-actualization are multifaceted constructs, and this gives them any number of possible intersections.

See also: The Dark Side of Creativity; Divergent Thinking.

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Serendipity

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Glossary

Abductive reasoning The process of logical inference which intuitively connects seemingly unrelated facts, often leading to a hypothesis.

Creative contemplation The intentional, yet dispassionate, delivery of a conscious problem to the deep unconscious mind for creative processing (in Sanskrit, *sanyama*).

Determinism Theory that acts of will, natural occurrences, and psychological phenomena are causally determined by preceding events or natural laws.

Dual serendipity Serendipity and pseudoserendipity participate in the same discovery process.

Indeterminism Theory that certain acts of will, natural occurrences, psychological phenomena have no cause and therefore exhibit freedom and spontaneity.

Pseudoserendipity Discovery by accidental means of things sought for.

Quantum leap The discontinuous, very fast 'jump' of an electron from one energy level to another after a brief existence in a state of superposition.

Quantum uncertainty The boundaries of reality are determined by the limit of man's ability to observe, and measure, the universe at the quantum level.

Serendipity *Walpole* discovery by accidental means, and sagacity, of things not sought for.

Synchronicity *Jung* the simultaneous occurrence of two, or more, meaningful events that are not causally connected.

Origins

The term *serendipity* was coined by British writer and politician, Sir Horace Walpole, in a letter to his friend, Horace Mann, on January 28, 1754. Walpole shared, therein, his good fortune in discovering an old book with the Capello coat of arms, an emblem he sought to adorn the frame of a cherished painting, sent to him by Mann, of Bianca Capello, the Grand Duchess of Tuscany. Walpole refers to her as 'her serene highness.' Walpole attributes his luck to an uncanny ability of finding "everything I want *à point nommé* when I dip for it" (Horace Walpole, Wilmarth S. Lewis (ed.), 1960: 408). The phrase *à point nommé* means 'to be in the right place at the right time' and *dip* denotes his intention. Arthur Koestler called this type of discovery the *library angel*, a class of fortunate coincidences involving libraries, references, quotations, etc. Combs and Holland, in *Synchronicity: Science, Myth and the Trickster*, regarded such anomalies as examples of *synchronicity*, or meaningful coincidence, a term first used by Carl Jung in 1935. Walpole, however, likened his discovery to a new construct:

This discovery indeed is almost of that kind which I call *serendipity*, a very expressive word, which as I have nothing better to tell you, I shall endeavor to explain to you: you will understand it better by the derivation than by the definition. I once read a silly fairy tale, called *The Three Princes of Serendip*: as their highnesses travel, they were always making discoveries, by accidents and sagacity, of things they were not in quest of . . . (Walpole and Lewis, 1960: 408).

A careful reading of *The Three Princes of Serendip* illuminates the nature of serendipity and its relation to creativity. *Serendip* is an ancient Persian corruption (*sarandib*, *serendip*) of the Sanskrit *Sinhaladvipa*, a name for Sri Lanka (previously Ceylon). The tale cited by Walpole forms part of a collection by Christoforo Armeno published in Venice in 1557. In the tale, three loyal, academically adept princes are banished by their

father, King Giaffer, as a ruse to increase their worldly experience. While traveling, they are thrown to the vagaries of fate, encountering many unexpected challenges. They confront each challenge openly (apparently nonplussed with potential failure) and prove their worth through astute observation and sagacity. For example, one prince determined that a missing camel was blind in its right eye because grass was eaten only on the left side of the road where grass was less thick. Empathetic to a young queen's plight, another prince foiled a huge open hand which regularly emerged from the sea to drown her unwary subjects. The prince effectively countered its power with two outstretched fingers, a symbol of victory. His rationale was this: while the hand represented the power of five men to conquer the world, his two fingers demonstrated that two men are enough. The types of problems faced by the princes are similar to the insight problems utilized in creativity research. The princes' innate abilities matched the challenges they faced. Their desire to serve humanity, lack of self-consciousness and concern for failure, and an open undistracted focus on the moment invites a connection to Csikszentmihalyi's concept of flow, developed in 1996 to describe the psychology of discovery and invention. Serendipity, as depicted in the tale, integrates meaningful chance occurrences with creative intelligence, wisdom and an objective, almost serene, attitude toward constraints.

The Oxford English Dictionary, first to list the word, defines serendipity as "the faculty of making happy and unexpected discoveries by accident" (*The Oxford English Dictionary*, 2nd edn., 1989: 5). Serendipity has played an important role in many fundamental scientific discoveries such as Newton's universal law of gravitation, Archimedes principle, electromagnetism, dynamite, the Dead Sea scrolls, Teflon, cellophane, rayon, penicillin, X-rays, Velcro, bioelectricity, radioactivity, the microwave oven, and so forth. It is often characterized by unintentionality, accident and sagacity. Royston M. Roberts in

his book, *Serendipity: Accidental Discoveries in Science*, coined the term *pseudoserendipity* to differentiate true serendipity from accidental discoveries involving intention. In 1995, Diaz de Chumaceiro and Yaber suggested *dual serendipity* to describe the combined presence and absence of intention in a serendipitous event. As Walpole noted, there also appears to be an overlap with the construct of synchronicity which can also be intentional, or not. Since Walpole's conception, few empirical studies have been conducted on serendipity's creative origins largely because of its acausal nature, small sample sizes, the challenge of measuring intention and the need for an accurate taxonomy within the spectrum of meaningful coincidences. Most discussions on serendipity include examples, anecdotes and testimonials provided by serendipitous discoverers and/or their biographers. Consequently, many publications have applied case studies in an attempt to classify serendipity as discovery by accidental means with, or without, intention. The importance of sagacity has also been mentioned. This article has taken an alternate, more in-depth, approach to the phenomenon by presenting scientific theory and evidence stemming from closely related areas of study. It is hoped that some readers will be inspired to delve more profoundly into the phenomenon of serendipity which could eventually lead to new ways to empirically investigate it. To facilitate this, serendipity's overlap with synchronicity, its acausal, sagacious, and intentional attributes must be addressed.

Serendipity and Synchronicity

Meaningful coincidence is a broad description of unforeseen external events that elicit some benefit (or change) to the observer. Jung used the term *synchronicity* to describe this class of phenomena. Synchronicity has been associated with serendipitous occurrences such as Newton's apple and Archimedes's bathwater as well as a host of parapsychological phenomena including telepathy, precognition, retrocognition, remote viewing/healing, psychokinesis, and poltergeists. According to Jung's model, the external event and the inner state of the observer are not connected causally but by a mutual resonance of meaning called the *archetype*, a construct containing symbol or myth. Ira Progoff, in *Jung, Synchronicity, and Human Destiny*, suggested that emergents (a term Henri Bergson used to describe novel elements manifested in the process of evolution) include synchronistic coincidences emerging acausally from an individual's core creativity. Synchronistic events appear accidental or intrusive due to their acausal nature. Synchronicity, like serendipity, may be devoid of any apparent intentional element. Examples are parapraxes (e.g., slips of the tongue inviting reflection) and repetitive patterns (i.e., common themes, ideas, or events that tend to reoccur). In certain contexts, synchronicity complements an intention. Examples are library angels, remote viewing/healing, induced telepathy and telekinesis. Alan Vaughn in *Incredible Coincidence* notes that an interest in synchronicity increases synchronistic occurrences.

Synchronicity may be divided into two types (Types 1 and 2) based on the absence or presence of conscious intention, respectively. Synchronicity is therefore defined as two or more observations (i.e., measurements) of temporally synchronous, spatially separate, and apparently causally unrelated phenomena (an element(s) or state of the mind (P, e.g., archetype) and some

external event(s) (E)) that become entangled reflectively within a similar space of meaning (P(E)) and are either consciously sought for (Type 2), or not (Type 1). Entangled systems are spatially separate yet integrated within a single state without a specific time definition; that is, they are simultaneously linked. Synchronicity, though capable of challenging an observer's 'either/or' thinking, does not ensure originality or creative output.

Serendipity is historically construed to be devoid of conscious intention. The term has been modified by some researchers to interpret accidental discoveries associated with consciously directed problem finding and solving. Meaning found in serendipitous events, unlike synchronicity, is less immediate. It requires a special skill Walpole called *sagacity*. To better classify serendipity and clarify its overlap with synchronicity, an adaptation of the 1991 serendipity equations developed by Dias de Figueiredo and Campos is applied so that metaphor (herein called an operator) provides the mechanism for serendipitous discovery. An operator does not necessarily entail the deep resonance of Jung's archetypes. Serendipity is also characterized by the presence (Type 2), or absence (Type 1), of conscious intention. It is therefore defined as two or more observations (i.e., measurements) of temporally synchronous, spatially separate, and apparently causally unrelated phenomena (an element(s) or state of the mind (P₁, e.g., an initial problem) and some external event(s) (E)) whereby an operator (x) entangles with the external event (E(x)) providing a new space of meaning (P₂, e.g., new problem and/or solution) that is associated with P₁ and *consciously* sought for (Type 2), or *is not* associated with P₁ and *not consciously* sought for (Type 1).

Both serendipity and synchronicity involve observation; an apparently acausal, yet synchronous, relationship between inner and outer events in which informational boundaries are bridged; salience; and the presence, or absence, of intentionality depending on which type is evidenced. Serendipity, however, displays distinct differences: (a) the external event is acted upon by an operator which creatively alters or shifts, not merely influences or activates, the original problem space; (b) insight generates originality in finding a new problem, restating the initial problem and/or solving the initial problem in a new way. The term operator signifies that some instances of serendipity (more generally Type 2) are not metaphorical. They arise from false notions or additional observations about the initial problem (e.g., Christopher Columbus' belief he'd found a direct route to the Indies instead of the New World and Jacques Brandenberger's discovery of cellophane for food packaging after rethinking his viscose-coated, airtight, water-proof tablecloths, respectively). In 1994, Pek van Anandel listed what he called 17 basic serendipity patterns including analogy, observation, error, information alteration, inversion, false (or lacking) hypotheses, belief testing, interruption and disturbance, playfulness, jokes, and dreams of forgetfulness. Operators act through the dynamical nature of these patterns.

Alexander Fleming's discovery of penicillin in 1928 is often cited as Type 1 serendipity. Fleming was investigating antibacterial agents (P₁). He had cultures of *staphylococci* bacteria in his lab when, 1 day, he noticed a discarded culture had been contaminated with a rare *penicillium* mold from the hospital's mycology lab downstairs. The culture had unexpectedly developed an unusual growth pattern, eliminating the bacteria

(E(x)). Fleming was known to habitually pursue odd phenomena. He quickly realized penicillium's potential as an antiseptic agent (P₂). Through his initial efforts, and the persistence of others, the drug penicillin was proven an effective therapeutic agent in the field of antibiotics. Note that P₂, the new solution, is closely associated with both P₁ and Fleming's original intention to discover effective antibacterial agents. Fleming's discovery is actually an example of Type 2 serendipity.

On the other hand, Wilhelm Röntgen's discovery of X-rays, in 1895, exemplified Type 1 serendipity. While attempting to detect cathode rays from an evacuated glass tube fitted with a black cardboard sheath (P₁), he noticed that a distant cardboard screen coated with *barium platinocyanide* fluoresced with each discharge of the tube, regardless of which side of the screen the tube faced. The anomalous energy penetrated the black cardboard sheath and operated at distances beyond the effective range of cathode rays in air (E(x)). He realized that he was witnessing a new phenomenon. He later used it to record a skeletal image of his wife's hand on a photographic plate (P₂) confirming the existence of X-rays. Röntgen's discovery exemplifies Type 1 serendipity. He never intended to discover a new form of electromagnetic radiation and the problem (skeletal imaging) was original.

Meaningful coincidences fundamentally represent a creative self-world dynamic. Synchronicity reconnects the self with the world via a mutual resonance that redefines, or enlarges, the sense of self. This resonance is meaningful (though not necessarily pleasant) and therefore not perceived as being in error. In 2002, Rita Durant suggested that synchronicity can act as a destabilizing mechanism which blurs, or even threatens, the essential distinction between self and world. Such psychological border conditions could result in creative insight. Serendipity, alternatively, defies an observer's knowledge by disconnecting an existing articulation of self and world by the appearance of an anomaly or error, and then challenges the self to reconnect to the world in a new meaningful way. The disarticulated event in conjunction with an operator, and insight, becomes the foundation for new associations. Albert Rothenburg, in 1988, preferred the terms *articulation of error* and *conversion of error* in describing these discrepancies in order to differentiate serendipitous events from other meaningful coincidences. He attempted to put serendipity on a more solid scientific foundation by replacing chance with the less ambiguous word, 'error.' Chance, however, is considered by many researchers as an important element of creativity.

Chance and Creativity

In 1981, Francis Crick, codiscoverer of the DNA structure, said "chance is the only source of true novelty" (Francis Crick, 1981: 58). Chance is derived from the old French *cheance* which described the accidental falling of dice. In modern usage, chance denotes the absence of cause in events that are predicted, understood, or controlled; or the probability of an event occurring. There are two fundamental approaches to understanding acausal events: (1) the event is deterministic but individuals lack the 'all-seeing' purview required to delineate the complex causal patterns involved; and (2) the event is purely indeterministic, or stochastic by nature.

The Deterministic View

Classical (traditional) physics is deterministic. It includes Newton's laws of motion, classical electrodynamics, thermodynamics, the special theory of relativity, the general theory of relativity, chaos theory, and nonlinear dynamics, etc. Some of the systems described by these laws are highly complex (e.g., weather patterns) and difficult to predict in practice. However, if initial conditions are known in sufficient detail, the random output of such systems becomes predictable. In 1996, Tobi Zausner described creativity as a chaotic or nonlinear dynamical system (NDS). She proposed that creativity, like chaotic processes:

- systematically dissipates information and energy;
- fosters open exchange between an individual and the environment, knowledge domain, social and political structure, culture, etc.;
- iterates in the development of ideas;
- is time irreversible;
- adapts and self-organizes into creative expressions or products;
- is autocatalytic via positive feedback loops involving reward;
- allows bifurcation of ideas and processes, and;
- exhibits far-from equilibrium conditions especially during periods of inspiration.

Perhaps, the most important component of NDS is sensitivity to initial conditions, often referred to as the 'butterfly effect.' This effect manifests as an exponential growth of error causing a system to behave as though it were random. Tiny differences in the systems' initial state result in enormous changes in its final state (even over small timescales) giving the impression of random behavior. The butterfly effect involves a unique confluence of space-time events. The butterfly, in fact, doesn't initiate a storm on the other side of the planet. It's simply 'in the right place at the right time.' Its wing motion is integral to an underlying pattern which actualizes the complex escalation in weather patterns. Walpole's *à point nommé* becomes no simple matter. Chance discovery, from a chaos perspective, is deterministically subject to initial conditions, yet unpredictable. Creativity exhibits unpredictability most remarkably in the timing of insights and in the nature of their content. Serendipitous discovery is externally unpredictable in the emergence of random events that elicit insight.

In 1984, Prigogine and Stengers noted that far from reaching equilibrium, nonlinear systems become exquisitely sensitive to variable changes. This phenomenon also appears in creative individuals. In 1996, Martindale and others observed that creative individuals are significantly more sensitive to physiological stimuli, habituate more slowly, and remain alert to incoming stimuli even after developing a cortical model for them. Similarly, scientists who make serendipitous discoveries are sensitive to random variations in their environment and are capable of suspending focus on an initial problem to explore alternate routes of investigation. They exhibit opportunism in the recruitment of chance permutations. Chance-related opportunity is minimized in areas bearing well-established principles from which specific results can be deduced. It is maximized where the frontier of knowledge is wide open and phenomenological causes are hidden. In 2003, James Austin suggested that

serendipitous chance is enhanced by acute observation and sagacity as well as variability due to increased physical mobility (e.g., the traveling princes) and unique, or individualized, motor behavior corresponding precisely to the external environment in ways that allow for unusual approaches and favorable circumstances in discovery.

In 2004 Simonton, using Darwin's biological evolution model, proposed that the acausal nature of serendipity arises from an 'as if' blind combinatorial process. This quasi-stochastic element results from the unpredictability of spontaneous combinations in a rich environment of cross-connections among a diversity of simultaneous projects and professional/recreational behaviors which, in themselves, represent serendipitous effects. Serendipity is spontaneous but not accidental. It depends on the quantity of combinations within a given time period, combinations that are at some level causally linked. Simonton further hypothesizes that creative chaos in the conscious mind pales in comparison to the multiplicity of unconscious creative thought processes which are highly fertile ground for serendipitous effects. When openness to 'irrelevant' phenomena produces manifold associations leading to one original solution, that solution's probability of occurrence is exceedingly low with respect to the total number of unconscious and transient thoughts that induced it. This implies that serendipitous effects in the conscious mind are significantly lower than those in the unconscious mind. In the deterministic perspective, chance is due to 'hidden variables' and a fundamental ignorance of causality. Unconscious processes are important hidden factors. This model, however, relegates choice (and therefore creative decisions) to those same natural processes.

Similar to the evolutionary model, computer scientists for over 20 years have explored implementing a background of subtle agents for randomly searching, browsing, playing with, and filtering interesting information in order to duplicate serendipity-like chance. In 2009, André Schraefel and others noted that in one study, 21% of all potentially serendipitous web search results were found interesting but irrelevant to the user's original query. They proposed using background recommender systems to provide interesting, personalized information which is unknown and unexpected. However, support for human insight, and sagacity, is a greater challenge. To elicit insight, they suggest that computers track user's existing domain knowledge and offer opportunities for extending it by highlighting knowledge gaps and offering collaborative cross-fertilization with other domains under a common language. This does not mean that the user will recognize a meaningful coincidence and make a discovery. The mechanisms proposed by this computational approach are also deterministic. Perhaps the foremost hidden variable lies in the design of the system itself.

The Indeterministic View

Quantum mechanics, a form of indeterminism, has demonstrated classical physics to be fundamentally flawed. Heisenberg's uncertainty principle provides evidence for the pure stochastic nature of both micro- and macroscopic phenomena. In quantum physics, initial conditions cannot be known with certainty because the initial conditions of any system (NDS for example) stem from immeasurably minute fluctuations in a

long causal chain which is traceable to the earliest phases of the universe, where quantum uncertainty reigned. Quantum physicists declare that radioactive decay and the movement of elementary particles are also completely random. Since macroscopic phenomena are composed of elementary particles, randomness is an intrinsic aspect of all observed reality. In 2000, Evan Harris Walker compared macroscopic reality's dependence on the uncertainty principle to a game of dice. If a die's velocity, direction, angular momentum, point of impact and orientation angle on impact is exactly known, classical physics can exactly determine its motion. However, the uncertainty principle puts a limit on the precision of calculating complementary physical components. Both the velocity of the die and its position cannot be known exactly; neither can its angular velocity and orientation on impact. Its future motion can only be represented by a smeared-out state of probabilities falling within these uncertainties. Furthermore, uncertainty escalates with each bounce of the die. The die formally exists as a linear superposition of states (all orientations at once). Observation is what keeps the die in one position over another. In short, quantum randomness, or pure chance, is affected by an observer's choice. Schrödinger's cat, a famous thought experiment in which a cat's survival within a closed box is indeterminate prior to opening the box, is another example of this principle.

Einstein was frustrated by quantum uncertainty. He once declared that 'God does not play dice.' In 2006, quantum teleportation investigator, Anton Zeilinger disagreed. While commenting on nature's freedom, he said, "It is so random that not even God knows the answer" (Anton Zeilinger, Interview, 16 February 2006: 8). These diametrically opposed positions are not yet resolved. Quantum mechanics, however, using probabilistic formulations, is the most precise measurement system known to man. It allowed for innovations like the laser, transistors (e.g., basic components of CPUs), and magnetic resonance imaging. It also underlies quantum computer development. In 2006, Rosenblum and Kuttner said that the enigma of quantum physics rests in juxtaposing its empirical accuracy with the measurer's consciousness affecting measurement, a 'minor point' most working physicists choose to ignore. Quantum physics challenges our concepts of time, chance and the separation of self and world. Its view of nature appears to resonate with unusual phenomena like synchronicity and serendipity (especially Type 2).

Amit Goswami, in his book *Quantum Creativity*, connects what Michael Polanyi, in 1998, referred to as the 'logical gap' arising at the actual moment of creative illumination and the discontinuity of nature at the quantum level described by the quantum leap. Quantum leaps occur in atoms when electrons jump instantaneously from one energy level to another much like the discontinuous leaps found in creative insights. Between quantum leaps, electrons exist as infinitude of probabilities similar to the ambiguity that permits divergent thinking. Ambiguity in creativity may actually stem from subconscious awareness of indeterministic, noisy neuronal processes.

Another chance-related quantum phenomenon is nonlocality, or entanglement. Entanglement occurs when the common state of particles, after interaction, is not the product of their individual states, regardless of the distance between them. Alterations to the property of one particle influence,

instantaneously, its entangled partner. Because there is no apparent cause, quantum events appear random. This implies at the macro level that humans, as products of the Big Bang, are basically, variously, and instantaneously interconnected with the entire universe. Their actions don't have random consequences. Theorists like Roger Penrose, Henry Stapp, and Evan Harris Walker propose that the micro universe of the brain acts in the neuronal synapse like a quantum computer, giving it more computational power than previously imagined. Goswami, blending both universes posits that creativity is enhanced through greater awareness of the interconnectivity between self and world.

Unlike the deterministic approach where chance is fundamentally nonexistent, quantum physics suggests that all information past, present, and future exists in a superpositioned, or coherent, state and that the emergence of a new association is dependent upon some form of 'observation' on the part of nature. Barring Hugh Everett's 'many-worlds' interpretation where all space-time trajectories exist with equal certainty in multiple dimensions (e.g., simultaneous different solutions for one life), the basic uncertainty in nature allows for free choice, placing creativity at the very core of consciousness. Furthermore, quantum entanglement does not discount the possibility that conscious, perhaps unconscious, choices influence 'objective' reality to synchronize meaningfully with the individual. The range of influence, however, is limited by the general theory of relativity to the speed of light thereby 'localizing' empirical observation. It takes about 77 ms for information traveling at light speed to circuit half the globe, less than the time it takes to process a thought. In the quantum view, 'chance,' as an acausal property of the observer's capacity for choice, supports creative insight through the entanglement of many nonlocal, nonapparent associations. Chance, in the indeterministic perspective, suggests that phenomena like synchronicity and serendipity are emergent properties of the consciousness relationship between the creative individual and the world, whereby one profoundly reflects the other.

Sagacity and the Prepared Mind

During a lecture delivered in 1854, Louis Pasteur said, "In the fields of observation, chance favors only the prepared mind" (Louis Pasteur, Lecture University of Lille, 7 December 1854). The history of scientific discovery is full of examples of what were missed serendipitous opportunities by the final discoverer's predecessors including the discovery of fission, the role of vitamin C in scurvy, DNA, penicillin, and X-rays. Besides extensive domain knowledge, language ability and capacity for logical, critical, and convergent thinking comprised of analysis, synthesis, planning, deduction, induction, memorization, etc., the scientifically creative mind exhibits some special attributes.

Since J. P. Guilford's 1950 address to the American Psychological Association in support of creativity research, researchers have discovered many characteristics of the creative mind that may enhance serendipitous effects including divergent thinking as mental fluency (generate many ideas), flexibility (generate multiple categories of ideas), and originality;

orientation toward novelty; imagination; flat associative hierarchies; capacity for remote associations; openness to experience; cognitive playfulness; curiosity and questioning; ranging interests; tolerance for ambiguity; sensitivity to external stimuli and nuance (more prevalent in artists); empathy; intuition and insightful thinking.

In 2007, Horan proposed that the preparation and verification phases of Graham Wallas' creative process depend on intelligence and the discrimination to recognize, evaluate, and manipulate information, ideas, and constraints while incubation and illumination phases depend on dispassion, motivation, and the capacity to transcend those constraints. Creativity's basic predisposition is to challenge/extend boundaries and overcome limitations, or what David Perkins, in 1988, called 'boundary fiddling.' This attribute takes effort, perseverance, and the willingness to take risks. In 1992, Rubenson and Runco postulated that experienced researchers who are unwilling to entertain new perspectives but expend energy on defending previous achievements may be adverse to the psychic risk of having their previous achievements devalued or invalidated. Assuming this is correct, the capacity for serendipitous discovery, among this group, would be minimized even though serendipitous events do occur.

From a reasoning perspective, serendipitous discovery differs from knowledge discovery because knowledge discovery extracts certain patterns from data while serendipitous discovery predicts future outcomes from a multitude of possible outcomes. Not everyone is adept at prediction. The science of economics provides many good examples. By 1976, executives from most major Hollywood film studios had rejected *Star Wars* saying that science fiction films were unmarketable; in 1943, Thomas Watson, the chairman of IBM predicted a world market of only five computers while in 1970, Ken Olsen, founder of Digital Equipment Corporation reportedly said there is no market for personalized home computers. Alan Ladd (CEO of 20th Century Fox) and Bill Gates (CEO of Microsoft) looked at alternate possibilities, successfully.

Serendipitous discovery challenges both inductive and deductive reasoning because both are limited to present and/or past information. While inductive reasoning determines a value, deductive reasoning formulates the consequences of a hypothesis. Neither guarantees accurate predictions in an ambiguous environment. In 1965, Charles Sanders Pierce, proposed that creativity arises from abductive reasoning defined as a logical process used in the formation of explanatory hypotheses and the introduction of new ideas. Serendipitous discovery is abductive. It requires creative, insightful thinking. In *The Three Princes of Serendip*, some of the princes' insights were likely inductive (e.g., blind camel) while others (e.g., the open hand) were abductive by virtue of their multipotential outcomes.

Creativity researchers use insight problems like the nine-dot problem to assess creativity. There is doubt over the efficacy of this approach because solutions already exist though they are peripheral to results generated by common problem-solving approaches. Real-world creativity, and therefore serendipity, does not have this luxury. Walpole described the three princes as being sagacious. In 2003, Robert Sternberg observed that sagacity, or wisdom, though correlated with creativity, has a closer affinity with intelligence. Citing King Solomon's clever determination of a child's real mother, he suggested that wise

solutions to problems often require creativity when they lack obviousness. While routine problems utilize common sense, wisdom problems embody novelty by presenting new features not evident in old problems.

Sagacity, not routine problem solving, decides serendipitous discovery. In hindsight, sagacious solutions may appear as the only possible solutions derivable from the data. Progress in science has shown repeatedly that this is not a truism. Until the early 1900s, Newton's clockwork universe was the prevalent paradigm in physics, though Newton doubted its completeness. Einstein shifted Newton's paradigm with his general theory of relativity. Soon after, the foundations of classical physics were disputed by quantum mechanics.

Whereas synchronicity appears to be ubiquitous, reports of serendipitous discovery are notably absent in the fine arts, except for rare examples like Picasso's serendipitous decision to enter a blue period. This observation helps to highlight an important aspect of the scientifically prepared mind and its relation to sagacious insight; that is, the requirement of objectivity. Kantorovich (1993) suggested that whereas scientists and inventors are constrained by observational data which must conform to the natural world, experimental results and the zeitgeist (spirit of the times); art is constrained solely by the zeitgeist.

Scientists' creative problem solving is channeled into solutions that exhibit consensual validity, or objective efficacy, within a specific domain. To achieve this, problems must be falsifiable and solutions tested and retested until their objective merit is suitably proven. Serendipitous discovery in science, similarly, is distinguished by the objectivity that scientists labor under. Objectivity, implied in Walpole's concept of serendipity, is a combination of *serene* detachment and the ability to investigate (or *dip* into) phenomena. In the art domain, serendipitous discovery is accepted as part of the artist's natural exploration of a particular creative space in the development of new forms of subjective expression. In this regard, it is not surprising that the most highly reported serendipitous discoveries are those in which solutions significantly impact humanity's more utilitarian needs.

Creative Intention

In 1999, Conti and Amabile proposed that creativity is motivated by psychic conflict or self-actualization. Psychic conflict is prevalent in individuals suffering from mental disturbances such as bipolar disorder or affective illness. Creative expression is effective in channeling anxiety induced by psychic conflict in some individuals. Self-actualization, alternatively, is evident in individuals pursuing important problems, often of a humanistic nature. In both cases, the primary drive is to overcome limitations. Whereas psychic conflict diminishes a premature, perhaps conventional, sense of psychological closure (and satisfaction) thereby fostering new avenues of thought, self-actualization sensitizes individuals to existing boundary conditions inspiring attainment of individuals' full potential.

In 2007, Horan addressed both factors by describing creativity as the "manifestation of the intention to transcend the limitations of information" (Roy Horan, 2007: 182). It would seem that simply having an intention (motivation) to solve

a problem creatively does not preclude creative output. Intention must be supported by a prepared mind, genetics, personality, education, family, zeitgeist, etc. The proclivity, however, to display creative intention involves some, if not all, of all these factors. Combs and Holland noted increased reports of synchronicity induced by psychic conflict (boundary conditions) and self-actualizing practices like meditation. The relationship between intention, synchronicity, serendipity, and other meaningful coincidences has not been adequately investigated.

Serendipity is divided into two types according to the existence, or absence, of conscious intention. What is less obvious in this taxonomy is that intentions can be conscious and/or unconscious. Sometimes these intention levels may conflict. For example, parapraes occur when unconscious intent surfaces unexpectedly during situations where conscious intent is otherwise oriented.

Poincaré, Pauling, and others have attested to unconscious processing during creative incubation. In 1985, Oakley and Eames cited neuropsychological studies of unconscious information processing being reflected in behavior. In 1998, Baars indicated that the unconscious mind's capacity for processing information exceeds the conscious mind. Volition is an important element in both conscious and unconscious processes. In 1925, William James described volition as "nothing but attention" (William James, 1983: 424). Posner (1994) stated that attention appears at all levels of information processing including consciously directed, sustained attention. In 2001, John Taylor indicated that subconscious goal-directed attention is woven into perspectivalness, the sense of having a point of view. Therefore attention (intention) is, at all levels, a form of choice.

In 1987, Yaniv and Meyer proposed that unsuccessful attempts at problem solving activates memory traces relevant to a solution, but when attention is engaged elsewhere the activation process sensitizes the individual to chance encounters with external stimuli that are further integrated into trace information. This mechanism reflects the common experience of 'keeping a problem on the backburner' (incubation) while unconsciously seeking appropriate solution stimuli. If incubation is sustained, the chance of relevant stimuli appearing increases. This may also account for how apparently random external stimuli found in serendipitous events react with unconscious attentional processes to induce insight. For example, if sustained, perhaps lifelong, unconscious intentions like discovering the nature of reality, its underlying physical principles, or developing innovative products exists simultaneously with specific intentions like testing a radio-telescope antennae (e.g., cosmic background radiation leads to the Big Bang theory), deducing why the moon remains in orbit (e.g., falling apple leads to the universal theory of gravitation), or testing a magnetron for radar sets (e.g., melted candy bar leads to invention of the microwave oven), those unconscious intentions could conceivably direct an individual's awareness, and curiosity, toward the investigation of unusual phenomena.

The more poignant question, perhaps, is: Can unconscious intentions influence the seemingly random events involved in serendipitous discovery? In *The Intention Experiment*, Lynne McTaggart reviewed a considerable amount of serious research

on parapsychological phenomena. She noted that intention can have a nonlocal/nonrandom influence on biological systems and random event generators (REGs – electronic devices driven by quantum fluctuations). The effect sizes, over many studies and trials, were significant though generally quite small. Effects also tended to decline over time.

In 2007, von Lucadou and others provided empirical evidence that: (a) the decline in effect size is balanced by an acausal displacement toward noncomparable variables; that is, other apparently unintended phenomena are affected by the original intention; (b) the process does not involve any known form of signal transfer; and (c) individuals with innovative behavior, though less motivated than other subjects to participate in a REG experiment, demonstrated an increase in nonrandom effects. Results imply that creatives may naturally induce meaningful coincidences.

Empirical confirmation of this phenomenon may be feasible via nontraditional experimental designs. Though the exact mechanisms of these intentional influences are presently unknown, and often contested, unconscious processing is suspected. The larger effects in most of these studies are attributed to mindfulness and the ability to 'let go,' or surrender, conscious intention to a greater, universal sense of self. Creative individuals often describe this process as consciously 'letting go' of unresolved problems in order to solve them unconsciously. In 2009, Horan posited that the process of surrender is part of a neuropsychological phenomenon he terms *creative contemplation*, a practice with ancient roots in some meditative traditions. Creative contemplation extends the sense of self by temporarily dissolving the self-other dichotomy. Creative contemplation doesn't limit new associations to weak or non-existent neural connections within the brain; it expands its associational influence into external reality 'as if' there were no difference between self (brain) and other (world). Horan suggested that this transcendent-integrative connection is attentional (intentional) in nature and exists in higher creativity and certain meditative states.

Chaos models could account for an intention's apparently discontinuous, acausal influence on the physical world if it operated (consciously and/or unconsciously) as a strange attractor, a fractal entity which evolves over time and incorporates self-world information into new emergent patterns. A fractal structure could potentially give serendipity (and synchronicity) an appearance of discontinuity or acausality. Intention, as an attractor, would be subjected to natural evolutionary processes both within and outside the brain. It must compete with other intentions, and noise, thereby making the overall self-world connection effect quite small. Though serendipity and synchronicity have noticeably small effect sizes, they could conceivably be magnified over time through persistent creative effort.

Another interpretation of intention's potential effect on space-time events was suggested by the work of David Bohm. In 1980, he posited the implicate order, a deep universal structure in constant flux from which space-time, quantum, and classical events emerge like vortices in a stream (the explicate order) and wherein no sustainable distinction between thought and matter exists. Bohm's implicate order parallels Jung's collective unconscious consisting of subtle archetypes, or psychic behavior patterns, embedded in the universal mind as themes or images which are mirrored in external reality via

physical processes in the brain. Archetypes, like intentions, carry psychophysiological energy and may trigger, or be triggered by, synchronistic events. They provide the alphabet of metaphor and comprise the symbolic relationships found in dreams, myths, legends, cultural icons, and much serendipitous discovery.

Bohm's theory did not receive much acceptance in the physics community. His ideas did highlight the fact that physicists get different statistical results each time an atom is measured, suggesting some additional process is at work. Walker, using information theory, proposed that human will capacity, estimated at 60 000 bits per second, acts not only directly on the physical body but nonlocally on external physical reality. He calculated that will's influence is small within the brain due to a low signal-to-noise ratio which disallows most individuals from distinguishing will from other thought processes in the brain. Consequently, individuals don't experience a complete efficacy of will.

In 2004, Stapp proposed a mechanism for the mind's ability to alter physical reality called the Quantum Zeno Effect, a confirmed physical effect demonstrating the influence of high-frequency repetitive attentional states on the physical state of an atom. Stapp's theory divides mind and matter according to John von Neumann's quantum interpretation in which the choice of question physically affects the system being addressed.

The main contention with a quantum interpretation of a serendipity effect is decoherence, nature's tendency toward closure. In the complex, thermal/chemical fluctuating environment of the brain, quantum coherence is so fleeting and extremely localized that any potential effect in the brain (much less externally) is canceled. What is overlooked in decoherence theory is that thermal/chemical fluctuations themselves are indeterminate quantum processes. Rosenblum and Kuttner also remind us that decoherence is the probability of what one might expect, or find, not what actually exists in physical reality. Consciousness becomes unavoidable.

In 2009, Ryser posited that even if individuals could intentionally manipulate the indeterminacy of their brains and bodies, the indeterminacy of external reality is influenced solely by the universal mind. This concept corresponds with both historical accounts of paradigm-shifting creativity arising from the universal mind of God and modern research on the power of intentional surrender to influence physical reality. If unconscious intention can influence incubation and illumination as well as apparently random occurrences of meaningful external events, then the presence or absence of conscious intention may not be the distinguishing factor in serendipity, or in its relation to synchronicity. What may uniquely identify serendipity is the creation of new meaning by operator-induced insight and sagacity.

Conclusion

Walpole's legacy continues to intrigue the scientific community. A careful reading of his letter to Mann and the tale of the *Three Princes of Serendip*, sheds further light on the phenomenon of serendipity and its relation to other meaningful coincidences like synchronicity. Whether serendipitous chance is considered determinate as in chaos theory or indeterminate as

in quantum theory, the consensus is that nothing about serendipity is truly accidental. From the deterministic perspective, hidden variables within nature are involved while in the quantum view, the consciousness of the observer influences serendipitous chance. The sagacious, creatively prepared mind, acting via an operator allows for insight to occur. This process is a form of abduction. Scientists who experience serendipitous discovery, are not only sagacious and creative, the constraint of objectivity permits them to investigate unusual phenomena free of preconceived notions whereas artists tend to incorporate serendipity as part of their subjective expression. The role of conscious intention in differentiating types of serendipitous discovery and its relation to synchronicity is challenged by the possibility of unconscious creative intention influencing the manifestation and interpretation of apparently random meaningful events.

See also: Attention; David Bohm 1917–1992; Chaos Theory and Creativity; Divergent Thinking; Flow and Optimal Experience; Incubation; Insight; Jungian Theory; Logic and Reasoning; Metaphors; Mindfulness; Motivation; Pablo Picasso 1881–1973; Self-Actualization; Synchronicity and Creativity; Unconscious; Zeitgeist; Zen.

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Anne Sexton 1928–1974

Poet

Author of *To Bedlam Part Way Back* (1960), *All My Pretty Ones* (1962), *Selected Poems* (1964), *Live or Die* (1966), *Love Poems* (1969), *Mercy Street* (1969), *Transformations* (1971), *The Book of Folly* (1972), *The Death Notebooks* (1974), *The Awful Rowing Toward God* (1975), *45 Mercy Street* (1976), *Words for Dr. Y* (1978), *Collected Poems* (1981), *Selected Poems* (1988)

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Anne Sexton in Library. Used with permission from CORBIS/Bettmann.

With a high school diploma in one hand and no college degree in the other, ANNE SEXTON became one of the most famous and respected contemporary poets of her time. She began writing poetry in 1956 after watching a lecture on television about writing a sonnet. She propped up a typewriter and confidently began to write. From then on, Dr. Martin Orne, with whom she had just started psychiatric treatment following a suicide attempt, cultivated her identity as a poet as a way of recovering from the emotional instability that had led her to attempt suicide. Soon she would bring dozens of poems into her therapy sessions where she obtained the strength and encouragement she had lacked in her upbringing. Throughout her lifetime, Sexton received accolades from the most prestigious universities in the world such as honorary doctorates and Phi Beta Kappa keys from Harvard, Radcliffe, Tufts, and many more. She was praised by a myriad of literary societies including the most notable—the Pulitzer Prize for her book *Live or Die*. She received travel grants, Radcliffe fellowships, and eventually became a regular instructor at Boston University—an accomplishment she was very proud of. She performed and read her poetry at readings all over the United States and England. Sexton spoke before Auden in a British event and with the most noted poets of her day. She took workshops with Robert Lowell, W. D. Snodgrass and John Holmes; and she was privately tutored by notable mentors. She had her own musical group backing up her rhymes, called *Anne Sexton and Her Kind*. When she took her life in 1974, Sexton was only 45 years old. A previously scheduled reading at Town Hall in New York City turned into a memorial service for the poet. In her eulogy, Adrienne Rich said, “We have had enough suicidal women poets, enough suicidal women, enough

self-destructiveness as the sole form of violence permitted to women.” Later, Denise Levertov wrote the Boston Globe’s obituary of Sexton: “Anne Sexton’s tragedy will not be without influence in the tragedies of our lives. We who are alive must make clear, as she could not, the distinction between creativity and self-destruction. The tendency to confuse the two has claimed too many victims.”

Childhood

Anne Gray Harvey was born on November 9, 1928, in Newton Massachusetts. She was the third of three girls; Jane was born in 1923 and Blanche was born in 1925. Her parents were Ralph and Mary Gray Staples Harvey, whom biographer Diane Wood Middlebrook described as a couple “out of a Scott Fitzgerald novel.” They lived life at the fullest in the height of the roaring 1920s. Anne’s father, Ralph was a successful businessman in the wool industry and traveled extensively.

Later when Anne would meet her husband Kayo, he too would work in the wool business and spend many days traveling—a separation that was devastating for Anne. Ralph had but one sibling, a sister named Frances. Interestingly enough, Frances tried to commit suicide when she was in her twenties. She eventually married and lived a normal life with her husband on their horse farm. But in 1975, a year after Anne had taken her own life, Frances shot herself to death at the age of 69. Middlebrook noted that Anne’s own suicide had affected Frances profoundly. Anne’s mother, Mary Gray Staples, was an only child and, as such, was raised as a little princess. She came from a prominent and popular family. As the only daughter, Mary Gray was very close to her father, Arthur Gray Staples, whom everyone called AGS.

While Anne was growing up she and her sisters did not form strong emotional ties with one another, probably because they were constantly competing for their parents’ attention. Growing up, the eldest, Jane, was Ralph Harvey’s favorite. Blanche, on the other hand, was recognized as the studious one in the family. She was the only one who went to college and who had a stable life. Tragically, Jane and Anne would both commit suicide during middle age.

As the baby of the family, Anne loved to be cuddled. She recalled feeling very lonely as a child. Family life was formal. The “girls,” as they were commonly called, had to be formally

dressed and ready to entertain at any time. Ralph and Mary Gray led a self-serving and self-absorbed life, full of parties, drinking and excessiveness. It did not help matters that Anne was fidgety, messy, and loud. She hated mealtimes and would often take her food to her bedroom. Her physical appearance and attire did not meet Ralph's demanding and impeccable expectations. She was a chatterbox and very active.

Some of Anne's happiest times were spent on Squirrel Island during the summers when the family would vacation there. It was during this time that Anne was nurtured by the women in her family other than her own mother. Her favorite great aunt was Anna Ladd Dingley, whom she called Nana. They became very close. When Anne was 12, AGS died and the houses on the island were sold. Thus, the summers at Squirrel Island ended. During this time also, Anne's parents' drinking became worse, especially her father's drinking. Their behavior was unpredictable. They could be sweet at times, but at other times they would lash out in a rage. But it was her father's drinking that most seemed to affect Anne. He was like Dr. Jekyll and Mr. Hyde. One moment he could be very attentive. At other times he would insult Anne by telling her she disgusted him with her acne scars. Nana actually came to live with the Sexton's when Anne was eleven. In 1940 Anne had a severe constipation problem and was hospitalized at the Lahey Clinic. Anne later told her therapist that this was a traumatic time because her mother had threatened to take her for a colostomy if she did not make an effort to put an end to her elimination problems.

It was also during this time that Mary Gray was away from home a lot taking care of her dying father. At some point, someone suggested that Anne be taken for psychological evaluation—probably as a response to her elimination problems and to her problems at school. But her parents ignored this suggestion. As usual, her parents displayed more interest in keeping up with their social activities rather than attending to the needs of their children.

When Anne was 13, she became interested in boys and would spend more and more time on the phone and out with her friends. This meant less time spent with Nana. One day, Nana's ear closed up and she became disoriented. She eventually was taken to a mental hospital for shock treatment.

By this time, Anne was fifteen. Her grandfather Louis Harvey had a second nervous breakdown and Ralph, Anne's father, was drinking heavily. Mary Gray spent a great deal of time trying to hide her husband's problem. Finally in 1944, Nana was taken to live in a nursing home and she eventually died in 1954 when she was 86 years old. Anne would mark the departure of Nana for the rest of her life—feeling guilty that it had been her fault, that Nana got sick because she had abandoned her. This perspective was Anne's way of showing loyalty toward Nana. This guilt would resurface when Anne herself would become a mother.

Adolescence

Although in adulthood Anne recalled her adolescence as painful and uneventful, much information suggests otherwise. She had a couple of early relationships with boys that she recorded in her scrapbooks. Her first kiss came from Michael Bearpark who would later become a psychiatrist and see Anne again in

the early 1960s during one of her visits to England. Although this first kiss was special, it would also be associated with Nana's breakdown in Anne's memory. So the kiss was also associated with betrayal. Her other good friend from adolescence was Richard Sherwood. She later ran into him while on honeymoon with Kayo in Virginia Beach. Sherwood recalls Anne as being fun to be with and very talkative. When he saw Anne again with Kayo, he remembered how happy and full of sexual energy they were.

During the eighth grade, Anne had a steady boyfriend, Jack McCarthy. He was very much liked by Mary Gray and Sherwood and they hoped that she would eventually marry him. McCarthy remembered Anne as an extraordinary person—open about her feelings and energetic. They socialized a great deal and Anne was very flirtatious with other boys around him. Although McCarthy remembered Anne as pretty normal he did recall one incident that he found somewhat disturbing. One night, the couple had a date to go sledding behind Anne's house. McCarthy was late, but when he arrived at the house, Anne was not there. He found her at the bottom of the hill unconscious and bleeding. When he brought her inside the house, he realized that the blood was Mercurochrome and that she had faked passing out. She had dramatized her own death and rationalized it by telling him that it was a good joke on him. Early on, Anne displayed an obsessive curiosity with death. This incident marked the beginning of a long trail of experiments with death.

During her teens, Anne was seen as "boy-crazed." So her parents sent her to Rogers Hall, a boarding school. Again, while Anne would recall a lonely past, her yearbook portrayed a normal and even popular teenager. She was captain of the cheerleaders and was on the swimming and basketball teams. Most important, she directed a school play and starred in all the others. It appears that it was here at Rogers Hall that poetic seeds were planted in Anne's memory that would later save and serve her. She even published some of her poetry in the school's literary magazine called *Splinters*.

Early Writings

But it also seemed that early on in her life, her parents did not encourage her writing abilities. The first episode that scarred Anne for life was when her mother investigated the originality of one of her poems. The poem was going to be published in the school's yearbook. Prior to this, Anne's sister Jane had plagiarized and one of Anne's friends had been expelled from school for doing the same thing. Mary Gray, distrustful that her daughter Anne was also plagiarizing, sent the poem to a professor in New York for validation. The professor said that it looked like an original piece and that it showed a lot of promise. Anne was devastated and discontinued writing poetry for the next 10 years. It was clear from the scrapbooks that Anne kept during her high school years that she was expected only to find a husband and not to achieve academic success. Later on when Anne started publishing her first poems, she thought again about becoming the writer in the family. Her mother, Mary Gray, had the reputation of being the family writer—a reputation which perhaps led her to envy her daughter's achievements in high school. But Mary Gray was no writer.

Anne's second great parental disappointment came when she published poetry in the *Christian Science Monitor* and her father compared her writing to that of Mary Gray's. He said that the "girls" were creative, but that Mary Gray was brilliant.

Marriage and Motherhood

In May of 1948, while planning her wedding to a young man, Anne met Alfred Muller Sexton II, better known as Kayo. Three months later, the couple eloped. They married on August 16 in Sunbury, North Carolina and honeymooned on Virginia Beach. Kayo came from a wealthy Bostonian family. His parents were George Sexton and Wilhelmine Muller, whom everyone called Billie. He was born the same year as Anne Sexton, in 1928, and Kayo's younger sister, Joan, was born in 1931. It is perhaps of no surprise that Kayo would marry Anne. As children and into adolescence both Kayo and Anne lived with alcoholic fathers and with mothers who desperately tried to control their husbands' addictions.

In the beginning, Anne Sexton's relationship with Kayo was intense, happy, and sexually fulfilling. Sexton tried hard to become a good housewife while Kayo continued taking pre-medical courses at Colgate University. But he dropped out of school in order to begin a more serious and mature life with Sexton. He got into the wool business as a salesperson. Sexton became good friends with Joan, her sister-in-law. They eventually moved in to Kayo's parents' house where Sexton began to display some interesting personality traits, such as throwing temper tantrums when her mother-in-law would ask her to do something simple. But from the start, Sexton had not made a good impression on Kayo's mother Billie. The first time they met, right before the couple was married, Sexton shocked Billie with her bright red lipstick and chain-smoking. Motherhood and couplehood presented a variety of complications for Sexton. In 1953 Sexton had her first daughter, Linda Gray. In 1955 she had Joyce (Joy) Ladd. She found it impossible to care for her children and herself while Kayo traveled on business. She would go into deep depressions and rage at her eldest, Linda. After Linda's birth, she was diagnosed with post-partum depression. Shortly after Joy's birth, Sexton tried to commit suicide. This led her to Dr. Martin Orne who became a major player in Sexton's life.

Emotional Disorders and Treatment

When Dr. Orne first met Sexton, he asked her what she could do to have an identity in the world. Sexton could not think of anything to say except that she could possibly become a prostitute.

In the 1950s when Anne Sexton first showed dramatic signs of mental disturbance, the treatment of emotional disorders was rudimentary in the United States. When Sexton first resorted to mad suicidal gestures to display a formerly hidden anguish, the treatment available to her was limited. When she first entered treatment with Dr. Orne, she had been a housewife and mother, living in the suburbs of Boston. She was embedded in the Massachusetts conservatism that in the 1950s was at its height of sexism. Sexton with her constant

agitation was never noted as in any way out of the ordinary until she overdosed with sleeping pills. Her first suicidal gesture seemed like a hysterical play. Soon after marriage to Kayo, who became a traveling salesman like her father, Sexton unleashed her frenetic and manic temperament while her husband was on the road. She had brief sexual affairs in which she sought to have her hand held through the night. Being alone was intolerable. She commented that she didn't particularly like having affairs but that she needed "action." She manically defended against an inner emptiness generated by a sealed off early abandonment trauma. During her husband's regular absences, Sexton would stay up all night and listen to music, drink, and have drunken sex. After Kayo returned from his trips she would be temporarily all right. But she could not even cook a simple dish when he was away. One of Sexton's romantic infatuations led her to precipitous wish to leave Kayo. Both her mother and mother-in-law told her to drop her newfound love and commit to Kayo. It was then that Sexton grasped control through masochistic self-destruction. She, who feared her mother-in-law and who craved the attention of her own narcissistically self-absorbed mother, struck out in the mode of the impotent. Sexton very dramatically took a load of pills and began to vomit. This was a defiant reaction to the two mother figures. Her suicide attempt was impulsive—like a tantrum. This dramatic gesture was to be the precedent for a long line of suicidal acts that ultimately ended in the last and fatal deed. The family wished to forget, but Sexton's entrance into motherhood caused new seismic tremors. Sexton began to act totally out of control toward her older daughter, Linda. One day, at the sight of Linda putting feces in the back of a toy, Sexton threw Linda across the room. Later in a fight with Kayo, it would be her typewriter that she heaved across the room. Both Linda and the typewriter were extensions of herself. Sexton attacked Kayo by attacking herself, the writer in her who was symbolized by her typewriter. Sexton may have attacked Linda to disown that recalcitrant part of her inner being who wished to smear feces on her own mother when she had been so rigid about Sexton's constipation problem as a teenager. Despite all the years she would spend subsequently seeing therapists, nobody was ever to inquire into all this in an effective way. Sexton could rage at Linda like she could never have raged as a child because it would have been too threatening to her bond with her narcissistic mother. If Sexton didn't risk revealing her rage as a child, perhaps it was because she feared that her mother would turn away from her with contemptuous indifference. Sexton's terror of abandonment from a mother who was competitive, self-absorbed, and emotionally distant must have been incessant. Sexton's inability to form a healthy emotional and psychological bond with her mother must have severely impacted her ability to mother her own daughters.

From an object relations perspective, Sexton did not receive the proper treatment to her mental illness, which ultimately led to her own death. In a world without object relations theory and Melanie Klein, Anne was an example of the borderline personality. When Dr. Orne first treated Anne for her suicide attempts, he did not practice the standard psychiatric approach to hospitalization of those days. Due to him, her 8-year treatment stands as a fortunate contrast to that of Sylvia Plath, who received multiple volleys of electric shock. Sexton's

treatment was the exception to the rule. Dr. Orne prescribed some electric shock and a five times a week psychotherapy regime—an extreme exception for American psychiatry. At that time, Orne had been influenced by some education in psychoanalysis. Although not trained as a psychoanalyst, Orne had knowledge of Freudian psychoanalytic theory and of some clinical theory that enabled him to think in terms of the interaction of genetic history and transference. He also knew about the standard defense mechanisms. Dr. Orne's five times a week engagement with Sexton during her early hospitalization at the Weston Lodge allowed Sexton to experience his presence, no matter how closed off she was by her dissociated and unintegrated psychic state. It is unfortunate that during later hospitalizations, Dr. Orne would not be with Sexton in this way. It appears that his counter-transference anger had by then got the better of him, as he did not know not to use and process such interactions in order to enable him to understand Sexton's internal world and its compulsion to perpetually repeat its drama. It appears that Dr. Orne gradually began to use hospitalization as a punishment.

But at this early stage of their contact, Dr. Orne was quite involved with observing all of Sexton's manifold incarnations. She was a chameleon becoming whomever she conversed with. Viewing this as a hysterical dynamic, Dr. Orne was not totally out of his depth when Sexton began to speak schizophrenic language. Not believing that she had a thought disorder, Dr. Orne removed Sexton from the schizophrenic ward and her language transformed back to normal. He noted her schizophrenic language induced by imitating others, as she merged with others to find an identity. He viewed this as part of Sexton's hysteria. Sexton's ability to so purely imitate, to model herself on others so quickly and thoroughly, can be related to a borderline hysterical dissociation, not to a neurotic hysteric's mode of repression. Dr. Orne did not make these distinctions.

Sexton lacked the subjective *I*. She was not in herself, not in her body. She inhabited the paranoid-schizoid state of mind most of the time, a state of mind in which reactive reflex and reenactive reflex dominate the scene, rather than reflective thought. Dr. Orne did not understand the core schizoid level of Sexton's hysteria—the borderline preoedipal condition and its need for in-the-moment contact in treatment. He didn't understand that Sexton's chameleon mode of identification with anyone near her indicated a core lack of subjective self-identity and a borderline dissociation process as differentiated from neurotic hysteric's mode of repression that is founded on adequate preoedipal development. Dr. Orne attempted to uncover her memories and history as in sessions in which she reported incest and sexual abuse from her father. He helped her discuss her lies and distortions, in relation to her memories. Yet the true memory lived in the moment—he did not tune into this.

One common aspect of Sexton's behavior was to go into trances. With Dr. Orne these trances would occur at the end of many sessions. Her sealed-off yearnings for connection, often manifested by body cravings or by an incorporation process in her mind, threatened to emerge through a pressured trance state, but they were warded off by emotional distancing during the therapy session. She became paralyzed at the end of each session, unable to leave and separate. She had not gotten what

she needed in the session, the emotional contact and connection she required. The terror, need, blocked rage, and pain were contained in the state of trance.

During one session, this splitting process threatened to form a multiple personality. Unacquainted with borderline splitting, Dr. Orne was unequipped to deal with the phenomenology of a split-off personality appearing in the therapy session. Hoping to prevent Sexton's transition into a multiple personality, his response was to ignore the created personality whom Sexton called "Elizabeth." He said that when he ignored Elizabeth, she went away. Dr. Orne thought he had stopped a pathological process. According to Sexton, however, Elizabeth was a little bitch. This bitch-witch part of her was the one that was erotically engaged in a sadomasochistic struggle with her father. Her father had become her demon lover when he spanked her and aroused her erotically. She wrote a poem for Dr. Orne titled "The Royal Strapping." Through the poem, Anne told him how her father had stripped her naked on his marriage bed and beat her behind with her own riding crop, just after she had returned from horseback riding. But the poem was never consciously experienced in the session, neither by Dr. Orne nor by Anne Sexton.

One of Sexton's best friends was the poet Maxine Kumin, whom she met at a poetry workshop by John Holmes. The two women had many things in common and they quickly became good friends—sharing poetry as well as dresses. Kumin, however, was well recognized in the poetry scene by the time she met Sexton. It appears that Kumin's successful status as a poet served Sexton well in terms of motivation and good role modeling. The first time Sexton shared a poem with Kumin—the poem "Music Swims Back to Me"—Kumin praised and encouraged Sexton.

Sexton eventually became a published and well recognized poet herself. In her personal life however, she did not make progress. The mere presence of her daughters living at home with her disrupted and threatened her emotional well-being. As a result, Joy lived most of her early years with her paternal grandmother, Billie. Linda lived for a short while with her Aunt Blanche and Blanche's husband Ed. Although Linda lived with them a short while, she remembers this period of her life as an eternity. Unfortunately, Linda continued to suffer physical and emotional abuse from her Uncle Ed who would torture her with his leather belt and his lashing tongue.

As a result, Sexton spent very few years with her daughters, which affected the entire family. Billie seems to be the rock that kept the family together, but at a great cost. Having Billie pick up the pieces meant that Sexton had the freedom to manipulate and control as much as she wanted. Middlebrook noted that Joy was grateful for Billie's presence and mothering, however. Linda Gray made the same observation in her own autobiography. Soon problems with Kayo began to arise due to Sexton's compulsion with poetry. Conferences, workshops, and trips would interfere with Kayo. Mixed in with her mental instability, Kayo found Sexton's new life intolerable. When he was around, they would get into horrible drunken fights in which they would both physically attack each other. Many of these happened in the presence of their daughters who would later have to explain to the police what had transpired.

No doubt that Sexton lived with a horrible fear of abandonment, which had existed since her childhood days. The feelings

of being abandoned continued into adulthood. Anne lost Dr. Orne who took a job out of state. She eventually divorced Kayo, and her daughters went away to boarding schools or college. Sexton's psychiatric treatment continued with a series of other doctors who just could not seem to help her. She became addicted to sleeping pills and alcohol. One of the most documented and alarming situations was Sexton's affair with one of her therapists, Dr. Ollie Zweizung. Breaching one of the cores of the patient-doctor relationship, Dr. Zweizung did not seem to understand the damage he would cause Sexton with his breach of boundary.

The last therapist Sexton saw was Barbara Schwartz. Nine months after she started seeing Schwartz, Sexton went to her scheduled appointment. It was October 4, 1974. She brought with her a poem she had written for Schwartz about a female therapist who took a young schizophrenic patient through a symbolic gestation and rebirth. Sexton had apparently felt a sense of gratitude toward Schwartz for the 9 months of therapy she had given her. Schwartz did not see the poem or Sexton's behavior as a form of saying good-bye until she noticed that Sexton had deliberately left her cigarettes behind—something Sexton would never do. Later that day, Sexton had lunch with Kumin who was getting ready to take a long trip with her family to Europe. After the lunch, Sexton went home. After having a drink of vodka, she took off all her rings, and put on her mother's

fur coat. She went to the garage; got in her car; turned on the radio and started the engine. On this night Anne Sexton experimented with suicide for the last time and ended her own life.

It was evident from the amount of documentation that Sexton left behind that she led a troubled life. Unable to cope with the demands of motherhood, Sexton lived torn between being a bad mother and wife, and being a great poet. The two lives could not coexist. She had once told Dr. Orne, "You see, I've taken care of that 'life' part by writing poems." This quote could not better describe Sexton's feelings for wanting to be a complete human being with a unique talent. But amid all the turmoil in her life, she was able to work every day. She was able to love her daughters as is depicted in Linda Gray Sexton's own autobiography *Searching for Mercy Street* where she quotes a song that her mother had written for her: "Night-night time has come for Linda Gray, Night-night time, the same time every day, It's night-night time, It's night-night time, night-night time has come."

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William Shakespeare 1564–1616

English dramatist, poet, and actor

Author of 37 plays 154 sonnets

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WILLIAM SHAKESPEARE created a body of plays and poems that are considered among the greatest in English literature. The plays include tragedies, such as Hamlet, Othello, and King Lear, comedies, including Much Ado about Nothing, As You Like It, and Taming of the Shrew, and histories, such as Richard III and Henry IV, Parts I and II. Besides the collection of sonnets in Elizabethan form, Shakespeare wrote two heroic narrative poems, Venus and Adonis and The Rape of Lucrece. Often given the byname Bard of Avon or Swan of Avon, Shakespeare's literary creativity has shaped immeasurably the vocabulary, imagery, metaphors, and modes of expression in the English language. His best plays are often judged as among the greatest in any language, ancient or modern. Shakespeare is frequently seen as the prototypical literary genius.



William Shakespeare. Used with permission from The Folger Shakespeare Library.

Life

For a creative genius of his stature, the biographical information about Shakespeare's life is surprisingly meager. We know that he was born in Stratford-upon-Avon, on April 23, 1564, where he presumably was educated at the local grammar school. At 18 he married Anne Hathaway, from the same town, who bore him three children, a daughter Susanna and the twins Judith and Hamnet. A couple of years later, he began to attain success as a playwright in London, where he became a member of the Lord Chamberlain's Company, London's leading theater group. Shakespeare prospered sufficiently that he could retire to his birthplace, living out his final years as a country gentleman. He died in Stratford-upon-Avon on April 23, 1616, and was buried in the parish church. Only a

month before, Shakespeare had made out his will, famous for the passage in which he left his wife the "second-best bed" in the house. Only a handful of largely impersonal legal documents and miscellaneous notices add any further details to this biographical sketch.

The sparseness of the biographical information has led a number of dissenting scholars to argue that Shakespeare was not the true author of the works that currently make up the canon. Among the candidates put forward are the essayist and philosopher Francis Bacon, the dramatist Christopher Marlowe, Edward de Vere, the 17th earl of Oxford, and William Stanley, 6th earl of Derby. These rival claims are often predicated on the belief that the true author must have had a higher social standing and a better education than that enjoyed by Shakespeare – an assumption that may reveal more class prejudice than a genuine understanding of creative development. Moreover, advocacy of these alternative candidates must overcome a host of factual difficulties of their own. Marlowe, for example, was killed in a tavern brawl in 1593, before Shakespeare began to produce the major plays on which his reputation rests. Just as important, more than four dozen contemporaries testify to Shakespeare's authorship, including his fellow actors as well as his fellow playwright, Ben Jonson. It is always possible that some authentic document will someday be found in some dusty archive that proves once and for all that someone else wrote the plays and poems. But until that day arises, the best conclusion to draw is that the traditional attribution is the correct one.

In any case, given how little is known about the man, it is clear that if we wish to understand Shakespeare's creativity we must turn from biography to the creative products that have earned him such an exalted place in world literature.

Works

Shakespeare's two large poems, *Venus and Adonis* and *The Rape of Lucrece*, were both written relatively early in his career, the first appearing when he was 29 and the second when he was 30. Although not without considerable literary merit, Shakespeare's reputation rests most firmly on his sonnets and plays. Furthermore, these latter two manifestations of his genius are those that have attracted the most empirical research by psychologists who study creativity.

The 154 Sonnets

Shakespeare's sonnets were published in 1609, when the poet was in his mid-40s, although most of the poems probably

date from when he was in his 30s. There has been considerable scholarly speculation about the autobiographical significance of these sonnets. The poems contain many cryptic references to various persons, including a rival poet, a dark woman, and a handsome young man. Whether or not these persons were real or imagined may never be determined. But what can be expressed with confidence is that Shakespeare managed to express strong feelings and universal themes within a tightly regulated literary framework. Almost all sonnets follow the same Elizabethan form of three quatrains and a couplet, all 14 lines in iambic pentameter and restricted to the rhyme scheme of *a b a b, c d c d, e f e f, g g*.

Although many of these poems represent some of the highest accomplishments in the history of the English sonnet, it remains true that the collection contains creations of uneven merit. Research on creativity has shown that even the greatest geniuses have days when their muses seem to abandon them, and Shakespeare was no exception. This variation in aesthetic success is evident in the differential frequency that the 154 sonnets are included in anthologies or cited in books of quotations. Content analytical studies have shown that the more popular sonnets differ in identifiable ways from those that remain in relative obscurity. In particular, the more successful sonnets treat a greater variety of themes, employ a richer vocabulary, and display much more primary-process imagery. These investigations have also demonstrated that the more popular sonnets tend to manipulate linguistic expression across the consecutive lines in highly distinctive manner. Particularly notable is the way Shakespeare designs the concluding couplet so that it provides enriched associative linkages with the preceding three quatrains. Remarkably, these characteristics of the most accomplished sonnets have been discerned by computer programs designed to tease out the content and style of literary text.

Unfortunately, it is not yet known whether these enhancing aesthetic attributes apply to other poems besides those attributed to Shakespeare.

The 37 Plays

Shakespeare wished to stake his fame on his poetry. Crafting plays, in contrast, is what he did to earn a good living—roughly analogous to writing film scripts today. Yet it is one of the ironies of his life that the dramas now probably represent his most pervasive and influential legacy to world civilization. Needless to say, not all of Shakespeare's dramas have received the same praise from posterity. Like the sonnets, the plays are not all of equal quality. For example, *Hamlet* is by far the most highly acclaimed, whereas his *Henry VI* trilogy could disappear off the face of the earth without damaging Shakespeare's reputation whatsoever. Accordingly, to appreciate better the basis for Shakespeare's creative genius, researchers have tried to fathom why some plays are more successful than others. The starting place for such empirical inquiries is the information exhibited in [Table 1](#). This lists all of the plays in the traditional Shakespeare canon (omitting only *The Two Noble Kinsmen*, which most scholars ascribe largely if not entirely to John Fletcher). Alongside each play are two key data. First are the estimated dates based on a statistical analysis of the many tentative datings of the plays advanced by Shakespeare

TABLE 1 The Shakespeare dramatic canon: production dates and dramatic popularity

<i>Play</i>	<i>Date</i>	<i>Popularity</i>
<i>King Henry VI, Part 1</i>	1591	−1.51
<i>King Henry VI, Part 2</i>	1591	−1.41
<i>King Henry VI, Part 3</i>	1591	−1.62
<i>The Comedy of Errors</i>	1592	−0.37
<i>The Tragedy of Richard III</i>	1593	0.23
<i>Titus Andronicus</i>	1593	−1.13
<i>The Two Gentlemen of Verona</i>	1593	−1.13
<i>Love's Labour's Lost</i>	1593	−0.81
<i>The Taming of the Shrew</i>	1594	0.58
<i>Romeo and Juliet</i>	1595	1.34
<i>The Tragedy of Richard II</i>	1595	−0.02
<i>A Midsummer Night's Dream</i>	1595	1.00
<i>The Merchant of Venice</i>	1596	0.98
<i>The Life and Death of King John</i>	1596	−1.13
<i>Henry IV, Part 1</i>	1597	0.27
<i>Henry IV, Part 2</i>	1598	−0.27
<i>Much Ado about Nothing</i>	1598	0.31
<i>The Life of Henry V</i>	1599	0.48
<i>Julius Caesar</i>	1599	0.55
<i>As You Like It</i>	1599	0.82
<i>The Merry Wives of Windsor</i>	1600	−0.07
<i>Twelfth Night (or What You Will)</i>	1601	0.90
<i>Hamlet, Prince of Denmark</i>	1601	2.19
<i>Troilus and Cressida</i>	1602	−0.74
<i>All's Well that Ends Well</i>	1603	−0.68
<i>Measure for Measure</i>	1604	0.34
<i>Othello, the Moor of Venice</i>	1604	1.19
<i>King Lear</i>	1605	1.36
<i>Macbeth</i>	1606	1.53
<i>Antony and Cleopatra</i>	1607	0.31
<i>Timon of Athens</i>	1607	−1.51
<i>Coriolanus</i>	1608	−0.81
<i>Pericles</i>	1608	−1.31
<i>Cymbeline</i>	1610	−0.17
<i>The Winter's Tale</i>	1610	0.19
<i>The Tempest</i>	1611	1.00
<i>The Famous History of the Life of King Henry VIII</i>	1613	−0.89

scholars. Despite the presumed disagreements, these amount to no more than “tempests in a teapot,” for an extremely impressive consensus prevails (i.e., the internal consistency alpha reliability of the datings is .999). Second are the ratings of the 37 plays according to their frequency of performance, recording, and quotation, the number of single editions and film versions, the number of operatic versions, subjective evaluations by Shakespeare experts, and so forth. These summary scores, too, are highly reliable (i.e., the internal consistency alpha is .88). To facilitate comparisons, they have been put in the form of standard scores (viz., z-scores with means of zero and standard deviations of 1). Thus, plays with negative scores are below average in merit, whereas those with positive scores are above average in merit. It is obvious, for example, that *Hamlet* stands at the very top, while *Henry VI, Part 3*, sits at the very bottom. The play *Richard II*, in contrast, may be said to represent the typical level of quality for a Shakespeare drama.

These two columns of data immediately suggest an interesting question: How did Shakespeare's dramatic success change

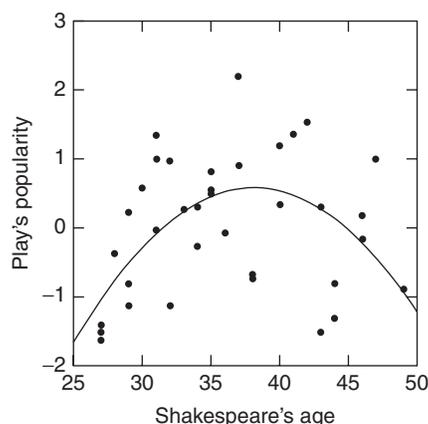


Figure 1 The curve best describing the relation between Shakespeare's age and a play's dramatic popularity. The quadratic function explains 27% of the longitudinal fluctuations.

over the course of his creative career? At first there may seem to be no clear pattern, because successful and unsuccessful plays seem to be interspersed throughout his career. Yet closer inspection suggests that many of his greatest plays appear when he was in his late 30s and early 40s, a career peak well in accord with the findings of research on the relation between age and achievement. In fact, when we fit a curvilinear age function, we obtain the results seen in [Figure 1](#). The inverted-U curve accounts for 27% of the longitudinal variation in dramatic merit, a highly impressive percentage.

Of course, there still exists considerable fluctuation around this trend line. Hence, most of the differential impact of Shakespeare's plays cannot be attributed to age alone. Nonetheless, as in the case of the sonnets, empirical investigations have managed to isolate some of the factors that discriminate the masterpieces from the also-rans. One predictor is the thematic material that is featured in the play. For instance, those dramas that treat strong human feelings—especially those that verge on madness or emotional excess—tend to gain in popularity. *Othello*, *Lear*, and *Hamlet* are fine illustrations of this effect. In addition, certain stylistic devices also make a contribution to aesthetic impact. For example, Shakespeare's output shows evidence that he skillfully employed puns in order to enhance the effectiveness of his plays. Especially fascinating is his use of puns to provide comedy relief, such as the famous Porter Scene in *Macbeth*.

Thus far we have been concentrating on the determinants of the comparative popularity of the 37 plays. But this has not been the only aesthetic attribute worthy of investigation. In fact, much research has concentrated on the factors that shape the form and content of these same dramas. Shakespeare's age, for instance, is linked with the themes scrutinized in his plays. As a young man, love themes tended to be relatively conspicuous, especially when he was in his early 30s, but gradually this preoccupation yielded to more weighty issues, such as conflict in human affairs. The contrast between *Romeo and Juliet* and *Hamlet* exemplifies this change. Other developmental shifts may be seen in his use of primary- and secondary-process imagery, incongruous juxtapositions of images, and various linguistic devices, such as the use of rhymes, prose, and

run-on lines. Clearly, Shakespeare's mode of creative expression was far from static, but rather displayed a dynamic progression over the course of his long dramatic career. In this respect, the Bard behaved just like other geniuses of the highest rank, such as Beethoven and Michelangelo. Creative geniuses seldom sit still.

The plays reveal Shakespeare to be like other great creators in yet another respect. The creative genius, no matter how grand, does not work in isolation from the external milieu. On the contrary, Shakespeare's dramatic output betrays many signs that he was ever responsive to the zeitgeist, especially in the political realm. Conspiracies against the throne, internal rebellions, and military threats from foreign powers all left their imprint on the thematic material found in his plays. For instance, when England found itself under attack by foreign military forces, Shakespeare was inspired to devote more lines to the discussion of war, conquest, and empire. The political circumstances could even exert a more direct effect on a play's aesthetic success, for the more popular works tended to come shortly after a major rebellion or conspiracy shocked the nation. The less popular dramas, in contrast, were more likely to emerge after the times had been more politically tranquil. This is also a consequence that has counterparts in the careers of other creators.

Conclusion

The foregoing review could only present the highlights of what has become a very rich research literature on the Shakespeare canon. These empirical findings have not only given us insights into Shakespeare's life and works, but have also shed some light on how creativity may operate in other writers. Indeed, if we had to pick one genius as the starting point for a more general understanding of literary creativity, it is hard to imagine a better place to start than with the Bard. He is arguably the most influential of all literary creators. After all, Shakespeare's plays are still produced on stages all over the globe and in all of the world's major languages. They have been recorded on records, cassettes, compact discs, videotapes, and full-length feature films. The plays have also been adapted, extended, or transformed in a great diversity of ways, such as Akira Kurosawa's movie *Ran* (from *King Lear*), Leonard Bernstein's musical *West Side Story* (from *Romeo and Juliet*), and Tom Stoppard's play *Rosencrantz and Guildenstern Are Dead* (from *Hamlet*). Additional reverberations of his dramas show up in cartoons, comic books, and children's storybooks as well as in tone poems, songs, modern dance and ballet compositions, puppet shows, and even kabuki theater. Shakespeare's dramatic genius has inspired more operas than any other author, classic or modern. A partial list of the operatic composers inspired by his greatness include Adam, Barber, Bellini, Berlioz, Britten, Bruch, Goldmark, Gounod, Halévy, Holst, Nicolai, Purcell, Rossini, Smetana, Vaughan Williams, Verdi, Wagner, and Wolf-Ferrari. Even the Bard's poetry has continued to sustain his posthumous reputation, albeit in a more quiet way, such as a booklet titled *Sonnets* gently tucked away in a traveler's suitcase. As Ben Jonson declared in the 1623 *First Folio*, Shakespeare "was not of an age, but for all time!"

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George Bernard Shaw 1856–1950

Writer

Author of many works of fiction and nonfiction; most noted for his plays such as *Pygmalion*, *St. Joan*, and *Major Barbara*

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*GEORGE BERNARD SHAW is one of the most quoted writers of the past 2 centuries. He was born in Dublin in 1856. Never a good student, he quit school at age 15 and worked as a clerk in a real estate office. His self-education in the arts flourished, and in 1876 he emigrated to London where his mother and two sisters had gone 3 years earlier. In London he made friends with a wide range of artists and intellectuals. He began writing music and art criticism, and in 1878 wrote his first novel, *Immaturity*. After writing another four novels in 4 years, he gave up this genre. He was greatly influenced by the work of Marx and other socialist writers. During the 1880s he was active in the Fabian Society, a middle-class socialist group in which he learned to debate and lecture. There he met Sidney and Beatrice Webb, as well as Charlotte Payne Townshend, whom he married in 1898. Shaw's plays became a means to express his ideas about class and his criticism of Victorian and romantic attitudes. He became well known for the polemical prefaces that he wrote to his plays. A Nobel Prize winner, Shaw wrote more than 50 plays during his long lifetime. As a playwright, critic, public speaker, and even as a politician, his influence has spread worldwide.*



George Bernard Shaw in the study at Shaw's corner, 1946. Used with permission from Popperphoto/Archive Photos.

Early Life in Dublin

George Bernard Shaw was born in Dublin on July 26, 1856, to George Carr Shaw (1814–1885) and Lucinda Elizabeth Gurly Shaw (1830–1913). George Carr Shaw was the second cousin of a baronet, and this status as a gentleman gave him certain privileges and invitations; however, he had no inheritance, no particular skills, and an unfortunate drinking habit that soon alienated the whole Shaw family. George Carr Shaw eventually became a teetotaler, a practice his son would later assume. Although the younger Shaw often described his father

(as well as his mother) in disparaging terms, he nevertheless acknowledged the gift of humor he received from him. In his autobiographical *Sixteen Self Sketches*, written when he was 93, Shaw described his mother as “the daughter of a country gentleman,” “brought up with ruthless strictness to be a paragon of all ladylike virtues and accomplishments by her grand aunt.” He attributed his imagination to Lucinda Elizabeth Gurly, an accomplished musician who apparently took care not to squander any passion on her family. The capacity for (or perhaps pose of) emotional coolness for which Shaw is often criticized must have been learned from his mother. George and Lucinda were not a happy couple and their home life was lacking in warmth. Given this type of upbringing, Shaw's self-reliance was learned early.

Fortunately for young Shaw there were a few maternal uncles who helped provide some nurturance and guidance. But perhaps the most important influence on him was that of George John Lee (1831–1886), his mother's singing teacher and close friend of the family. Lee was an eccentric man, short, dark, and crippled since childhood by an accident to his foot. He was a well-established orchestral and operatic conductor in Dublin who had created a method of singing that Shaw claimed preserved his mother's voice perfectly until her death at over age 80. Lee offered music to the Shaws, as well as the vitality of fresh ideas. Lee and the Shaws united households in 1863 when the two families moved into a four-storey house at Number One Hatch Street. Shaw loathed school. He quit school at age 15 and became a junior clerk in the Charles Uniacke Townshend land-agency office. Meanwhile, the household was filled with music rehearsals and lessons of Lucinda Shaw and George John Lee, and young Shaw had an excellent ear for music. He also spent hours studying the masterpieces at the Dublin National Gallery and enrolled in free-hand classes in the Royal Dublin Society's School of Art. He was an avid visitor of the Royal Theatre, and he read Dickens, Scott, Shakespeare, Bunyan, the Bible, and much of the contemporary popular literature. Shaw's work at Uniacke Townshend was a source of boredom for him, but he did his job well. In *Sixteen Self Sketches*, he wrote that “my desk and cash-box gave me the habit of daily work, and taught me that I must learn to do something instead of daydreaming, and that nothing but technical skill, practice, efficiency: in short, mastery, could be of any use to me.” Thus, we see the beginnings of a most remarkable self-discipline that would result in Shaw's prolific output through his long career.

In 1873 the Shaw-Lee household broke up when Lee's musical career became so successful that he changed his name to George John Vandeleur Lee and ambitiously left Dublin for

London. One month later, Mrs. Shaw sold the Hatch Street House, sent her husband and son to a nearby boarding house, and with her two daughters followed Lee to London. Young Shaw soon became restless in Dublin, and in 1876 he resigned from his job at Uniacke Townshend and moved to England.

Shaw's Apprenticeship in London

Shaw arrived in England just 4 days after his sister Agnes died of consumption on the Isle of Wight. He stayed there with his mother and sister Lucy for a month before the three of them then moved to London. Shaw notes in his diary that he was "unoccupied" during his first months in London. He was shy and awkward at this time. Although he was not certain where his talents would take him, he claimed many years later in the preface to his first novel, *Immaturity*, that "as the English language was my weapon, there was nothing for it but London." He began to ghost-write articles for *The Hornet* and he continued to study music, French, and Italian.

In 1878 Shaw undertook three serious literary efforts. He began *My Dear Dorothea* in January. This short piece (approximately 4200 words) is a fictional letter of advice to a 5-year-old girl, Dorothea. It was intended to be the first of a series of letters on moral education, but no other letters of the proposed series have ever been found. *My Dear Dorothea* was published posthumously in 1956. Shaw's most important advice to Dorothea is that she "always strive to find out what to do by thinking." He warned that thought will bring self-insight, and that this insight may be disappointing. In this early effort one can see the emergence of Shavian form and content: humor, paradox, moralizing, the use of the letter as a means of expression, a female as the main character, and many inchoate ideas that would later become major themes of Shaw's work. *Passion Play*, a satirical drama in verse form, was begun in February 1878 and never finished. In this play Shaw continued to develop some of the themes from *My Dear Dorothea*. Also written in 1878 was an outline for a novel, which Shaw never completed, called *The Legg Papers*. In March 1879 Shaw began his daily habit of writing every day. He submitted about a dozen essays to numerous publications. Two were accepted: "Opera in Italian" and "Christian Names." He read books at the British Museum on etiquette so that he could accept invitations from his sister's friends (as well as from associations he met through Lee). Gradually, he developed self-confidence. During this same year he began working for the Edison Telephone Company at a position that required him to persuade reluctant people in the east end of London to erect telephone poles on their property. He was promoted twice, but he eventually gave up the job in order to devote all efforts to writing. During the next 5 years he completed five novels, none of which were successful.

London in the 1880s was a good place to stimulate Shaw's curious mind. The ideas of such thinkers as Darwin, Marx, Spencer, and the Mills created an intense intellectual climate in which people could discuss and argue scientific, social, philosophical, and political issues. During this time Shaw became a lifelong believer in vegetarianism. He joined the Land Reform Union and the Fabian Society, both of which were middle-class socialist groups.

In 1885 Shaw began writing *Widower's Houses*, in collaboration with his friend William Archer. Archer, who had known Ibsen personally, had translated some of the Norwegian playwright's work, and around that time Shaw became familiar with and deeply impressed by Ibsen's social criticism. In 1891 Shaw wrote *The Quintessence of Ibsenism*, championing Ibsen's plays of social purpose. *Widower's Houses*, which Shaw would later complete on his own, was an attack on the practices of slumlords in Victorian England. It was produced in 1892, with little success, and eventually published in his *Plays, Pleasant and Unpleasant* (1898).

Shaw had come to feel that people should attend the theater in order to face unpleasant facts rather than to be entertained. The four "pleasant" plays in this collection, comedies with serious themes, are *Arms and the Man*, *Candida*, *The Man of Destiny*, and *You Never Can Tell*. The "unpleasant" plays (in addition to *Widower's Houses*) that deal with class injustice and sexual morality are *Mrs. Warren's Profession* and *The Philanderer*.

Shaw in The 20th Century

Shaw went on to write *Plays for Puritans* (1901), which included *The Devil's Disciple*, *Caesar and Cleopatra*, and *Captain Brassbound's Conversion*. Declaring himself a puritan in the broad sense of adhering to the dictates of conscience, he wrote these three plays as studies of conscience. In these plays he continued to see the stage as a means of social criticism on which he could broadcast his belief in the evils of capitalism, romanticism, and traditional morality. Other famous plays include *Major Barbara* (1905) and *Pygmalion* (1913), both of which were eventually made into motion pictures. Shaw's *Heartbreak House* (1917) is a somewhat pessimistic portrayal of disillusionment and ends with the outbreak of World War I. His monumental *Back to Methuselah* (1921) is a five-play collection that explores human progress from Eden to a science fiction future. In *Saint Joan* (1923), Shaw created a heretical Saint Joan of Arc whose brilliant monologues make the play one of his most popular. He was awarded the Nobel Prize for literature in 1925.

Shaw continued to write plays and prefaces, as well as other works of fiction and nonfiction, into his 90s. His *Common Sense about the War* (1914) and *Everybody's Political What's What?* (1944) are critiques of society in general and Britain in particular. *The Intelligent Woman's Guide to Socialism and Capitalism* (1928) echoed many of the feminist themes of his earlier plays. The novella *The Adventures of the Black Girl in Her Search for God* (1932) describes Shaw's creative evolution and the idea of the "life force," or the energy of progress. According to Shaw, the life force was a metaphor for a universal will that each individual has and that strives to improve the human race. Shaw died on November 2, 1950, in his country home at Ayot St. Lawrence.

The Evolving Systems Approach to Creativity and Generalizations About the Development of A Creative System

One way to study creativity is the evolving systems approach, a method constructed by Howard Gruber and his associates.

A creative individual is an evolving system that regulates creative activity, which in turn regenerates the system. Creative thought is a product of such a system and occurs as a constructive process involving a series of changing and growing structures. The creative system evolves through the interaction of three interrelated subsystems: purpose, knowledge, and affect. Organization of purpose refers to the way a person orchestrates his or her activities to achieve optimal work. The creative person pursues a network of enterprises that is crucial to his or her productive life. Organization of knowledge refers to the structures of the creative individual's thought—that is, creative thought does not imply one great moment of insight. Rather it involves a stable, repetitively functioning system whose thoughts evolve over time in many enterprises. A third subsystem, organization of affect, refers to the feelings that occur when a person is being creative or functioning optimally.

Can any generalizations be formed from the life of George Bernard Shaw and the lives of other creative people like him? One generalization may be that creative people at some time early in their careers set up a scaffolding on which to further develop their ideas. For example, *My Dear Dorothea* shows that the style and content of Shaw's later work was present in his early work. This short work may have provided for Shaw what Gruber and Davis have called an "initial sketch the rough draft or early notebook to which the worker can repair from time to time—that serves as a sort of gyroscope for the oeuvre."

An initial sketch should not, however, be mistaken for the later work. The sketch provides a direction for the creative system, perhaps a reminder of or commitment to the initial sense of purpose. For instance, Shaw did not simply discover the idea of creative evolution by reading Samuel Butler, nor did he somehow pick up ideas about class injustice by reading Marx. These ideas were constructed through repetition and variation of structures, beginning with such early works as *My Dear Dorothea* and progressing through the novels, plays, letters, and essays. In *My Dear Dorothea*, the rudiments of Shaw's life philosophy are many and stimulating, but a close look shows this work to be a first draft, an experiment of the life force, with tenuous arguments to be developed and perfected by the author for the rest of his life. The construction of a creative work, for instance, Shaw's *Back to Methuselah*, was a result of years of struggling with and debating about some of the themes in *My Dear Dorothea*. Gruber and Davis cited the examples of Darwin, Piaget, and Picasso, in which each of these creative people made initial sketches that provided a guide for later work.

Another generalization may be what Gardner and Wolf call "asynchrony" in the life and work of a creative person. They define several levels of creativity: neurobiological, cognitive, affective, domain, and field. The neurobiological, cognitive, and affective levels have been more thoroughly researched than the levels of domain and field. Domain refers to one's organization of knowledge within a particular area, craft, or discipline. Field is a sociological concept that refers to the people who work in a particular discipline, and the agencies, institutions, and reward systems that motivate and govern the discipline. Outstanding examples of creativity tend to emerge not when there is synchrony between or among these different levels, but when there is an asynchrony. The asynchrony may be

a discordance or tension, some kind of conflict that motivates the system to construct something new. Gardner and Wolf hypothesized that the lives of creative individuals may be characterized by asynchrony not because it *plagues* them, but rather because they *seek* it. This notion is similar to Hudson's (1966) finding that crisis seeking is characteristic of original thinkers and the correlation that Barron (1963) found between attraction for disorder and originality. Arlin (1984) described a postformal process by which problem-solving operations are replaced by problem-finding operations.

There are many examples of asynchrony in Shaw's life. His family were Protestants in a predominantly Catholic country. George Carr Shaw's adequate income was asynchronous with the high social rank that he claimed. Bernard Shaw was motivated to leave Dublin at the age of 20 and spent the rest of his life as an Irishman in England. His organization of knowledge was characterized by constructive opposition in which he created asynchronies. Gardner and Wolf hypothesized that "perhaps [creative people's] temperament is such that, constitutionally dissatisfied with the status quo, they are perennially predisposed to up the ante, to stir up troubles, to convert comfortable synchrony to tension-producing asynchrony."

In *The Quintessence of Ibsenism*, Shaw wrote that "every step of progress means a duty repudiated, and a scripture torn up." How does a creative system know when to construct from a foundation by modifying an earlier work and when that foundation should instead be "repudiated" or "torn up"? In other words, if a creative system seeks asynchrony, when is this asynchrony appropriate to creative work and when does it become counterproductive? A meaningful life is guided by a network of enterprises that enables the system to make the best use of time and energy. A purposeful life is guided by a network of enterprises that regulates the important need to tear down and rebuild. Thus, Shaw's iconoclasm was not destructive, because he did not randomly annihilate but instead carefully chose his targets and offered solutions. For instance, his disgust with poverty and the economic system that he felt created it should be replaced by socialism. The mindlessness of organized religion should be replaced with a belief in creative evolution. Rather than intoxicating theater goes with romantic escapism, he offers the realism of moral fiction.

Another generalization derived from Shaw's life is that creative people are likely to be creative in more than one domain. Shaw attended art school in Dublin and was a self-trained musician. He was fascinated with photography, and his last completed work is a small book of photos he took and rhymes he made about his home at Ayot Saint Lawrence, *Bernard Shaw's Rhyming Picture Guide to Ayot Saint Lawrence*. Shaw saw the advent of cinema as an opportunity to transfer his plays to a medium that would be available to a larger audience. (But Shaw did not appreciate the fact that cinema has a dramatic technique of its own and insisted that motion pictures must be filmed theater.) Hjerter (1986) has compiled a picture book of the art of more than 50 writers—for example, William Blake, Charlotte and Emily Bronte, Ibsen, Faulkner, and Harriet Beecher Stowe—who were also talented visual artists. A creative system again depends on a network of enterprises that is organized for optimal use of time and energy. A creative system intelligently chooses which talents, or enterprises, to pursue and which he or she may not have time or energy to pursue.

Finally, it is apparent from work with the evolving systems approach that creativity must be seen in a larger system, that a creative person does not function in a vacuum. Collaboration was an important theme in Shaw's life. A prolific writer, he wrote thousands of letters. Many of these were published, for example those to the English actresses Ellen Terry and Mrs. Patrick Campbell. Shaw was well aware that creativity does not spontaneously generate itself. As he wrote in the preface to *Major Barbara*: The body of thought is the slowest of growths and the rarest of blossomings [and the] conception of clever persons parthenogenetically bringing forth complete original cosmogonies by dint of sheer 'brilliancy' is part of that ignorant credulity which is the despair of the honest philosopher, and the opportunity of the religious impostor.

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Social Psychology

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Glossary

Extrinsic motivation Being moved to perform a task from the outside, because of external rewards such as money or fame.

Intrinsic motivation Being moved to perform a task from the inside, because it is a source of passion and gives pleasure and satisfaction.

Labeling theory The view that a phenomenon is not intrinsic to an act or person, but a label given to that act or person by a majority or a significant group of 'gatekeepers' (e.g., art critics, gallery owners).

Methodological holism An approach to research that takes the social system as the unit of analysis.

Methodological individualism An approach to research that takes the individual as the unit of analysis.

Expanding PPP: Person, Process, Product

The research on creativity that emerged in the 1950s and 1960s was initially organized around 3Ps: Person, Process, and Product. In the images of creativity popularized by Hollywood, the lone tormented genius is the exemplar of the creative *person*, the comic book image of the creative *process* is the light-bulb going on over a person's head accompanied by a cry of Eureka!, and the Product is inevitably the earthshattering discovery in the sciences or the sublime creation in the arts that will stand the test of time. In all three popular images and in the initial research that started in the 1950s the unit of analysis in thinking about creativity was the individual. Academically, the focus was predominantly on psychodynamic, personality, humanistic, and cognitive processes. Fueled in part by the context of the Cold War, considerable emphasis was placed on finding the best and brightest, and the selection of gifted individuals.

The PPP model meant that by definition creativity was a function of an individual. Making the individual – the Person – the unit of analysis lead to an intensive study of the creative person, but it also meant that the study of creative collaborations, groups, and environments was almost entirely excluded. Creativity was conceived to be something that occurred *only* in individual persons. The creative process was considered to be fundamentally intra-psychic.

Social psychologists stress that having an idea is not enough, and that the role of the environment has to be included in order to provide a fuller understanding of the dynamics of creativity. Motivation, a key dimension of creativity, can be inhibited by certain kinds of social environment. The study of the environment therefore became a new and important dimension which found particular resonance in management and organization studies where, in the 1990s, innovation was becoming an increasingly important topic. If the environment in a group, organization, or even a country was not conducive to new ideas, then no new ideas might ever become a reality even with a high number of creative individuals present.

Social psychologists also address the question of the creative product. They point out that calling something a 'creative' product involves a judgment. This judgment has to be made by a person or group of persons, and involves a community of

'gatekeepers,' such as art critics or the editors of scientific journals. It is therefore important to understand who makes those judgments, how, and why.

The 3Ps, Person, Process, and Product represented the Who, How, and What of creativity. Who is or can be creative? How does creativity manifest? What is considered creative? Social Psychology was the first to begin to challenge this tripartite definition systematically from within the dominant discipline studying creativity, psychology. As a more 'social' approach has been introduced into the research, the 'Who' has begun to include groups, collaborations, and social systems. The creative process, the 'How,' is no longer confined to an individual intra-psychic process but may be seen to be emerging in the interactions between two or more individuals, and stretch from the conditions receding the emergence of an idea to the actual performance or creation of the product. Not just writing a song, or play, but performing it, with all the complex factors that involves.

The 'What' of creativity, is, according to Social Psychologists, a decision and judgment made about a product. There is nothing *intrinsically* creative about any product, process, or person. In order to be creative, something has to be deemed to be so by human beings. This perspective, which in sociology dates back at least to labeling theory, had not been explicitly articulated in the context of creativity research. It has been the source some considerable controversy.

Today there are at least 4Ps in the study of creativity, with the 4th P representing 'Press' or the social environment of creativity. Other Ps have been proposed, including Persuasion, which also highlights the importance of the relationship between the creative person, the creative idea, and the environment. As our understanding of the complexity of creativity grows, Social Psychology's key contribution has been to highlight the importance of the 4th P.

Motivation and Environment

Social Psychology has long studied the social influences on motivation. In the context of creativity research, this has also proved to be a valuable entry point. What is the relationship between creativity, motivation, and the environment?

To be motivated, means *to be moved* to do something. Unless we are moved to do something, it is unlikely we will be creative in doing that task. Motivation can therefore be thought of as a person's attitude toward a task, which ranges from being highly motivated and therefore wanting to move towards a task, to being highly unmotivated to do it, and wanting to move away from it, presumably as fast as possible. Research indicates that intrinsic motivation is a key factor in creativity. Intrinsic means 'from within.' Intrinsic motivation literally means that we are moved from within to do something. The intrinsically motivating factors can include fascination for the subject, enjoyment while performing the task, or a feeling of accomplishment. Intrinsically motivated people enjoy what they do, and they do so because they find the task itself rewarding. The journey is the reward.

Extrinsic motivation is motivation that comes from external sources rather than the pleasure of the task itself. Financial incentives and social approval are examples of extrinsic motivation. Extrinsically motivated people do the task because there is an external reward attached to it. The task itself is not what they enjoy; it is the reward (financial or otherwise) that provides the appeal.

There is ample evidence to suggest that people are much more creative when they are intrinsically motivated, rather than when they are driven to perform by extrinsic motivation. This finding makes intuitive sense: performing a task because it provides personal enjoyment or a basic feeling of gratification is a very different type of motivation than doing something because of external pressures or extrinsic rewards, or 'just to make a buck.' Yet, using rewards to manipulate or control behavior, achieving an expected reward, meeting deadlines, winning or competing, or managerial edicts are all frequently used motivators.

A particularly interesting implication of this research of course is that whether a job is intrinsically interesting to us or not is on some level a personal choice. This choice as to how we view a task or job reflects a subjective dimension of work. We can choose to find our particular task boring, or we can find something fascinating about it. Even dishwashing can be interesting if performed with certain states of mind. It is possible to focus not on the nature of the task itself (dishwashing does not strike most people as an intrinsically fascinating task), but on the nature of our awareness while we perform a task. If we are not interested in a task, we tend not to do such a good job. If our interest is in doing a good job, and working at our peak regardless of the nature of the task, we can actually 'be moved' by the task. It is also possible to reframe the task at hand, from one that is desperately boring to one that is potentially exciting – finding a new way of performing the task, or finding something that we can learn while we do the task.

Intrinsic motivation is diminished when external rewards are used to make people perform. The presence of such extrinsic factors alters peoples' perceptions or reasons for engaging in the task. Creativity will be inhibited if the perception is that a task is being performed for the purposes of getting a reward, rather than because of intrinsic interest in the task itself. This does not mean that creativity requires the total absence of rewards or recognition for good work, simply that external reward should not be the main motivation.

Expanding the Creative Process: The Where and How of Creativity

When approached in a wider perspective, the creative process can be seen as a phenomenon that emerges in many different contexts and in different ways. Even in the arts and sciences, historically the privileged contexts for creativity, there are many different ways in which creativity manifests. The novelist at his desk, a scientist in her lab, a jazz band performing together on stage, and a large crew working on a motion picture. Most of the eminent creative individuals studied by psychologists did their work essentially alone. They were scientists, novelists, mathematicians, painters, and poets. Poets, novelists, and painters can do their work almost entirely on their own, if we limit our scope to the production of the actual poem, rather than its distribution and dissemination. But what of the performing arts, where theater or musical groups have to work together to create a performance, or songwriting teams or software development? It is interesting to note that much of the impetus for a more social psychological approach to the study of creativity came because the initial research was not addressing all the dimensions of creative work. In R&D labs or theater productions, collaboration is essential. Many scholarly articles these days are coauthored, which makes writing and research a collaborative process. As innovation has increasingly become a core competence for business in the twenty-first century, there is a need to understand creativity in the context of relationships, organizational structures, and more broadly, a series of environments.

Creativity and Interactions

A subject that is only just beginning to get the interest it deserves is how creativity can be triggered by relationships. There is a long history of creative collaborations, with songwriting teams such as Gershwin and Gershwin, Ellington and Strayhorn, Lennon and McCartney being classic examples. Other important creative relationships include Marie and Pierre Curie, Pablo Picasso and Georges Braque, Margaret Mead and Gregory Bateson, Steve Jobs and Steve Wozniak, Igor Stravinsky and George Balanchine. The nature of these relationships and how they appear to have triggered periods of intensive and extensive productivity is still under-researched. How do certain relationships stimulate greater creativity and productivity?

The performing arts and the nature of creative groups are also under-researched in the United States, although there has been an emerging interest in jazz groups and R&D teams. Creative groups can have very different characteristics. For a jazz band, the process of performance is the product. For R&D teams there is no such immediacy and the nature of performance is different. Whereas for a jazz group the process is the product, for an R&D team the process leads to a product, but they are not one and the same.

It has been argued that one of the barriers to the study of groups has been methodological. The argument from psychologists has been that groups are harder to study than individuals. But it may be that the problem lies in the methodologies generally available to psychologists, because sociologists and even social psychologists have extensive experience studying groups, with a particular focus on qualitative methodologies.

Sociological works such as Howard Becker's (1963) *Outsiders* and Robert Faulkner and Becker's (2009) *Do You Know...?* illustrate how creative groups can be studied.

Groupthink: Eliminating the Creative Process

Research on creativity in groups is a relatively recent phenomenon. Groups were mostly associated with the phenomenon known as groupthink, which is in fact quite antithetical to creativity. An awareness of the phenomenon and its characteristics is important in order to remain alert to how groups can actively block creativity.

Groupthink involves a number of factors. They include:

- the unwillingness to examine anything but a few alternative courses of action, often only two, without a survey of the full alternatives;
- failure to examine the course of action initially preferred by the majority of the members from the standpoint of non-obvious risks and drawbacks that had not been evaluated originally;
- neglect of courses of action initially evaluated as unsatisfactory by the majority;
- little or no time is spent discussing whether nonobvious gains have been overlooked or whether the ways of reducing seemingly prohibitive costs which make alternatives undesirable;
- few if any attempts to obtain information from experts who can supply sound estimates of losses and gains to be expected from alternative courses of action;
- selective bias is shown in the way the group reacts to factual information and relevant judgments from experts, the media, and outside critics;
- members take interest in facts that support their initially preferred policy, and take up time in their meetings to discuss them, but they ignore facts and opinions which do not support their policy; and
- members spend little time deliberating about how the chosen policy might be hindered by bureaucratic inertia, sabotaged by political opponents, or temporarily derailed by the common accidents that befall the best of plans.

Groups that become victims to groupthink have already made up their minds and are unwilling to listen to any other views. There is a pressure to conform, and go along with the group consensus. In terms of the creative process, they cannot accept divergent thinking, because they have already converged on the right policy or plan. Victims of groupthink therefore eliminate creativity altogether to the extent that no new perspectives or alternatives are encouraged. The group process to some extent displays processes that occur at the individual level but writ large. 'Premature closure,' or the unwillingness to explore alternatives after the initial diagnosis, is the most common error in medical diagnoses, for instance.

Environments that Support Creativity

Some social environments promote creativity, whereas others can inhibit it. Traditional management practices and organizational structures were not designed to foster creativity. On the

contrary, the focus was on conformity and predictability. The main metaphor for an organization was the machine. Considerable changes have occurred in the more than 100 years since Frederick Taylor articulated his model of 'scientific management,' but it is telling that it has only been in the last two decades that there has been any sustained research into environments that foster creativity, and creativity in the workplace. The research indicates that the characteristics of creative environments are paradoxical or 'cybernetic' in the sense that they involve navigating between 'creative tensions' such as being too challenging or too boring, specialization and a broad outlook, autonomy and the need for respect and approval, and so on.

If tasks are not challenging enough, they are not likely to elicit intrinsic motivation and creative thinking. On the other hand, too much challenge can result in people feeling overwhelmed and in 'over their heads,' creating a high level of anxiety that inhibits the capacity for creative thought. Mihaly Csikszentmihalyi (1997) has identified the 'flow state,' beyond boredom and anxiety. This is a condition of high performance that is just challenging enough to push the person beyond their comfort zone but not far enough that they are overwhelmed by anxiety. The original research on flow state was with individuals, and recent research has suggested that particularly high-performing groups may also experience a collective flow state.

An important element in enhancing creativity in organizations is to match peoples' interests and skills with the right assignments. A good match requires knowledge about the parties involved and the nature of the assignment. The jazz big-band leader Duke Ellington is said to have made sure he even knew how his musicians played poker. He wanted to know all about them in order to be able to match them with solos in the right songs. That way he could write songs that reflected the musicians' passion and ability and find a fit between individuals and the larger whole.

Creative environments do not stress overspecialization. They allow the freedom to move around in a variety of disciplines and knowledge bases. In fact, many innovative new ideas have come from individuals who are not overspecialized and bring in information or ways of approaching problems from other disciplines or areas of research. Specialization offers a sense of security because one is in familiar territory. Drawing on unfamiliar disciplines means our expertise is reduced, and therefore losing expert status. Comparatively speaking, we become a relative beginner. This is a challenge, both to our status and to the ability to gain familiarity with new material. These challenges keep creative individuals fresh, and environments that allow for this cross-pollination remain stimulating. They require self-confidence and the ability and willingness to keep learning.

Creative individuals tend to be autonomous and nonconforming, but this does not mean they do not care at all what others think of them. They do want to work in an environment in which they are appreciated and respected by their peers. It is a disincentive for them not to know how they are being assessed by their peers, and not having any way of gauging how their own contribution is being received. Knowing that we will not be ignored and our views will be given a serious hearing also helps to build an environment supportive of creativity.

Environments where the fear of failure is high, where failure is strongly penalized inhibit creativity. Fear of failure inhibits risk taking, and with it the likelihood that something new and creative will be uttered, let alone tried out. Environments that support creativity provide 'champions' for creative ideas – whether they come from teams or individuals – that provide external support and advocacy and help them navigate the organizational bureaucracy.

Micro-management is not conducive to creative environments and creative work. Amabile usefully differentiates between tasks that are *algorithmic*, that involve specific, pre-established steps that have to be followed very closely, with one right way and one right answer, do not lead to creativity. On the other hand tasks that are *heuristic*, with a clear expectations and considerable autonomy, have been shown to be much more likely to lead to creativity.

Environments that foster creativity cannot have the old 'look busy' attitude of the assembly line where a minute of distraction can lead to a breakdown. The creative process involves periods of immersion and incubation, of mulling over an idea, where no apparent 'work' may be seen to be going on. Periods of relative isolation, meditation, and reflection are required. Many creative scientists spend time both in the world of theory and the world of application. Along with freedom from external constraints, creative individuals often need the time to be alone with their creative process and not be interrupted. This is not to say that they do not also need time for vigorous exchanges and interactions. The creative process requires both isolation and interaction, and environments that permit both those 'moments' in the process.

Environments that support creativity encourage creative dissent. They allow for vigorous exchanges of ideas, challenging assumptions, and discourage conformity. Creative individuals may not, and often don't fully share the goals and interests of higher management. What sets them apart is that they are open to listening, and will take direction, if they know they are also being listened to and respected for their opinions. At the same time, creative ideas may initially seem bizarre or wrong-headed, so in order to support creativity, it is also important to be able to allow ideas to emerge and not attack them and test them too aggressively before they are fully formed.

Disciplinary and Philosophical Considerations

In the United States, creativity research has historically been the province of psychologists. Within psychology, personality and cognitive psychologists were the most represented, as might be expected given the 'Person' and 'Process' framework. The publication of Teresa Amabile's (1983) *The Social Psychology of Creativity* work was significant because it brought a different (sub-) disciplinary perspective to bear on the topic. While still within the larger discipline of psychology, social psychology's entry into the discourse of creativity marked the beginning of what was to become a stream of more 'social' research, with a focus that extended beyond the individual.

The emergence of a more social approach has raised numerous complex and important issues that can in turn be traced to ongoing debates in the philosophy of social science. It also highlights the role of disciplines in framing questions and entire subject areas.

Broadly speaking, Psychology is the study of the individual person (whether individual personality, cognitive processes, behavior, mind, brain, etc.), and Sociology the study of society. Social Psychology arguably resides between the two, in the sense that it is interested in the relationship between self and others. This includes, for instance, how people relate to one another, how social factors influence our behavior, and how people think about each other.

Social Psychology has made important contributions to our understanding of creativity because it has addressed aspects of creativity that were traditionally either not addressed at all, in the dominant discourse of creativity, or addressed in much less depth. For instance, the selection of eminent creative individuals for the classic research conducted at the *Institute for Personality Assessment and Research* in Berkeley California on the creative personality was done by asking a representative sample of successful architects to nominate those in their field who they considered most creative. This was the accepted method of selection, but the purpose of the selection was to study the eminent individuals. It is only later that this 'social' dimension was problematized and proposed as an indication that creativity should be thought of as a social judgment rather than the function of an individual's personality or mental process.

Controversy

Along with the contribution of new, more social, perspectives there has also been considerable debate and controversy. One of the central sources of controversy has been the emphasis of some of the more socially oriented researchers to stress the role of judgment and attribution. The central idea is that in order for an idea or product to be creative, somebody has to say it's creative. Without the label 'creative,' it is by definition not creative. Judgments about creativity in the arts and sciences are usually made by a small group of gatekeepers, art critics, journal editors, and so on. In some models of creativity, the environment now seems to play a more significant role than the individual. Creativity appears to be a function of judgment. This shifts the attention to the group making the judgment, and to the larger social environment. As the focus shifts towards the creative person's interactions with his or her environment, it also begins to address issues of how individuals involved in creative work can manage their image and engage in impression management to become more successful. It takes attention away from what was traditionally studied, the individual and her or his process.

Some psychologists have argued strongly that research on the social dimensions of creativity is valuable but not essential, since such factors as reputation and judgment actually hinder our understanding of the phenomenon of creativity *itself* inasmuch as they are *about* creativity. The social dimension involves subjective judgments made by people about creativity, something quite different from the creative process itself. This debate about judgments about creativity interferes with the actual study of the creative process.

Some representatives of sociological approaches to creativity have sometimes harshly dismissed earlier forms of creativity research, particularly personality approaches, suggesting that this research can now safely be discarded in favor of the more social approach. Any characteristics imputed to creative

individuals can only occur and be relevant in a particular context. To speak of universal characteristics of the creative person is simply not possible. This is in many ways a rehash of the critique of personality theory made in 1968 by Walter Mischel. Nevertheless, the research on personality and on the creative person has continued, and, with some modifications, the latter generally continues to be viewed as a major contribution to the understanding of creativity.

The controversy about the introduction of a more social element in creativity research has many ramifications, including disciplinary allegiance. Eminent psychologists who have introduced more social dimensions in their research have made a point of explicitly affirming their loyalty to psychology. They are not 'switching sides,' they point out, merely broadening the frame of creativity research. The fact that these kinds of statements need to be made reflects the tension that exists between disciplines, disciplinary affiliations, and the problems that can be associated with stepping out into other disciplines.

Philosophical Assumptions

Another reason these controversies have arisen is because different underlying philosophical assumptions lead to very different perspectives on the subject. In very broad terms, one key difference between psychology and sociology is the *unit of analysis*. Psychology views creativity as the result of characteristics, processes and properties of individuals. Social Psychology has studied how the external environment affects the individual's motivation and creative performance. Sociology views creativity more as a function of social structures and processes. In the philosophy of social science, these different perspectives are sometimes referred to as atomism and holism, or methodological individualism and methodological holism respectively (Simonton, 1999).

For methodological individualists in creativity research, the focus is on the individual and whatever is outside the individual is essentially *epiphenomenal*. It is not necessary to include these factors in order to gain a full understanding of the subject. Even in the context of a seemingly solitary activity as writing, Burke Lefevre summarizes the critique of methodological individualism by emphasizing the impossibility of being completely separated from one's social environment and criticizing

(T)he inadequacy of a conception prevalent in current composition theory that invention is the act of an atomistic individual who recollects or uncovers ideas from within, all the while remaining apart from a material and social world. (Burke Lefevre, 1987, p. 8)

For methodological holists it is the individual who is largely epiphenomenal. Specific individuals are merely vehicles for ideas that were part of the *zeitgeist*, or 'in the air' [see *Zeitgeist*] The implications are considerable. Since methodological individualism has been the dominant approach in American creativity research, it is not surprising therefore that creative collaboration, group creativity, the study of creative cities and epochs and generally of environments that foster or hinder creativity have received less attention, with some notable exceptions.

If psychologists have focused on the individual, social psychologists have brought discussions of the social environment into the creativity discourse. Disciplinary perspectives often

emerge in opposition to each other, and this can be seen in the individualist and holist approaches to creativity. The individualist approach has been dominant since the 1950s, and it is now becoming clear that in order to address specific phenomena such as group and collaborative creativity, and to reflect findings in the natural and social sciences about complexity, interconnectedness, and interdependence, a more social approach is emerging. It is not clear whether this more social approach will succeed in integrating the findings of the more individualist, person-oriented researchers, or whether the individualist approaches will be renewed by the challenge of alternative views. Certain proponents of the Systems Approach propose that in order to address this problem it is necessary to go beyond a certain way of thinking that is reductive and disjunctive, reducing creativity either to a social or an individual phenomenon, and adopt a way of thinking grounded in systems and complexity theories.

The underlying philosophical assumptions of the two major perspectives on creativity have further differences. It has been argued that the psychological individualistic approach is fundamentally *idealistic* in the sense that the focus is largely on the generation of creative ideas, but no systematic attention is paid to how those ideas can become a reality. Idealist philosophy is more interested in the idea rather than its physical manifestation. An idealist aesthetics holds that the score of a musical composition is an ideal which can only be approximated by a performance because it is closer to what the composer had in mind, and subject to less translation and interpretation. Unlike the psychologists, who focus on the idea, sociologists have brought a different perspective to the table, namely a more materialist philosophy. Particularly with sociologists of work we see this in their close study of what it actually means to work in professions such as the arts and put on a jazz performance, get a motion picture into the theaters, in a novel into bookstores, and so on. The romantic mythology of the creator as lone genius takes a back seat to the network of relationships necessary to take any creative idea into the world.

The credits of a motion picture begin to give some idea of the enormous collective effort that is required to bring a movie in front of the public. The same is true for a musical recording, a book, and even a school production of a musical requires extensive collaboration. To attribute the creation of a motion picture or the performance of a jazz group to one individual is very problematic.

The sociological approach has broadened the understanding of creativity to the extent that it tells us about how an idea becomes a reality, and clearly this is an extremely important dimension of the process. A greater understanding of how creative ideas become realities can assist in the creation of systems that support creativity more. Nevertheless, the question remains, where do we draw the boundary around what constitutes 'the creative process?' Is the creative process confined to the generation of the idea, or does it extend to include the entire production of a movie, including the script writing, editing, and all the support functions from the technical to the logistical?

Individual and Society

The influence of Postmodern and Feminist perspectives on psychology and on its underlying philosophical assumptions

is gradually being felt. This involves, among other things, a shift away from the emphasis on individual mind and an objectively knowable world towards a more communal, socially constructed understanding of the self and of knowledge. Such an approach does not make such hard and fast distinctions between self and society. Rather than focusing on two separate entities, the stress is on relationships and on both self and knowledge as 'constructed,' rather than given. The self emerges out of a network of relationships and does not have an 'essence.' The self changes in various contexts so one cannot speak of universal traits or more generally of 'the' 'creative person.' 'Essentialism,' the proposition that individuals have an unchanging essence, is being challenged by views that are more contextual and argue for the social construction of the self.

If one social psychological approach asks to what extent the social environment hinders or fosters creativity in an individual, another more radical way of looking at the issue is to suggest that there can be no clean split between individual and society. No individual creator can function as a human being, let alone as a successful creator, without being part of a discourse, a larger tradition. The relationship between the individual and the social environment cannot simply be reduced to the way the social environment supports or hinders the creative person. It is a more complex matter, because society is already 'in' the person (language, education, culture, scientific or artistic heritage and practices, etc.) just as the person is 'in' society. The focus on relationships and interactions in the creative process has raised questions about the nature of the person. The individualist, closed-system view of Piaget and others is critiqued and contrasted with more relational, 'socially constructed' views of the individual, which often draws on the work of the Russian psychologist Vygotsky. Vygotsky's approach was sociocultural, and stressed the central role of social interaction in cognition.

These are the sorts of philosophical problems that are being raised by the 'social constructionist' strain of social psychological research, questions that veer far into the philosophical and theoretical domain, but whose implications are considerable for our understanding of creativity, which historically dates back to Romantic conceptions of *ex nihilo* creation and genius without learning. While these Romantic 'myths' of creativity may seem remote and unlikely in the twenty-first century, they do persist to some extent in the public imagination. As an example, it is only in the first decade of this century that several popular books about the importance of hard work for successful creatives have been published and begun to make an impact in the popular culture, countering the Romantic myth of 'genius without learning.' Likewise, the research on group creativity is still minimal compared to the research on the creative person or the relationship between creativity and mental illness, for instance, an association that is closely connected with Romanticism.

Women and Creativity

Much if not most of the creativity research has been about eminent individuals in the West who are white males. The picture that has been built up about creativity, the creative person, and the creative process is based on a sample that is predominantly white and male. In the last 50 years tremendous

changes have seen many more women become prominent in the arts and the sciences. Women were historically not given access to the domains where creativity was traditionally recognized, namely the arts and the sciences. In Europe and the US women were not allowed to practice drawing nudes, give concerts in public, go to medical school, and study science until the middle of the nineteenth century. But does that mean that women were not being creative in Europe and the United States until the middle of nineteenth century? Or merely that the socially constructed definition of the who, where, and how of creativity was preventing us from understanding how the creativity of women was manifested? The recent concept of everyday creativity offers us an interesting new possibility – both because it is itself a new 'constructed' understanding of creativity, and because it allows us to see creativity in places and activities where before it would not have been looked for. The title of Virginia Woolf's *A Room of One's Own* is illustrative because it shows that women had trouble finding the time and the place to be alone. Women's creativity throughout is described as being more relational and therefore 'social' because it manifested in the context of the family and everyday life.

Future Trends

In a networked society, it is not surprising that research shows college students identify creativity more with everyday events and social relations rather than with extraordinary individual achievement in the arts and sciences. This points to a changing concept of creativity in the 'implicit theories' of new generations' one that may reflect the more 'social' approach. The challenge for both social and research views of creativity is to incorporate the best of all the research that has gone before, and to develop a new, richer, and more inclusive understanding of creativity.

Conclusion

The Social Psychological perspective has opened up a considerable opportunity for debate, expansion, and integration in the research on creativity. A more 'social' perspective goes beyond the disciplinary boundaries of creativity, veering into sociology but eventually pointing the way to a new inter- or trans-disciplinary approach that draws on a plurality of disciplines.

See also: Attention; Attribution and Creativity; Everyday Creativity; Group Creativity; Implicit Theories; Innovation; Organizational Development; Systems Approach; Zeitgeist.

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Sociobiology

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Glossary

Adaptation In evolutionary science, a structure, physiological or psychological process, or behavior that enables an organism to survive and reproduce. As well: the evolutionary process leading to such traits' formation.

Darwinism The theory of evolution by natural selection, proposed by Charles Darwin (1809–1882).

Epigenetic rule Genetically shaped procedures of brain development that direct the assembly of mind during enculturation; instantiated as the timing and logic of the activation and repression of the nervous system's developmental genes.

Evolutionary psychology The study of behavior and mentation – in humans and animals – as Darwinian adaptations.

Fitness As used in evolutionary science, differential representation in later generations.

Gene–culture coevolution The coupled evolution of genes and culture, that is, of genes and the artifacts, behaviors, and belief systems transmitted by learning among members of a society, and the multilevel holistic patterns they form. Learning one culture in all is uniqueness, depth, and particularity is called enculturation.

Group selection Change in gene frequencies caused by the differential survival and proliferation of groups of individuals within a population.

Kin selection Change in gene frequencies caused by individuals favoring or disfavoring the survival and reproduction of relatives (others than their own offspring) who possess the same genes by common descent. Kin selection is expressed during evolution through inclusive fitness, the sum of an individual's own fitness plus all its influence on fitness in its relatives other than its direct descendants.

Natural selection The differential contribution – through survival and reproduction – to subsequent generations by individuals of different genotypes but belonging to the same population. When natural selection acts simultaneously across diverse scales on the same population, from individual gene and organism through kin group to social alliance and other subgroups and subpopulations of various sizes right up to the population as an adapting whole, it is called multilevel selection.

Reciprocal altruism The benefits to survival and reproduction gained through alliances with non-kin, in which adaptive aid expended on others is likely to be reciprocated at some future date.

Sociobiology The evolutionary science of social behavior in all its conceivable forms, stressing especially the properties of entire societies. As relevant to sociobiology, a society is a group of individuals in the same species organized in a cooperative manner.

Introduction

Sociobiology is the evolutionary science of social existence. As a scientific discipline its goal is to understand all patterns of social living, including those of humans, from the perspective of evolutionary biology. The principal technical novelty of sociobiology is its treatment of societies as populations subject to evolution by natural selection. Each animal society has a characteristic size, networks of gene flow, means of communication among its members, dominance structure, and other traits of the population considered as an intact whole. These traits can be observed as they change over time, just as the chemistry, neurobiology, and behavior of the society's constituent organisms can themselves be studied. The principal intellectual novelty of sociobiology is its hypothesis that such whole-society traits are emergent, adaptive outcomes of Darwinian evolution. Thus sociobiology is, in a direct sense, the cosmology of the sciences devoted to sociality. It examines social existence in the broadest possible scientific perspective, erecting comparative frameworks that accommodate all conceivable patterns of group living from the simplest communal microorganisms to the most passionately conscious creative primates. In principle it also embraces, for the purposes of teaching or deductive clarification, the systematic description

and comparative analysis of social forms thus far only conjectural or hypothetical, such as sapient communal insects or replicating creative machines.

Origins

Sociobiology is the brainchild of Edward O. Wilson, Harvard University's fabulously gifted ant specialist and natural philosopher. A succession of books by Wilson defines the canonical form and content of this young science. His masterful 1975 *Sociobiology: the New Synthesis* forged diverse, widely scattered ideas and facts about social evolution into a system of unprecedented explanatory scope. The glittering insights marshaled by Wilson especially included William Hamilton's concepts of kin selection and inclusive fitness beyond the individual genetic success; Robert Trivers' influential notion of reciprocal altruism as the evolutionary cement bonding alliances among genetically unrelated members of the society; John Maynard Smith's vision of social behavior as games played out with Darwinian strategies of conflict and cooperation among relatives and nonrelatives alike; and the subtle effects of group selection, the once-taboo notion nurtured by Wilson and others that natural

selection can act on multiple levels of intact groups as units of survival and reproduction within the society, not just on single genes or individual organisms.

Whereas *Sociobiology* devoted most of its pages to animal social existence, Wilson's *On Human Nature* – his Pulitzer Prize winning book published in 1978 – flashed the new science's intense beam into the depths of human behavior and sociality. A few years later, Wilson and I (in the 1981 *Genes, Mind and Culture* and the 1983 *Promethean Fire*) introduced gene–culture coevolution as sociobiology's key to mind and culture, humanity's symbolic worlds. In his 1998 *Consilience*, Wilson turned that key on behalf of universal scholarship, arguing powerfully that a sociobiological approach to mind and culture opens the path to essential unification not only among the sciences of humankind, but within and between the sciences and the humanities themselves.

The attempts by Wilson and others to establish human sociobiology triggered intense debate about the proper role of science – especially evolutionary science – in human affairs and in the so-called human sciences of the time. Those academic fights, sometimes recalled as the sociobiology wars, are now a case study in intellectual politics and idea succession in science. Today the idea that genes guide the brain's development, along the way shaping mind, behavior, and social living, is less controversial thanks to the Human Genome Project and several decades of nonstop progress in the brain and behavioral sciences. Scholarly attention in sociobiology now focuses on hypothesis formulation and testing, and less on general arguments about feasibility or intellectual legitimacy. Contemporary sociobiology is thus a vigorous young science sustained by specialist journals, college courses, learned societies, and popular books – a field driven by several generations of investigators siloed across the problems of social living revealed in hugely diverse zoological taxa. Alongside these primary investigations, intellectual historians, philosophers, and social critics continue to map the field's past, present, and practical import.

Close Associates

Sociobiology does not stand alone among the evolutionary sciences in its focus on social behavior. Sociobiology is closely allied with ethology and evolutionary psychology, fields which can be characterized briefly as the evolutionary study of behavior in individual organisms under natural conditions. All three disciplines deal with the history of species and the way behavior adapts organisms to their environment, serving the needs of survival and reproduction. Ethology and evolutionary psychology concentrate on the details of individual behavior, including the role of brain activity and its development over the individual's life history. Sociobiology deals more with the organization of entire societies, and with how these patterns of social organization emerge from individual behaviors stressing cooperation and conflict. Although rooted in the behavior of the individual members of the population, such patterns are difficult or impossible to predict solely on the basis of information about individuals alone, and require approaches that consider the feedforward and feedback among multiple organizational levels.

Pinnacles and Paradoxes

Sociobiology identifies four great pinnacles of group cohesion across the range of evolutionary possibilities in the patterns of social living: the colonial invertebrates (corals, sponges, colonial jellyfish); the social insects (ants, bees, wasps, termites); monkeys, apes, and social mammals excluding human beings; and humankind. Against the vista afforded by these pinnacles are set two seeming paradoxes: first, that sociality exists at all, and second that as we traverse the four pinnacles in order of increasing behavioral complexity we seem to slip progressively downward in the population's social cohesion, rather than ever upward.

The members of advanced colonial invertebrates, such as the Portuguese man-of-war, show extreme task specialization and are fitted together into a single superorganism almost indistinguishable from a single well-knit multicellular organism. The insect society is far less well integrated than that of a colonial invertebrate, but is still more so than vertebrate and human societies. The individual worker insect may show distinct phenotypic and behavioral specialization related to its tasks and duties in the colony. Although far from perfectly coupled to and integrated with those of its nest mates, the behaviors issued by its comparatively modest nervous system tend to be altruistically directed to the welfare of the colony as a whole. Such holistic patterns of response also qualify social insect colonies as superorganisms, albeit less perfectly integrated than the colonial invertebrates. Vertebrates have big, flexible brains compared to social insects, and complex flexible behaviors; but their societies depart even further from an idealized pattern of total societal harmony. The individual vertebrate only marginally serves the welfare of its group. In comparison with coral polyps or ant workers, the members of a vertebrate society are self-centered, strife-ridden, and preoccupied with sexual opportunities.

Then, remarkably, this skid toward lower societal integration halts and reverses in human societies. Possessed of a brain supporting fully symbolic language, imaginative consciousness, generalized long-term memory capacities, and long-term contracts upon which elaborate forms of reciprocity can be based, we humans apparently have bucked the paradox and attained relatively high levels of cooperation, altruism, division of labor, and social integration – all without surrendering our basic mammalian heritage of personal identity and individual welfare.

What is going on?

Natural Selection and Selfish Genes

In seeking to unlock such puzzles, sociobiology centers on 'why' questions: why social behavior exists; why certain patterns of group cohesion define a population; or why a species' mating patterns have a certain specific form. The scientific 'why' can be answered only through the study of history and, at all levels from molecular through to ecological, the history of biological systems is by the definition of evolution. Its creative process is natural selection acting through, and on, genetic variation, resulting in the differential transmission across generations of genes that affect survival and reproduction.

Natural selection does not act alone. Mutations can occur at such high frequency as to change the percentage of mutants in a population without the involvement of natural selection. As well, immigrants can bring new genes into the population at a high enough rate to change its overall genetic composition. If the population is a small one, random sampling effects caused by mating choices and genetic recombination can shuffle genes in an unpredictable fashion from generation to generation. Sociobiology hypothesizes that, taken over long periods of time relevant to biological evolution, these intriguing processes are less potent than natural selection in shaping behavioral adaptations and the integrative structure of social populations.

Individuals of course do not duplicate themselves during the process of reproduction. They transcribe their genes and impart them into their progeny. From the viewpoint of evolutionary theory, and hence sociobiology, all the traits of individuals and societies are therefore potential enabling devices for the expansive replication of hereditary material involved in the expression of these traits. Consciousness, language, moral sensibility, loving tenderness toward children, creativity – all are possible adaptations by which genes might spread through future generations.

And hence the first paradox: Why sociality at all? Why not every individual for itself as the Darwinian universal? If it pays genes only to be selfish, in other words to encode adaptations that promote their particular individual survival and replication, why should their behavioral effects tilt toward cooperation and help? Cooperation entails actions that aid others at the cost of one's own time and effort. It is the essence of social life but seems to steal time and effort that might go into making copies of one's DNA. How is such altruism and sociality possible in a world of selfish genes?

Genetic Selfishness Begets Altruism

We know that parents may sacrifice much on behalf of their children, sometimes even their own lives. Among humans as in other species, so long as offspring are preserved the parents' genes are not lost. They are passed on, and this gives us the key to the first paradox. If the self-sacrificing behavior of the parent is influenced by some of the favored genes (via neural hardwiring or the directed learning of nurturance, for example), then that particular form of altruism can spread through the population. Altruism of a broader kind can evolve by essentially the same mechanism: full siblings share, on average, half their genes through common descent, so if an individual makes a sacrifice on behalf of a brother or sister – and in consequence the sibling has more children – the altruistic act can cause an increase in the number of genes in the population that are identical to its own. This form of natural selection is called kin selection and was enunciated by the British evolutionary theorist William Hamilton during the mid-1960s. Its Darwinian force, inclusive fitness, can result in the spread of sociality among close kin other than offspring.

Beyond first cousins, however, it takes a relatively great increase in the reproductive success of the benefited relative to compensate one's unilateral sacrifice. So kin-selection altruism toward distant relatives is expected to be rare. In organisms with potent capacities for situation-specific memory and

problem solving, such as humans and the most intelligent monkeys and apes, cooperation and sociality is generalized as reciprocal altruism, a Darwinian mechanism set forth by the American evolutionary theorist Robert Trivers early in the 1970s. In this form of giving and self sacrifice, the altruistic act is performed among individuals whose genes incline them to repay in kind, perhaps at some future date. Among such organisms, adaptations for complex strategies of reciprocal altruism, set in patterns of transient, ever-shifting alliances and confrontations between group members, can spread through the population by natural selection. The enhancement of survival and reproduction by reciprocating patterns of do-and-repay has been proposed as a main force shaping the evolution of primate cognition and emotion, including the detection/recording of (and, conversely, the capacity for and response to) deception and cheating.

Refracted through the powerful conceptions of reciprocal altruism, kin selection, and group adaptation, answers to sociobiology's second paradox also snap into focus. The members of coral colonies and other similar tightly clustered groups of invertebrates originate from a single fertilized egg and multiply by simple fission and budding off of entire new organisms. The coresident individuals are genetic clones. Under this circumstance kin selection can easily overcome strictly individual selection: looking after a neighbor is the same as looking after oneself as far as replicating genes are concerned. The calculus of close kinship holds too for the social insects, but with less rigid consequences than for the colonial invertebrates. Colonies of ants, bees, and wasps are comprised mostly of sisters. Because of the haplodiploid mechanism of sex determination in these insects, sisters are more closely related to each other than are mothers to daughters (termites are another story). On the average, three-quarters of their genes, instead of half, are identical by common descent. Thus the insect society is far less well integrated than that of a colonial invertebrate, but is still more so than vertebrate and human societies. In vertebrate social populations, the diploid inheritance governing gene transmission focuses kin selection on near relatives at most, but advanced memory and decision capabilities set the stage for complex cohesive patterns of shifting alliances favored by reciprocal altruism. Hence a vertebrate norm: social life is exploited for the improvement of survival and reproduction of self and immediate kin, along with one's allies-of-the-moment.

Elegant and far-reaching, gene-transmission arguments like these answer questions about why specific patterns of social behavior evolve. Demographic and ecological factors are now recognized as key additional causal elements. These shape, for example, the risks of leaving home to found one's own nest as compared to staying with the established enclave and rearing kin there – in short, of a solitary existence versus the boons of sociality. Modern sociobiological research treats multifactorial hypotheses, in which survival and reproductive success interact with ecology, life history, information transmission, and other causal elements within the evolving population. One such striking instance sits atop sociobiology's fourth pinnacle, where humans have reversed the socially corrosive effects of mental flexibility and used their minds to regain high levels of cooperation, altruism, division of labor, and social integration, all without erasing personal identity and individual liberty.

In order to understand this striking reversal, it has been necessary first to understand how culture and its evolution have refashioned the sociobiological agenda of replicating genes.

Gene–Culture Coevolution

Most animal evolution arises from the differential replication of genetic information, but human evolution obligatorily involves the differential transmission of both genetic and cultural information across generations. Changes in the popularity of a song or an art style over time exemplify cultural evolution in its simplest conceivable form. A hallmark universal to our species, cultures are essential to human existence yet wondrously diverse, organized through species-characteristic central tendencies around which cultural diversity plays. Thus, while human cultures differ hugely in the details of their kinship terminologies, no human culture lacks terms for making sense of one's place as, inevitably, each new generation rises up and the old fades away.

Sociobiology is part of an emerging consensus among the human sciences – in which subjects as diverse as evolutionary psychology, anthropology, developmental neuroscience, and the cognitive and behavioral sciences also play essential roles – that genes and culture do not remain isolated one from the other as they evolve. The neurobiology of human mental development binds them. In this mode of evolutionary change, genes have a voice in determining how a culture's information store affects the growth of individual memory, personality, and character in that society. In 1981, Wilson and I suggested that the term gene–culture coevolution be used to describe the effects of Darwinian natural selection and its key allied population forces on genes, mind, and culture. In gene–culture coevolution a circuit of reciprocity operates. Culture is generated and shaped by the biological imperatives embodied in adaptive outcomes, while genes shaping the complex agendas of learning and mental development shift in response to changing cultural opportunities.

Natural selection figures prominently in the study of gene–culture coevolution, as it does in the kin selection and reciprocal altruism of animal sociobiology. But when culture acts too, natural selection can take paths different from those foreseen on the basis of genetic evolution alone. The diversity of possible evolutionary outcomes can increase, and the speeds with which they are approached change. Cooperative sociality may spread through a gene–culture population without the aid of kin selection, reciprocal altruism, or any of the mechanisms traditionally envisaged to account for animal social behavior. These and diverse other striking possibilities have made gene–culture coevolution an active subject in sociobiology, evolutionary psychology, and the social sciences. Using sociometric data and mathematical techniques, powerful computer methods assay the gene–culture connection through its linkages to behavior governing reproduction, gene flow, learning, and other adaptive forces.

Underlying such behavioral adaptations is individual development and learning. Epigenesis is a term used by developmental biologists to refer to the total process of interaction between genes and environment (including culture) during the course of organismic development, including the development

of the nervous system and the mind. If neural and mental development are approached as complex sequences of temporally organized events occurring at various sites throughout the nervous system, the basic building blocks of these sequences can be identified and described. Wilson and I have suggested that Darwinian forces have organized these basic elements into two principal classes: primary epigenetic rules, through which genes mediate the development of neural networks and information processing from initial sensory filtering to perception, and secondary epigenetic rules, through which the patterned timing and activity of genes mediates the development of cognition, temperament, and personality. The primary rules are the more genetically restricted and inflexible of the two classes; cases involving vision, hearing, taste, and smell have been identified. Each class exerts important effects on the mind's capacity for self-organization, including creativity and innovation.

The organization of sequences and stages in mental development, and the molecular neurobiology in which they are grounded, command interest from developmental psychologists and neuroscientists. They have striking immediate impact on sociobiology too, because their conceivable range of action at once illuminates the principal distinct extremes of gene–culture coevolution (GCC) in the population as a whole.

GCC Via Pure Genetic Transmission

In this mode of GCC, the outcome of brain and mind development is very tightly specified by gene activity; culture and social environment either have no effect, or always lead to the same outcome across the population. The genes determine all. For a human example, consider color. Although the number and semantics of basic color terms is exquisitely culture-dependent, normal socialization has no effect on the number (3) of color receptor types in the retina and their spectral response properties, around which this cultural richness plays.

GCC Via Pure Cultural transmission

In this mode of GCC, gene activity creates another very specific kind of nerve circuit architecture in the brain: one able to learn almost any culture. Thus innate genetic activity during pure cultural transmission does not filter cultural information the way pure genetic transmission of culture does. Indeed the opposite is the case. GCC via pure cultural transmission selects for genes that enforce a huge range of possible outcomes in temperament, personality, emotional valence, knowledge, and morality. The culture and social environment determine which outcomes are realized by these generalized learning capacities. Individuals like this are the blank slates or *tabula rasa* minds popular among social revolutionists and political dystopians of the last century. Not free to shape themselves, *tabula rasa* minds are determined by the forest of cultural symbols into which they are born. Thus under pure cultural transmission the unique properties of individual minds, together with the differences among individual minds, arise solely from differences in their sociocultural environment. Culture determines all. So, for example, in seeking to understand why in my native land of Canada we drive on the right side of the road while our

cultural forebears in England eschew the right side for the left, we do not look to genetic differences between Canadian and British populations. Instead we read deeply into their social histories.

GCC Via Gene–Culture Transmission

The intermediate mode of GCC stretches from the extreme of pure genetic transmission on one side to pure cultural transmission on the other. Gene action during neural and mental development plays a colorful role here. Unlike pure genetic transmission, gene action does not commit the developing mind and brain the one innately programmed specification of which cultural information will be accepted. And in stark contrast to pure cultural transmission, gene action does not flatten the individual's learning potential into a landscape of outcomes determined solely by culture. In gene–culture transmission, the activity of developmental genes establishes hills and valleys of learning preference. The hills mark outcomes partially blocked or less likely to occur; allied cultural information has little or no effect on learning and mental development and is less likely to be transmitted or utilized in an arbitrary manner. The valleys mark outcomes to which the mind's development is more likely to flow. Allied cultural information is strongly preferred and likely to be transmitted within and across generations of the evolving population, and used for specific goals in mental development. Thus, all cultures enjoy rich structures of myth and folklore within the creative uniqueness of each language community; grounding these language arts, however, are the deep universals of human linguistic cognition, a species universal that opens the door to mutual intelligibility and the swiftly meaningful translation of texts between cultures.

In gene–culture transmission, genes act to endow culture learning with directionality, not to program final behavior or mental state or leave the individual open to arbitrary cultural determination. The directionality essential to this form of learning can be operationalized only through choice, by selecting certain outcomes over others, and in humanlike species choice ultimately involves conscious reflective decision. Thus in marked contrast to pure genetic transmission and pure cultural transmission, Darwinian natural selection acting through gene–culture transmission is expected to select for individual minds which, in their creative actions of learning and deliberation, shape themselves. Their epigenetic rules endow them with basic competence for deliberative choice. Thinking to this extent for themselves, they are neither genetic robots nor culture slaves. We therefore begin to see why the hypotheses and proposals of human sociobiology have been found relevant beyond the natural and social sciences, especially in the debates of humanists, philosophers, lawmakers, and theologians.

These are principal conceptual alternatives in the mechanisms of cultural transmission during gene–culture coevolution. Although research is ongoing, provisional inferences may be made on the basis of the advances achieved by investigators in multiple fields across the biological, behavioral, and social sciences including sociobiology. Seen against the background of such advances, the paradigm of the *tabula rasa* or blank slate – ordaining pure cultural transmission – cuts a very poor figure.

Consistently across the developmental events spotlighted by the primary epigenetic rules are signs of either pure genetic transmission, or of gene–culture transmission focused tightly on a narrow range of sensoriperceptual competences. In the development of higher order capacities for learning, choice, decision, and creativity the gene–culture transmission strategies prevail, in which a range of outcomes is notably favored over others. The mode I have here called pure cultural transmission of course remains essential to complete understanding (you may drive on the left while I adhere to the right). However, no evidence supports the hypothesis that pure cultural transmission and the *tabula rasa* strategy of learning alone is suffice to understand human evolution and its consequences for sociality, culture, and creativity.

Kinds of Creative Mind

Sociobiology, through its alliance with evolutionary psychology and neuroscience, has been articulate about the kinds of mind pegged to each of its four pinnacles. The colonial invertebrate mind (to the extent the term mind applies at all) is at most a physiological or homeostatic regulator, dedicated to managing the relatively straightforward nutritive and reproductive requirements of these colonial superorganisms. The form of mind sustained by the social insects' minute but exquisitely organized brains is essentially a reactive automatahood, from which emerges the collective behavior of the insect colony superorganism in the form of the amassed individual actions of the colony members. Such an insect mind is specialized to recognize and support group needs through individual behavioral acts. These in turn are triggered by cues each colony member obtains from its immediate, local environment and the impact of the colony superorganism on that environment. Individual creativity and innovation play no role. Although individual capacities for signal detection and response support an innately limited set of behaviors, the colony superorganism emerging from these simple behaviors has an impressive capacity to assure colony founding, growth, and reproductive release even when the environment changes unexpectedly. Colonial invertebrates and insect societies may not be massively creative agents or innovation generating machines, but within limits can assimilate and adapt to novelty and turn it to Darwinian advantage.

Political is perhaps the word best suited to describe the form of mind sustained by the complex nervous systems of mammals and other social vertebrates: awareness innately tuned to the nuances of shifting opportunities for enhanced survival and reproduction, and capable of the swift decision-making serving the needs of self, kin, and allies. Within the modestly complex proto-cultures sustained by social vertebrates, chance favors those prepared to detect the behavioral innovations of others and funnel them into family and alliance networks. In these settings an unintentional shift in a call form that arouses mate attention, or the sudden appearance of a better termite fishing tool, can spread rapidly among eager adoptees. Innovations matter, and circumspect creators may for a time prosper from the relative advantages they and their allies enjoy. But this is casual creativity, in the sense that group life would continue in its opportunistically Darwinian manner

as smoothly in the absence of the occasional innovation as in its presence, however transiently delightful. And there is a splendid diversity of animal societies to be assessed in this manner. Wilson and I tallied almost 12000 species in which observational learning may circulate information through the population, and thus in which novel information can be seized for adaptive payoff.

The situation for humankind differs considerably from the patterns of creativity and innovation I have sketched above for the other three zoological pinnacles of sociobiology. Unlike the colonial superorganisms and the insect societies, we humans make novelty as well as consume it, to our individual and collective advantage. And unlike the social vertebrates, we have no more than Hobson's choice in the matter. Over its course of several million years, reaching from our early hominid ancestors to now, the reciprocating whirl of gene-culture coevolution has propelled humanity into a postmodern industrial condition in which creativity is not optional. It is essential to our survival. Our planet now teems with fellow humans at the same time its environment deteriorates, stressed by changes born of our species' prior creations and innovations. Our species now must create and innovate to ameliorate (dare we hope erase?) these threats from our past creative efforts – and do so at increasing pace to heal ecologies and feed everyone as our populations and consumption rates grow – or face oblivion. Innovate, or die.

It was not always so. Our hominid ancestors long roamed a planet populated just sparsely with competing conspecifics. During these long ages a planet replete with territories clean and unexploited awaited the roving bands. A modest kit of stone tools and other implements sufficed to gather, hunt, and no doubt try a bit of growing. For a long time creativity and innovation must have been comfortably optional luxuries for the hominid lineages. In the manner of the other social vertebrates with whom they shared the wide horizons, a new tool or vocalization might be welcomed for the burst of transient advantage the innovation gained till everyone had it. But in a world ready with foodstuffs and clean water, life could go on very nicely between times. As population densities edged up, the neighbors crowded in and fresh horizons slowly vanished, along with the low hanging fruit and the clean water. Sometime in this period our species seems to have crossed an evolutionary threshold. Evidenced by remarkable increases in the diversity, refinement, and capability of the tools, by the societal sizes and by complexities signaled in other archaeological remains, there was a creative explosion (John Pfeiffer's term) starting sometime in the Upper Paleolithic 25 000–35 000 years ago. For us humans it marked the transition from intermittent to increasingly rapid cycles of creativity, discovery, and innovation. As I noted above, we are now far enough down this long march of history that our dependence on the ever-quickening cycles is complete. The cycles in turn are propelled by the obligate creator, a form of mind for which we have no evidence prior to our species' creative explosion, but whose actions shape more and more of our planetary culture and its evolutionary future.

The Obligate Creators

Societies hungry for innovation are niches of unquestioned opportunity for those equipped, by way of their genetic and

cultural heritage, to bring forth abundant novelty. As other entries in this Encyclopedia make clear, the psychological equipment behind creativity is the target of vigorous ongoing research worldwide. It takes no great act of intellectual synthesis to dip into this impressive body of investigation and affirm that, among other abilities, creativity (simplistically, the inclination to produce novelty that matters) draws on the gifts of intelligence, domain knowledge and skill, curiosity, adroitness with interpersonal affairs (one's connections), a knack for persistence, and opportunity. These talents are likely to be among those at work in other species, in the innovators we find from time to time in vertebrate and early hominid societies. All are compatible with innovation as an occasional event, and may serve to diversify other behaviors as well besides creativity and innovation. They are part of a possible grand pattern of adaptations and pre-adaptations remaining to be mapped as the bridge between creative behaviors in the social animals, and those in our hominid ancestors and ourselves.

One gift, however, appears to be a hallmark signature peculiar – for better or for worse – to humankind. For the purposes of this encyclopedia entry I will call the resulting phenotype the obligate creator. Obligate creators occur, to the best of my knowledge, only in the human species considered among life on Earth. The obligate creator's origins are, for the time being, shrouded in human history and evolutionary time; similarly, the precise linkages of the obligate creator mind to the developmental action of genetic and cultural information remains largely to be clarified in future research. The obligate creator's traits are definitive however, and in societies dependent on innovation often startling in their effects. Compared to their more easygoing innovator counterparts among the social vertebrates and ancestral hominids, obligate creators are non-stop sources of significant novelty. To ally and foe alike, they seem impelled to create in their favored domain of human affairs. Setbacks do not dissuade them. So intense is their energy and so prodigal their capacities only death or its equal finally stills them. Working sometimes more in isolation and sometimes more as focal points of social networks that quickly refine and propel their works deep into society, they pass from the status of curiosities to essentials as societies are drawn to the flame of nonstop innovation.

If we were to frame the issue of obligate creativity for a hypothetical social species such as a super-innovator sapient ant or a novelty-genius penguin, talk of a creativity drive or an innovation instinct might suffice to orient the debate. In species that already use extensive innate hardwiring of neural circuits to run their behavior, it is not hard to envision Darwinian steps by which, under appropriate circumstances, genetic changes tweak the innate wiring and so boost the time allocated by the organism to novelty behavior. Such talk will not do for human beings however. Our brains are not hard-wired. For the human species, gene-culture coevolution has favored psychological development through gene-culture transmission, which we saw allows developmental gene activity to shape the elastic properties of cognition and mental activity without rigidly determining it.

Sociobiology therefore reminds us that in the instance of human creativity we must set aside the seductive talk of innate drives and instincts sometimes applied productively to other species. That is not the gene-culture way. There is instead the

human necessity of conscious choice and deliberation rather than hardwired drives. Supreme intellect and domain mastery, however spectacular in themselves, ultimately are no more than servants of an individual capacity for elective action, a specific moral stance taken in the face of known alternatives, which transforms a potential "I could create" into the passionate "I must create." For the obligate creator, giving oneself over to a life of creation, newness, and change is not optional. It is simply the right thing to do, and the lives so lived become wellsprings of novelty. In an organism endowed with a species-universal conscious grasp of notions about right and wrong, no choice about innovation can escape the winnowing filter of these culturally transmitted moral ideas and their diverse modes of expression across human cultures. Aside from the alien concerns of the life-destroying psychopaths and sociopaths who haunt the shadows of literature and cinema, gene-culture coevolution opens evolutionary time to the ascent of species like ourselves, in which creativity must have both a light and a dark side. One may create for both right and wrong reasons, with good and bad consequences. Creativity and morality, in the sociobiological perspective, are inseparably linked.

For the Rest of Us . . .

Where did the obligate creators come from? Well first of all we can be assured they exist. Glance along the index list of this encyclopedia and names of obligate creators jump out as favored subjects of inquiry among psychologists of creativity. Their achievements make them so: no fecundly creative moral being is fated to a dull life. They are the Mozarts, Einsteins, Edisons, Austens, Michelangelos, O'Keefes, and Caesars of human history. The biographies and histories of their lives chart the unscaled heights which seized their imaginations and the hard paths followed upward, where others might have turned aside. Historiometricians and social psychologists, bent to the task of counting innovations per lifetime and life stage, have long noted the sunburst of inventiveness enjoyed by a very few among those drawn to the creative life, and the disproportionate impact such lifelong creative production can achieve. We can also be assured the obligate creators have not been among us for long; obligate creators are something new under the Darwinian sun. They must be, else the archaeological and fossil records would strain with the detritus of their discarded inventions and works and their effect on the direction and speed of social change.

I have said that, among evolutionary sciences, sociobiology's hallmark is its focus on large-scale (population) patterns of social organization, and the relation of these patterns to the behaviors of the individuals comprising the society. Sociobiology can therefore be expected to help illuminate the evolved traits of societal organization that facilitate or impair the emergence of obligate creators, the impact of various schedules of innovation and creativity on the lifetimes of civilizations and the empires they fuel, and the timing of their creative outpourings in gene-culture coevolution. Can sociobiology and its methods of gene-culture coevolution help determine, for example, if the obligate creators long have been dormant within our species' epigenetic rules for mental development, awaiting only the right societal conditions to step forth? Or was

the Paleolithic's creative explosion the hallmark of a new genotype announcing itself in our ancestral tree, a transition that gave life on Earth access to obligate creativity for the first time? How often do obligate creators appear in history and why? How do their works and the lessons of their lives affect the rest of us, in terms both of material (bioeconomic) and spiritual import? Why do the world literatures and arts they have seeded brood upon certain patterns of conflict and struggle among the sexes, among the haves and have-nots, and among gods and heroes (Darwinian poetics)? When they favor creativity's dark side, what offers protection? Obligate creators are still more easily named than defined in rigorous abstract terms – we know them when we see them – but their nature and their role in the gene-culture circuit are central mysteries of human sociobiology.

The clues to these mysteries are enticing. All cultures of which we have knowledge sustain innovation and the creation in sanctioned areas, as well as their eager appreciation, critique, and use, although the directions in which creativity are expressed and channeled are culturally diverse. In this age of computers and large databases, the historiometry of innovation is an abundantly practical discipline, yielding striking evidence, through the work especially of Dean Keith Simonton and others, of nonmonotonic patterns of change in the form and content of works valued for their instrumental utility and/or as art objects. As we see throughout this encyclopedia, key relations between individual creativity and these societal patterns of creativity, innovation, and change are documented by the behavioral and social sciences, involving facets of the imagination, personality, intelligence, motivation, socioeconomic status, cognitive development and education, mood and psychopathology, enculturation, and cognition. Although individual creative potential and its action in everyday life are universal among members of our species, the most successful of the obligate creators anchor one end of a spectrum (apparently characterized by abruptly curvilinear fall-off) of those marked differences in creative output and impact. Very few of us innovate in a way that changes society in a big way, more find creative appreciation (and critique) at some level, and all of us come up with novel solutions when unexpected guests drop in for dinner.

There is a significant weakness in current writing about the evolutionary origins of this creative potential and its release through obligate and everyday creativity. So far, there are just too many good stories one can tell – given the impressive but limited evidence in hand – about why a disposition to innovate and adopt might help a naked ape cope with gene-culture coevolution. The Darwinian scenarios include creativity's uses in exploiting abrupt changes in group structure; the benefit of persuasion, cheating, lies, and seduction to self, kin, and allies; grabbing the attention of the powerful; improving gene-culture fitness because you're the one to copy; collecting mates; and so on. The interested reader will find these and other diverse possibilities explored in *Further Reading* and *Relevant Websites*. There is value in such diversity of course; it gestures toward the creative work still waiting on the road to explain the creative mind. Sociobiology and creativity psychology are young sciences in the grand scheme of things, and their transition from speculative scenario to testable evolutionary hypothesis encompassing creativity, consciousness and morality is human sociobiology's central challenge.

I am not trying to be evasive at this point. We cannot achieve effective evolutionary treatments of creativity and innovation until the specific manner in which our human minds engage in those activities is established, and established in a way that allows conceivable alternatives to be stipulated and evaluated in terms of their effectiveness within a process of gene–culture coevolution. A mammoth order for creativity research to be sure, but this is the era of an emerging scientific grasp of the specific cognitive, affective, social, and moral processes at work in the creative mind. Once we know better what these processes are and how they correlate with history and social form, we will be in a better position to explain why they are so and not otherwise. In the interim, sociobiology's consilient worldview reminds us that while all may – for now – opine on creativity's origins and meaning, none can decree which among creativity's endless possibilities the future one day will cherish.

See also: Adaptation, Adaptiveness, and Creativity; The Dark Side of Creativity; Evolving Systems Approach; Life Stages of Creativity; Nature/Nurture and Creativity; Play.

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- <http://www.vub.ac.be/CLEA/liane/> – Trans-disciplinary mathematics and computer science of creativity, culture, and cognitive evolution (Liane Gabora, University of British Columbia).

Socio-Economic Status and Performance on Creativity Tests

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Glossary

Elaboration A person's ability to add pertinent details (more ideas) to the minimum and primary response to the stimulus figure.

Father education A course of study that a father has successfully completed or an exam that he has passed.

Father income The money that is earned by a father from work/business.

Father occupation The type of work performed/the type of work for which a father is qualified.

Flexibility A person's ability to produce differences in the trend of thought. All those ideas that differ in approach or trend are treated as one for the purposes of flexibility scoring.

Fluency In scoring for fluency, a scorer goes through the responses to the item in question carefully and strikes off those that are irrelevant and/or have been repeated.

The remaining number of responses is the fluency score.

Mother education A course of study that a mother has successfully completed or an exam that she has passed.

Mother income The money that is earned by a mother from work/business.

Mother occupation The type of work performed/the type of work for which a mother is qualified.

Nonverbal creativity Nonverbal creativity refers to a fairly specific type of cognitive ability reflected in performance on a series of paper-and-pencil tasks. There are three nonverbal tasks, namely, picture construction, picture completion, and triangles and ellipses.

Originality The uncommonness of a given response. Responses given by less than 5% of the group are included and are given different weights.

Overall creativity Composite scores of verbal and nonverbal creativity scores.

Socio-economic status Socio-economic status (SES) variable is to be considered as the sum of the scores awarded for father's and mother's education, father's and mother's occupation, and average monthly income of the parents rather than the wealth and place of residence.

Verbal creativity Verbal creativity refers to a fairly specific type of cognitive ability reflected in performance on a series of paper-and-pencil tasks. There are four verbal tasks, namely, consequences test, unusual uses, new relationships, and product improvement.

Socio-Economic Status

The term 'socio-economic status (SES)' refers to an individual's position in a society which is determined by wealth, occupation, and social class and is a measure of an individual's or group's standing in the community. It usually relates to the income, occupation, educational attainment, and wealth of either an individual or a group. These types of variables are summarized into a single figure or socio-economic index. There is no general agreement on the definition of SES and so different socioeconomic indexes are constructed for different uses.

According to Sharan in 1986, SES is a mental construct, a degree of esteem or lack of esteem which people in society display toward an individual. High SES, therefore, indicates a high income, high status occupation and adequate living conditions, whereas, low SES refers to poor income, low occupation, and inadequate living conditions. High SES is considered to provide a healthy and enriched stimulating environment in which personality may develop appropriately, whereas children of low-income groups may develop feelings of insecurity and inferiority and an unhealthy attitude toward people and objects.

SES and Creativity

SES depends on a combination of variables, including occupation, education, income, wealth, and place of residence. But usually, the SES variable is to be considered as the sum of

the scores awarded for father's and mother's education, occupation, and average monthly income of the parents rather than the wealth and place of residence.

According to MacKinnon in 1962, a child from a low SES background is generally left on his own to a greater extent and is permitted to freely move around, explore, and form his own ideas. Though this latitude on the part of the parents is incidental and not deliberate, it certainly has a liberating influence on the child which is likely to enhance his creativity. Family SES has itself been directly related to creativity.

SES has been found to be a significant factor in most of the cognitive and psychomotor performances. It enters indirectly into learning and is regarded to bear some relationship with creativity. The reasons being that a family enjoying a high score SES is able to provide for conditions and facilities conducive to the growth of creativity and vice-versa. Social class differences in creativity have also been explored in a number of studies but the evidence arrived at has not been unequivocal. Arguments have been given to justify the incidence of creativity amongst low as well as high socio-economic background.

SES and Performance on Creativity Tests

There is a large empirical literature, both in India and abroad, showing the relationship between SES and creativity although a few contradictions are found here and there. However, all these studies show that much of what we know is based on psychometric assessment of creativity.

In 1980, Singh studied student teachers and concluded that all three indices of family background, viz., education, occupation, and income of the father, were quite significant in determining the development of creativity.

According to Singh in 2007, SES appears to be more instrumental in fostering or hindering creativity among children than any other determinants. Studies related to the SES of creators show that they come from an average SES in which children tend to be creatively stimulated and encouraged to create something new and original.

In 1965, Smith found that among fifth-grade white children in Pittsburgh, the middle class performed significantly better on verbal tasks, but the lower class excelled on nonverbal items. Dewing studied that the correlation between creativity and SES was highly significant. Ogletree and Ujlaki in a cross-cultural study of English, Scottish, and German subjects observed in 1973 that in all countries the creativity scores of the upper class were significantly higher than those of the middle- and lower-class samples. McDaniel indicated in 1974 that subjects from a higher SES performed better on creativity than those from a lower SES.

In 1979, Forman found that upper class children scored better than lower-class children on creative measures. An empirical study by Heinla in 2006 on 16–17-year-old Estonian adolescents' and 9–12-year-old children's creative thinking indicated a connection with parents' profession and the family economic status. The study results demonstrated that the creative thinking of 16–17-year-old adolescents is higher in the group where one or both parents have university education, work as top executives or specialists, where the families cope well economically, and live in the capital. The creative thinking of the 9–12-year-old children is higher in the group where the mothers have a higher education and when they live in a rural area.

In India A. K. Sharma, revealed in 1979, that students of upper SES scored significantly higher on creativity than students of upper middle, lower middle, and upper lower SES. Other researchers have found similar results.

In 1979, Awasthy reported that students of very high SES were superior to the students of high, average, and low strata SES in flexibility, originality, and total creativity, while students of high SES were superior to the students of very high, average, and low strata SES in fluency. The results of Sharma and Jarial

support the above results, whereas those of Sharma were different. Students of high SES scored significantly higher than the students of low SES in fluency, whereas no significant difference was found in the flexibility, originality, and total creativity scores of these groups.

In 1980, Ahmed found a significant difference in the verbal and nonverbal creativity of students coming from advantaged and disadvantaged home backgrounds, favoring the former.

Some studies have revealed that in India there is no significant difference in the creativity scores of high, middle, and low SES students.

An empirical study by Sebastian in 1997 with 398 children of 13–15 year age group from the Ernakulam district of Kerala, India revealed that the correlation matrix on overall creativity, verbal creativity, nonverbal creativity, and its dimensions are positively and significantly related to overall SES and its variables except mothers' occupation and status, the coefficient values ranging from $r = 0.32$ to 0.46 , all $p < 0.01$. Thus in the study it is found that the creativity of children increases with higher SES of their families including fathers' education and occupation, mothers' education, and monthly income of the family excluding mothers' occupation.

Mothers' occupation is not found to be related to verbal creativity and its dimensions, and the overall creativity. However, a low significant relationship is observed between mothers' occupation and nonverbal creativity ($r = 0.15$, $p < 0.01$). No relationship is observed between mothers' occupation and its dimension, and the elaboration of nonverbal creativity.

Another empirical study undertaken by Sarsani in 1999 with a sample of 373 students reveals that father's and mother's income was highly correlated with their education ($r = 0.38$, $p < 0.0001$ and $r = 0.19$, $p < 0.001$) and with occupation ($r = 0.31$, $p < 0.0001$ and $r = 0.58$, $p < 0.0001$). Father's education and mother's education was highly correlated with their respective occupational categories ($r = 0.36$, $p < 0.0001$ and $r = 0.27$, $p < 0.0001$). It is generally true that highly educated people have better opportunities to occupy good positions and earn more than any uneducated or middle educated group (Table 1).

From Table 1, a high correlation between father's education and mother's education ($r = 0.59$, $p < 0.0001$) reflects Indian socio-cultural practices. In India, marriages are normally settled by elders looking at various factors like education,

Table 1 Intercorrelations between students' parental background variables and creativity

Pearson coefficient of correlation (<i>r</i>)	Father			Mother			Children's creativity (CC)
	1. Education	2. Occupation	3. Income	1. Education	2. Occupation	3. Income	
Father							
1. Education	1.0	0.36****	0.38****	0.59****	0.18****	0.10*	0.15**
2. Occupation		1.0	0.31****	0.33****	0.09#	0.04#	0.07#
3. Income			1.0	0.38****	0.05#	0.14**	0.12*
Mother							
4. Education				1.0	0.27****	0.19***	0.17***
5. Occupation					1.0	0.58****	0.11*
6. Income						1.0	0.16**
7. Children's creativity (CC)							1.0

**** = Significant at 0.0001; *** = Significant at 0.001; ** = Significant at 0.01; * Significant at 0.05; # = Not significant.

Source: Sarsani (1999) (unpublished Ph.D. thesis).

occupation, and earnings. For example, a highly educated person looks for a highly educated bride. Of course there are some exceptions.

As for creativity, it was found that it correlated highly with mother's education ($r=0.17$; $p<0.001$), mother's income ($r=0.16$; $p<0.01$), father's education ($r=0.15$; $p<0.01$), moderately with mother's occupation ($r=0.11$; $p<0.05$), and father's income ($r=0.12$; $p<0.05$). There was no significant relation with father's occupation.

Parental Education and Children's Performance on Creativity Tests

In 1962, Getzels and Jackson found that the parents of the high IQ child also tended to have a somewhat higher educational level than the parents of the high creativity child. But what is perhaps more noteworthy is the greater specialized training of both the mother and the father of those with high IQs. A greater proportion of the high IQ fathers than of the high creativity fathers were found in academic or educational occupations. But, despite their greater professional training, a somewhat greater proportion of the mothers of the high IQ children than of the high creativity children were exclusively housewives and did not hold other full or part-time jobs. It would seem that the mothers of high IQ subjects had more time to devote to their children than the mothers of the highly creative subjects. High IQ mothers were in fact likely to be more vigilant about the 'correct' upbringing of their children than the high creativity mothers.

According to Runco, SES is relevant to creativity and its development in part because SES determines what kind of experiences and resources will be available. Additionally, parental education is correlated with family SES, and parental education by itself plays a large role in development. It determines communication patterns and content, for example, and conveys the idea that education is a valuable thing. SES may also determine how wide a range of experiences a child will have in terms of travel, but also in terms of the books that may be available, the range of people who may visit the home, and the cultural experiences (e.g., museums, theatres) the child will visit.

In India, Sudhir Kumar reported that father's education and mother's education were found to foster higher creative thinking ability; the students with well-educated parents attained higher creativity scores than those with illiterate parents. Parental occupation was not found to be a factor related to the creativity of children.

In 1968, Raina found that a higher creative group came from parents who were comparatively better educated than the parents of lower creative students. In 1977, Srivastava also observed that the children of highly educated parents scored significantly higher than the children of less educated parents on a creativity test. A more recent study revealed that parents' higher level of education was a favourable factor for the development of creativity in their children.

In 1999, Sarsani studied whether significant mean differences existed among the students in relation to their fathers' education level. It was found that the differences in verbal creativity were statistically significant ($F=2.97$, $p<0.001$) between groups of students based on their fathers' educational qualifications. In component-wise analysis, except in verbal

fluency, the mean differences were found in the components of creativity such as verbal originality and flexibility. It was found that there are no significant mean differences among the groups in nonverbal creativity and its component nonverbal elaboration, but not in nonverbal originality.

As for overall creativity (verbal + nonverbal), the F -ratio was found to be 3.32 which is significant at the 0.01 level. There were significant differences between the groups. Except for the group whose fathers were illiterate, there was a significant increase in the mean score obtained by the students whose fathers had higher education levels. Generally, better education in fathers relates to greater creativity. Why the children with illiterate fathers do not fall into this pattern is not clear and requires further research.

In the case of mothers, an analysis of variance (ANOVA) for verbal creativity ($F=2.89$, $p<0.01$) and its component verbal originality ($F=4.83$, $p<0.001$), and verbal flexibility ($F=2.20$, $p<0.05$), indicates significant mean differences among the groups whose mothers had different educational backgrounds. But no differences were found in verbal fluency.

In nonverbal originality, elaboration, and total nonverbal creativity, no significant differences were found among the groups whose mothers have different educational backgrounds.

Lastly, an ANOVA was performed on the overall creativity scores (verbal + nonverbal) in order to examine the variation in the means obtained by the students whose mothers had different educational backgrounds and was found to be significant ($F=2.16$, $p<0.05$). Overall, the greater the level of the mother's education the higher the level of verbal creativity. This did not apply to nonverbal creativity, where the difference was insignificant. Even in verbal creativity, the relationship was not always linear.

Parental Occupations and Children's Performance on Creativity Tests

The fathers' occupations were classified by Sarsani under eight categories on the basis of the National Classification of Occupations. The results reveal nonsignificant differences in mean scores of verbal originality, fluency, flexibility, and total verbal creativity among groups with different fathers' occupation levels. Similar nonsignificant results in nonverbal originality, nonverbal elaboration, and total nonverbal creativity were reported. This indicates that the fathers' occupation does not influence their child's creativity.

As far as overall creativity was concerned, the obtained mean differences among the different groups were not significantly different ($F=0.46$, $p>0.05$).

The mothers' occupations were classified under the same categories as fathers' occupational categories. The verbal originality indicates significant mean differences among the groups whose mothers had different occupational backgrounds ($F=3.10$, $p<0.05$). No significant differences were found for verbal fluency or verbal flexibility. However, a significant difference was found for total verbal creativity ($F=2.30$, $p<0.05$).

Nonsignificant differences were found for nonverbal originality, nonverbal fluency and total nonverbal creativity. Finally, a nonsignificant mean difference was also found in overall creativity. Generally, where mothers are working in higher level occupations their children's verbal creativity is higher. This does not apply to nonverbal creativity.

Parental Income and Children's Performance on Creativity Tests

A correlation matrix (Table 1) shows the Pearson 'r' correlation coefficient on the set of SES variables. There are other indicators of SES, such as ownership of land, buildings, cars, televisions, refrigerators, etc., but asking all these particulars may be misunderstood and may not give reliable information because of possible income tax avoidance or legal problems. There are no problems in disclosing education and occupation. Of course the income reported may not be 100% correct but, when verified with the school records confidentially, were found to be generally accurate.

The results reveal nonsignificant differences in mean scores of verbal creativity and its components verbal fluency and flexibility among groups with different fathers' income levels. However, verbal originality was found to be significant ($F=2.68$, $p<0.05$). With regard to the nonverbal creativity and its components, originality and elaboration, the differences in means were also not significant.

As far as overall creativity was concerned, the difference was not significant. It can be interpreted that fathers' income, overall, does not appear to influence their children's measured creativity.

Significant differences was found among groups with different mothers' income levels in verbal creativity ($F=3.31$, $p<0.01$) and its all components such as originality, fluency, and flexibility. The children of the highest income groups obtained higher scores than the lower income groups. Nonsignificant means differences were found for nonverbal creativity and its components, such as originality and elaboration.

As far as overall creativity was concerned, the difference was significant ($F=2.88$, $p<0.05$). The highest income group scored the highest and the lowest income group (or no income) achieved the least mean score on overall creativity. Again, the main influence appears to be on verbal rather than nonverbal creativity.

Conclusion

Overall creativity (verbal + nonverbal) scores were related to children's parental background, with better education, occupation, and income leading to higher levels of creativity. When parents were considered separately there were exceptions. The children of illiterate fathers seemed to score more highly

than those with more education. Why this might be so is not clear. With regard to the mother, the better educated the mother the higher the level of verbal creativity. This did not apply to nonverbal creativity. Fathers' occupation did not influence creativity, but for mothers, where higher levels of occupations were held, children tended to have better verbal creativity. Similarly, it was the mother's income, not the father's, which differentiated verbal but not nonverbal creativity. Overall, the research studies in India and abroad tends to suggest that there is a relationship between SES and the creativity trait. It can be interpreted that the higher the level of SES the greater the chances of one being creative.

See also: Economic Perspectives on Creativity; Education and Creativity; Research: Quantitative.

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Spirituality

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Glossary

Absorption Undistracted, deep cognitive/affective involvement with, and heightened sense of reality toward, attentional objects.

Contemplation The intentional act of deep thoughtful reflection, consideration; reflexive thought on the relationship between self and other; meditation on spiritual matters.

Dark energy Hypothetical form of energy permeating all of space that tends to increase the rate of expansion, dispersion, of the universe; a form of vacuum energy derived from the quantum physical uncertainty principle.

Dispassion The ability to detach from fixed interpretations of reality which supports qualities like openness, empathy, wisdom, creativity, and spirituality.

Mystical experience A deviation from ordinary conscious awareness which transcends ordinary experience and manifests as a direct, intimate, and intuitive encounter with a reality of a higher order of magnitude.

Singularity A singular point near which functions deriving information tend towards zero or infinity exhibiting extreme behavior; in astrophysics, a space-time point at which gravitational forces cause infinite space/time distortion where matter exhibits infinite density and infinitesimal volume.

Spirituality *Emmons* Search for meaning, unity, connectedness to nature, humanity, and the transcendent.

Synesthesia The ability to transform, enrich, and encode events in multiple sensory modalities in an absorbing manner.

Transcendence Knowledge of how objects (information) are experienced or constituted as objects; a form of conscious awareness that lies beyond the immediate grasp of the intellect; also, awareness of the infinitude of unrealized informational possibilities.

Transliminality *Thalbourne* The tendency for psychological material to move, in and out, across the threshold of consciousness.

Setting the Stage

One of Nature's greatest wonders is that a species devoid of fangs, claws, body armor or camouflage and whose young rely on extended nurturing for survival, should become the dominant species on this planet. The only advantage it had was a conscious awareness, and memory, of its limitations coupled with a sense of agency that other species did not have. Human awareness of sickness, old age, and death (SOD) probably predates the Paleolithic (2.5 million years ago), an era where hominids like *Homo habilis* first began forming stone tools. As SOD is usually unpleasant and ultimately terminal, early man found ways to deal with it. He discovered that natural phenomena like earth, wind, fire, water, and living things could be harnessed to improve and extend life. He developed language which led to the rise of civilization. He also realized his capacity for creative problem solving as well as the value of innovation and progress. There were times, however, when Nature appeared to be malevolent, beyond his willful control. He observed that, in such circumstances, surrendering to Nature's unknown, sacred power via chanting, prayer, and making offerings would occasionally appease his situation. Weather cleared, disasters were miraculously averted, and family members were saved or healed. The beneficial effects of expressing his humility, however, were not as guaranteed as the effects of progress. Assuming his knowledge, will and actions to be somehow deficient, he sought a deeper relationship with the sacred to establish meaning in his life. This goal gave rise to shamanism, and eventually religion. In man's search for meaning, along with his desire for progress,

he noticed an unusual phenomenon: the most productively creative individuals exhibited what Plato later called 'divine madness.' Creative inspiration somehow also had a mysterious, sacred quality to it.

Far removed from prehistoric times, modern man's battle with SOD continues. Technologies, for instance, involving biochemistry, bio-engineered clones and stem cells, high-speed computation and artificial intelligence promise healthy, extended lives. Yet, regardless of the tremendous progress in science, Nature's greatest mysteries remain an enigma. Entropy is unabated and immortality's out of reach. Philosophy, the study of truth, has been unable to resolve a single fundamental question and man's spiritual inclinations stand firm against the alluring explanatory powers of physicalism and materialism. The forces that motivate creativity and spirituality are still an open question. The purpose of this article is twofold: (a) to shed light on the ancient, profound relationship between two equally essential phenomena, creativity and spirituality; and (b) to open that relationship to future scientific scrutiny. Empirical investigation into the relationship between these two constructs is rare because spirituality, a common term related to overall purpose and existential meaning within diverse contexts, remains ill-defined and therefore almost opaque to measurement while creativity, though more specifically defined and hence measurable, displays tremendous breadth across multiple knowledge domains for discovering original problems, solutions, and expressions. In short, the relationship is bound to be both profound and complex, and so this article can only hope to serve as an initial probe into this vast subject.

Transcendence Manifested

The word spirituality is derived from the Latin *spiritus* which refers to breath as the vital, animating principle of life. Breathing is a dynamic process involving periodic oscillations between inspiration and expiration. In the Christian tradition, the gospel of John starts with "In the beginning was the Word . . ." Here, 'word' implies transcendental meaning, or knowledge, carried by the breath, or spirit, of God. In Hinduism, the Vedas speak of the primordial word *ParaVak* as the vibratory origin of the universe. Buddha, in the *Aggañña Sutta*, described a pulsating universe, expanding and contracting via natural causes over countless eons. Spiritual evolution, similarly, pulsates in a dynamic interplay between transcendence and immanence, between knowing as Being and knowing as grasping. According to Islam, and other theistic traditions, Nature's duality was created by God: "The heavens and the earth were of one piece, then We parted them" (Koran 21:30, Marmaduke Pickthall, 1992: 330). Spiritual evolution mirrors the divine creative process. It follows a spiral path to Truth, oscillating at increasingly subtle levels between inspiration and expression.

Robert A. Emmons defined spirituality as "a search for meaning, unity, connectedness to nature, humanity and the transcendent" (Robert A. Emmons, 1999: 877). Although spirituality is incumbent in religiosity, individuals describing themselves as spiritual may not consider themselves religious. David C. Dollahite defined religion as "a covenant faith community with teachings and narratives that enhance the search for the sacred and encourage morality" (David C. Dollahite, 1998: 5). In 2000, Peter C. Hill and others construed sacred as an individual's perception of a divine being or object, ultimate reality or ultimate truth. Search for the sacred, interpreted in accordance with specific beliefs and culture, is the common denominator for religion and spirituality. A study by Gerard Saucier and Katarzyna Skrzypińska, in 2006, indicated that spirituality and religiousness produce two highly independent dispositions. While *tradition-oriented religiousness* is associated with authoritarianism, traditionalism, collectively shared beliefs and low openness to experience, *subjective spirituality* has a mystical orientation highlighting the value of subjective experience. It is associated with absorption, fantasy-proneness, dissociation, magical thinking, eccentricity, and high openness to experience. The same descriptors have also been attributed to creative individuals.

Roy Horan defined creativity as the "manifestation of an intention to transcend the limitations of information" (Roy Horan, 2007: 182). He construed creative intention as both conscious volition and as an unconscious stream of attention directed toward a goal. In this respect, the state of transcendence precedes the integration of new information, or insight. His definition could easily apply to spiritual transformation, or self-actualization, wherein manifestation appears as a more psychologically integrated, insightful individual. The experience of transcendence supports both creativity and spirituality by altering common perceptions and habitual thought patterns. Spiritual transcendence involves a direct intuitive experience (revelation) of a higher self (or Being) which Merrill-Wolf, in 1995, argued occurs when the light of consciousness reverts upon itself, a way of knowing he calls *introception*. In creativity,

transcendence lies in the infinite realm of possibilities and in information gaps where, according to Amit Goswami in 1999, cognitive quantum leaps provide a mechanism for new associations to form. In both creative and spiritual processes, the normal interpretive intellect is momentarily breached, a phenomenon which manifests in openness to experience, sensitivity, absorption, synesthesia, dispassion, transluminance, unitive experiences of self-other, mysticism, during moments of inspiration and psychological freedom.

Sensitivity, Openness, Absorption, and Synesthesia

Earle J. Coleman's book entitled *Creativity and Spirituality: Bonds between Art and Religion* provided a broad overview of the relationship between artistic creativity and spirituality. One of the commonalities, he argued, is receptivity, or openness. He suggested that an esthetic orientation encourages the artist to wholly engage natural phenomena by developing rapport, empathy, and sympathy towards Nature. The native American, Walking Buffalo, illustrated this spiritual-aesthetic orientation, "We saw the Great Spirit's work in almost everything: sun, moon, trees, wind and mountains. Sometimes, we approached him through these things" (Walking Buffalo, 1971: 23). William James, in 1958, called this religious approach to natural phenomena a 'mood of welcome' (William James, 1958: 49). The mystic-poet, William Blake, in *Auguries of Innocence*, elevated this open aesthetic to another level:

To see a world in a grain of sand,
And a heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour
(David V. Erdman, 1982: 490)

Heightened aesthetic sensibility in creative and spiritual experience touches the very core of an individual's being, evoking deep emotions like awe, wonder, and ecstasy. Aesthetic sensibility suggests increased physiological sensitivity. In 1996, Colin Martindale and others compared galvanic skin response to creativity scores. They found that creative individuals are more sensitive to physiological stimuli, stay alert toward incoming stimuli regardless of having developed cortical models for them, demonstrate larger fluctuations in arousal levels, and habituate more slowly than less creative individuals. Sensitivity is also important to spiritual development. Meditation forms the central practice of many spiritual traditions. In 1999, Michael Murphy and Steven Donovan cited numerous neuropsychological studies supporting meditation's capacity to enhance empathy, sensitivity to stimuli and overall perceptual ability. Terry V. Lesh, for example, found in 1970 that Zen meditation increased sensitivity, openness to experience, and empathy in counseling students. Emotional sensitivity, however, is more common to artists than scientists.

Robert R. McCrae and Paul T. Costa, Jr, in 1985, indicated that openness to experience, an attribute significantly correlated to creativity, is related to scope of awareness and depth/intensity of consciousness. It is positively correlated with the need for variety, preference for complexity, tolerance for ambiguity, nontraditional attitudes, behavioral flexibility, rich, complex and ambivalent emotions, perceptual synesthesia, and is

negatively correlated with dogmatism. Gregory J. Feist, in 1999, noted that openness to experience is found in both creative artists and scientists. McCrae and Costa further noted that openness to experience positively correlated with the Tellegen Absorption Scale. In 1974, Auke Tellegen and Gilbert Atkinson argued that absorption is the capacity for self-absorbed, self-altering attention found in peak and mystical experience, hypnosis, and artistic creativity. Absorption is a readiness for undistracted, deep cognitive/affective involvement and a heightened sense of reality toward attentional objects. It permits the assessment of information in unconventional and idiosyncratic ways. In 1981 and 1987, Charles M. Rader and Tellegen discovered a significant correlation between absorption and synesthesia which is defined as the ability to transform, enrich, and encode events in multiple sensory modalities in an engaging manner. Synesthetes are noted to be very creative. Furthermore, many artistic works and spiritual texts bear descriptions of a synesthetic nature. Thirteenth-century Sufi mystic-poet Jaladin Rumi's *Ode 314* is one example:

Those who don't feel this Love
pulling them like a river,
those who don't drink dawn
like a cup of spring water
or take in sunset like supper,
those who don't want to change,
let them sleep
(Coleman Barks, 1990: 18)

Openness to experience, sensitivity, absorption, and synesthesia exhibit the quality of transcendence by detaching from existing informational patterns. They also intensify in profound artistic and religious experience.

Dispassion

Coupled to absorption is a capacity for what Horan, in 2007, translated as dispassion (*vairāgya*), an individual's ability to detach from fixed interpretations of reality, a quality which promotes openness, empathy, wisdom, and creativity. This construct is exemplified in the story of Śikhidvaja and Cūdālā in the *Yogavāsīṣṭha*, a renowned Hindu scripture illustrating the power of the mind. Cūdālā, the queen, teaches her husband, Śikhidvaja, that spiritual enlightenment cannot be attained by detachment from material things or even the body (asceticism), but by detachment from closely-held assumptions and interpretations of reality. Asceticism, or self-denial, is a common spiritual practice in monastic settings. In attempting to transcend desire, asceticism may promote a sense of separation from material phenomena eliciting, in response, a clinging to the concept of detachment itself which forms a major obstacle to spiritual evolution. If not approached properly, detachment can also lead to pathologically disassociated states. On the other hand, Donald G. Forgays and Deborah K. Forgays, in 1992, noted that sensory deprivation, a form of induced detachment, elicited creativity. In this respect, sense withdrawal acts as a constraint. Although the neuropsychological mechanisms connecting creativity to sensory deprivation are unclear, one could speculate that sensory inhibition activates the hypnogogic state. This ambivalent waking-to-sleep state has inspired many creative individuals. In meditative

traditions, hypnogogic reverie is considered a dispassionate first step toward transcendence. Jesuit priest Anthony De Mello described the open affective nature of dispassion: "You cannot love what you are not constantly discovering anew, the object of affection may be an artwork or natural beauty as well as a human or the divine" (Anthony De Mello, 1992: 97–98). This love arises by constraining the tendency to concretize interpretations of experience. In science, dispassion takes the form of objectivity which continually challenges basic assumptions and rediscovers the nature of truth, an approach that has stimulated an exponential growth in innovation and technology.

Transliminality

Another form of psychological transcendence, or loosening of informational boundaries, is transliminality, which Michael A. Thalbourne defined as a "hypothesized tendency for psychological material to cross thresholds in and out of consciousness" (Michael A. Thalbourne, 2000: 196). Transliminality is a form of psychic mobility that occurs across the threshold of awareness. In 2000, Thalbourne and James Houran found that transliminal subjects had greater belief in parapsychological and unusual events, reported more of these experiences, felt themselves to have powerful minds and demonstrated a proclivity for introspection, daydreaming, and altered states of consciousness. These descriptors are evident in many spiritual individuals. Thalbourne, furthermore, observed that the *Creative Personality Scale* had a significant correlation with transliminality as well as with the above-listed attributes; however, other measures of creativity like the *Revised Barron-Welsh Art Scale*, a measure of figure-complexity preference, did not support transliminality. This suggests that not all creative criteria involve transliminality. What has not been investigated is the distribution of transliminality in creative artists and scientists. In 1997 and 2001, Thalbourne and others noted that high transliminals are likely to report synesthesia-like experiences perhaps as artistic metaphor or via drug use, and hyperesthesia, a heightened sensitivity to sensory stimulation. EEG studies conducted by Jessica I. Fleck and others, in 2008, on high transliminals found reduced coherence in the low alpha/high beta range within the right temporal lobe which is consistent with studies of participants with high paranormal beliefs as well as creative individuals during baseline recordings.

Union of Self-Other

One of the primary transcendental phenomena observed in both creative and spiritual individuals is the perceived union of *self* and *other*. Coleman suggested that while the intellect tends to separate subject from object, aesthetic intuition and spiritual experience undermine this separation, often resulting in an ineffable harmony. Philosophical positions on the self-other union differ. While Christian mystics like Saint John of the Cross and Teresa of Avila suggested that monism is psychologically true but ontologically false, Advaita Vedantins declared the existence of a single ontological Reality (*Brahman*) in which the self and material world are merely appearance, or *maya*. The Upanishads refer to this as *Tat Tvam Asi* – That Thou Art. Coleman argued that absolute transcendence, or annihilation of the self, does not allow for important spiritual qualities like devotion or transformative creative processes. Annihilation

of the ontological separation between self and other, unless transient, is unimaginable because consciousness would be destroyed. Consciousness implies consciousness of something, even if that something is consciousness itself. Furthermore, Reality's creative power (even as *maya*) is virtually undeniable. Creativity permits immanence which, along with transcendence, describes ultimate reality in many religions. Though the Advaita Vedantins stress transcendence, they still account for appearances.

The union of self and other is a common theme in art. For example, the Chinese copy master painters, or sculptors, to perfection in order to experience the masters' creativity at a deeper level. Coleman suggested that Leonardo da Vinci implied this in saying, "He who cannot become the object cannot draw it" (Earle J. Coleman, 1998: 96). That is, an object also reflects its creator. Science tends not to acknowledge unitive self-other states because they belie the construct of measurement, and therefore objectivity. Quantum physics, however, has challenged this perspective. Werner Heisenberg stated, "The common division of the world into subject and object, inner world and outer world, body and soul, is no longer adequate and leads us into difficulties" (Werner Heisenberg, 1958: 24). Similarly, David Bohm declared, "Relativity and quantum theory have shown that it has no meaning to divide the observing apparatus from what is observed" (David Bohm, 1983: 143). The phenomenon of creativity, applying the quantum physical model, results from both Nature's spontaneous and the observer's conscious (or unconscious) choices which affect the probability of original information coalescing within a transcendent state (i.e., the quantum vacuum).

Most empirical investigations of the self-other union focus on the neuropsychology of mystical states and the practices that induce them. David M. Wulf, in 2000, defined mystical experience as a deviation from ordinary conscious awareness that leaves the indelible impression of encountering a reality which transcends ordinary experience at a higher order of magnitude. The mystical experience is often a defining moment leading to positive psychological transformation. Evelyn Underhill suggested that the ultimate transformation of the mystic includes a higher order of creativity:

... the mystic's personal encounter with Infinite Reality represents only one of the two movements which constitute his completed life. He must turn back to pass on the revelation he has received He is, in fact, called to be a creative artist of the highest kind . . . (Evelyn Underhill, 2003: 65)

In 2001, Andrew Newberg, Eugene d'Aquili and Vince Rouse, using single positron emission computerized tomography (SPECT), scanned Tibetan monks and Catholic nuns during meditation and prayer. They discovered reduced activity in the posterior superior parietal lobe (PSPL) and increased activity in the right prefrontal cortex (RPF) which they felt caused the sensation of absorption of the self into something larger. The PSPL is responsible for defining the boundaries of the self. It is also associated with creative insight. Decreased activity in the left PSPL results in a loss of self and reduced activity in the right PSPL enhances a feeling of unity with the world. They suggested that hyperactivation of the RPF stimulates the hippocampus to inhibit neuronal signals from reaching the orientation areas of the brain, thereby softening the self's boundaries. Roland

Fischer, in 1971, suggested that consciousness can be altered either via the *ergotropic* pathway of increased arousal ending in mystical ecstasy or, via the *trophotropic* pathway of decreased arousal ending in deep trance. Sometimes both pathways alternate in a single experience. The ergotropic pathway is founded in the sympathetic nervous system and exhibits higher EEG discharges while the trophotropic pathway is based on the parasympathetic nervous system and exhibits lower frequency discharges. In both cases, the boundary between observer and observed, between what is subjective and objective is blurred and the sense of time either accelerated or slowed. In 2009, Horan argued for a neuropsychological connection between creativity in incubation and illumination phases and meditation, resulting from *transcendence* and *integration*. Transcendence, reflected in low-alpha/delta brain-wave frequencies, surpasses informational limits while integration, reflected in theta/gamma frequencies, transforms and reestablishes informational boundaries. Mindful meditation (the technique of witnessing thoughts, emotions, and sensations until they subside) elicits information reduction, or transcendence, through dispersed attention while concentrative meditation (the technique of intently focusing on absorption-inducing vehicles) exhibits information reduction via focused attention. Both attentional strategies permit unitive self-other states, are not restricted to formal meditation, and are employed spontaneously to a greater or lesser degree by creative artists and scientists.

Mysticism, meditation, and prayer do not fully describe spirituality which contains a strong affective component associated with virtues like love, compassion, gratitude, forgiveness, and humility. Empirical investigations of spirituality as a psychological construct are quite limited, usually involving self-reports. Additionally, the affective relationship between creativity and spirituality is relatively unexplored.

Inspiration

The notion of creative inspiration being associated with the transcendent has deep roots in art, science, philosophy, and religion. Ancient Greek poets invoked the divine Muses for inspiration. The philosopher Philo once wrote "I have approached my work empty and suddenly became full, the ideas falling from a shower from above and being sown invisibly" (Abraham Joshua Heschel, 1962: 333). Similarly, the composer Johannes Brahms said "Straightaway the ideas flow in upon me, directly from God, and not only do I see distinct themes in my mind's eye, but they are clothed in the right forms, harmonies, and orchestration" (Willis Harman and Howard Rheingold, 1984: 46). In 1968, Srinivasa Ramanujan Aiyangar revealed that mathematical genius, Srinivasa Ramanujan had claimed his mathematical insights originated with the Goddess Namakkal, another way of saying he felt their origin to be transcendent. George Nugent Merle Tyrell, in 1946, cited the poet Percy Bysshe Shelly as saying, "One after another the greatest writers, poets and artists affirm that their work comes to them from beyond the threshold of ordinary consciousness" (Willis Harman and Howard Rheingold, 1984: 47). Even the scientific method, attributed to Rene Descartes, was predicated on the nonrational aspects of three dreams he had on the night of 10 November 1619. They occurred after Descartes failed repeatedly, while attempting

to unify science and mathematics, to reveal the mind of God. In 1977, Wassily Kandinsky wrote that Teresa of Avila attributed her literary work, *The Interior Castle*, to God. Rumi, ascribed his *Masnavi*, a collection of over 50 000 poetic lines, to divine inspiration. More generally, theologians suggest that scripture, which forms the basis of all major religions, is divinely revealed in its content and divinely inspired in its transmission or expression; that is, scripture emanates from without.

Inspiration emanating from within the individual, through intrapsychic forces, is a fairly recent idea. Eduard von Hartmann, in 1884, thought the unconscious mind produces more elegant and organic ideas than the conscious mind. In 1952, Ernst Kris described inspiration as regression in service of the ego; that is, cognitive regression toward primary processes occurs in order to facilitate flexible thinking and novel insight. In a similar vein, Ronald A. Finke, in 1995, suggested that the intentional merger of unassociated images stimulates the emergence of preinventive forms which lead to new inventions. Regardless of how inspiration is viewed, from within or without, it engages processes beyond the reach of the conscious mind and is therefore transcendent with respect to waking consciousness.

In 2003 and 2004, Todd M. Thrash and Andrew J. Elliot conducted a number of studies on inspiration. In the first study, they discovered that (a) inspiration's motivation is intrinsic, not extrinsic; approach-centered around positive affect, not avoidance-centered; (b) inspiration correlated positively with openness to experience in such a way that it appeared not only to co-vary with inspiration, but facilitate it; (c) inspiration is strongly related to work mastery and absorption which represent a transcendence of constraints in an individual's thought patterns and behavior. Both work mastery and absorption appeared as consequences suggesting inspiration's positive effect on motivation and focus. Though inspiration is evoked, it is not a passive phenomenon, but favors those with a prepared mind; (d) inspiration correlated positively with sense of competence, self-esteem, optimism and importantly, creativity, all of which emerged as consequences; (e) because self-determinism also emerged as a consequence of inspiration, the investigators suggested that "the self cannot take credit for inspiration: the self is discovered, not asserted" (Todd M. Thrash and Andrew J. Elliot, 2003: 886).

In the second study, Thrash and Elliot suggested that inspiration involves a juxtaposition of two processes (a) being *inspired by* which concerns denial of responsibility for the inspirational influence and (b) being *inspired to*, which influences the motivation to transmit or extend inspirational content toward a motivational object (e.g., self-actualization, creative work). Both processes are similarly described in Judeo-Christian and Muslim theologies as the source of scriptural revelation and transmission, respectively. The investigators suggested that the 'by' component of inspiration is triggered by illumination rather than reward salience. Therefore, inspiration is experienced as both transcendent and unwilling. Approach temperament, an ancient appetitive system involving sensitivity, reactivity and behavioral disposition toward positive/desirable stimuli, predicted motivational strength and appears to play an important role in the 'to' component, or transmission. Sometimes, transmission is automatic (as in spontaneous creative or spiritual expression); other times, it is more controlled,

for example, in translating inspirational content into a creative/spiritual work, a goal that fulfils man's higher longing to transcend the sense of self or existent knowledge state.

Search for Freedom

Rollo May, in *The Courage to Create*, declared "Creativity is a yearning for immortality" (Rollo May, 1975: 31). This idea connects creativity with man's deep spiritual longing to transcend SOD, to find meaning. In 2003, Swami Shantananda, in *The Splendor of Recognition*, a treatise on the Kāshmir Śhaivite text *Pratybhijñā-hṛdayam*, described the three psychological veils that limit perceptions of reality. They are the senses of imperfection (*ānava-mala*), separateness (*māyīya-mala*) and doership (*kārma-mala*). The sense of imperfection perceives SOD as a limitation of human will; that is, humans feel powerless to eradicate SOD. The pain of imperfection instills the longing to find perfect joy. Separateness discerns differences such as noise versus information, one idea exceeds another, and life is distinct from death. The pain of separateness creates a longing for union, for wholeness. Doership supports the belief that an action's effects are caused solely by the one performing the action. Doership tends to ignore the complex chain of macro/micro causality that determines even the smallest, most subtle action. The pain of doership creates a longing for surrender to something greater than the self. All of the veils both bind and motivate the individual to evolve. Why some individuals buckle under these existential constraints while others transcend remains an open question. Transcendence of the veils is said to result in liberation (*moksha*), or freedom.

Similar constructs are found in many spiritual paths, for example, Christians and Muslims claim that acts of divine grace bring god-men into the world and perfection to man in an afterlife; divine love overcomes the separation between both man and man, and man and God. Furthermore, actions accepted as offerings to the divine eventually release man from his ego. Creativity addresses these veils as well. It dissolves the sense of imperfection by inspiring artists to seek aesthetic perfection and scientists/mathematicians to aspire to elegance and universality. Overcoming separateness lies in the nature of creative synthesis. Openness to experience, sensitivity, absorption, and self-other unitive experiences alleviate the sense of separation. The creative individual may feel that he is not the actual creator, or doer of the creative work or expression. Dispassion and inspiration help allay the sense of doership. Creativity finds innovative ways to transcend SOD. If one veil is too thick, however, creativity may lead to unalterable destruction.

While the creative artist delimits himself by deepening his intuition and devotion to art, the creative scientist transcends through a process akin to negative theology, the practice of intellectually negating phenomena while seeking absolute truth. In 1935, Karl Popper asserted that hypotheses and theories are scientific only if they are falsifiable. His astute assertion gave science extraordinary explanatory power. A similar assertion rests in the Vedantin practice of 'not this, not this' (*neti-neti*) based on a theology that negates all phenomena as incomplete, or false, until Truth is revealed. The practice is also called the yoga of knowledge (*jñāna yoga*) and is considered the most challenging of all yogic practices because it

requires a high level of discipline, persistence, strong observational and discriminatory powers, objectivity, and the guidance of a qualified teacher. Science exemplifies these same attributes with guidance proffered by the scientific method and peer-derived feedback. Most scientists tend to reject the notion of God and the existence of transcendent phenomena as unfalsifiable. Yet, this does not obstruct the harnessing of scientific breakthroughs and innovative technologies to creatively draw what was once deemed transcendent into realm of falsification. In this respect, science brings us closer to truth, fosters humility and affords a sense of liberating awe at the deeper mysteries of existence.

Creative and Spiritual Contemplation

Horan's concept of intention as the basis for creativity seems insufficient to produce creative works that also require talent and intelligence. He suggested, however, that the root of creativity (which he calls the vacuous state) contains powerful unconscious intentions, or subliminal attentional flows, that also nourish intelligence. These deeper intentions produce intelligent creative works and expressions. Willis Harman and Howard Rheingold in *Higher Creativity: Liberating the Unconscious for Breakthrough Insights* suggested that, the unconscious mind can be yoked willfully through imagery, affirmation, meditation, etc., to make creative choices. In 2000, Tobin Hart suggested that a special internal mind-set is required for courting creative inspiration. It involves focus, trust, letting go, listening and embodiment. *Focus* is a deliberate attempt to use prayer, meditation, concentration, etc., to ask specific questions or direct attention more fully on some phenomenon. Whereas the religious person focuses through communion, liturgy, or a common language, the artist focuses first by preparing his environmental and psychological space then directing energy toward an artistic undertaking. The scientist focuses by reviewing data, finding a problem and creating a hypothesis. During focus, the 'self' reaches out to 'other.' *Trust* implies faith in "a nonrational, postreflective way of knowing" (Tobin Hart, 2000: 47) which elicits detachment from preconceived assumptions and provides suspension of disbelief. Whereas the scientist and artist trust in their gut instincts, the religious person trusts in God or some ultimate reality. Trust builds a bridge between 'self' and 'other.' *Letting go* is an act of volition leading to surrender which is a serious challenge to those who cling strongly to assumptions. Letting go is an extraordinary intention. It demands dispassion and openness, thereby making the mind fertile soil for cultivating new ideas. Artists and spiritual individuals recognize its importance in developing greater sympathy with objects of attention. William Butler Yeats in his poem *Among Schoolchildren* captured the epistemological impact of the artist's letting go, "O body swayed to music, O brightening glance, How can we know the dancer from the dance?" (William Butler Yeats, 1997: 219). Scientists often let go when the solution to a problem appears futile. For example, mathematician Henri Poincaré's discovery, in 1908, of a class of Fuschian functions arrived unexpectedly from what he called the 'principle of forgetting' (Henri Poincaré, 1952: 53). *Listening* allows insight to manifest. It ensures that subtle concepts or cues are not

overlooked. The spiritual person listens for revelation, the artist for inspiration, and the scientist for solutions. *Embodiment* is the transmission of an idea into form, such as a painting, novel, movement, invention, mathematical equation, and so forth. The entire process, from focus to embodiment, demonstrates an attentional rhythm – first contraction, then expansion, and contraction again – much like breathing. The rhythmic process contains a dynamic interaction between transcendence and manifestation, found equally in both creativity and spirituality, but to different ends.

Horan, in 2009, suggested a similar process for engaging the unconscious mind in creative work which he called *creative contemplation*. Creative contemplation is based on a very ancient yogic, or spiritual, meditation practice (*samyama*) developed by Patañjali in the second century AD. It was designed to intentionally induce supranormal powers in the practitioner, of which extraordinary creativity was one. Lynne McTaggart, in *The Intention Experiment* cited a body of empirical evidence supporting the power of intention to alter physical reality at a distance. Horan proposed that the same intentional process via brain plasticity enhances creativity. Creative and spiritual contemplation (or prayer) are similar because they enlist the same attentional mechanisms, one directed toward creative endeavor, the other toward solving existential dilemmas and seeking new ways to transmit old wisdom and meaning to new generations.

A Dynamic Relationship

Because the relationship between creativity and spirituality is both complex and relatively unexplored, a more general theoretical direction is proposed in order to facilitate empirical studies. In 1995, Franklin Merrill-Wolf suggested that an inverse relationship exists between appearances and transcendent Reality. Inverse relationships occur as one variable increases, the other decreases, like a see-saw. Merrill-Wolf indicated that the more an individual gets caught in what appears to be real (e.g., repeated thoughts, facts, assumptions) the less that individual is able to experience more sublime truths (e.g., pure awareness). Imants Barušs, in 2007, converted this profound concept into a simple equation. To better comprehend the relationship between creativity and spirituality, Barušs' equation has been modified (and generalized) as follows:

$$T = 1/I \quad [1]$$

whereby, 'T' is *transcendence* in the Emmanuel Kant sense of knowledge about how one experiences or constitutes objects as objects, a sublime witnessing state that lies beyond the immediate grasp of the intellect. Transcendence is knowledge of what constitutes knowing (i.e., Knowledge). It lies at the foundation of all perceived phenomena. More immediately, Knowledge also includes the infinitude of unrealized informational possibilities. 'I' represents *information*, recognizable pattern(s) that may or may not embody a message (e.g., clear versus ambiguous patterns) and which influences the formation and transformation of other patterns. Implied in the concept of information are partial differentiation and integration of patterns, partial in the sense that absolute differentiation equates to pure randomness (e.g., noise, nonsense) while

absolute integration describes a singularity (e.g., unitive experiences) ... two transcendent poles of the spectrum of knowledge. For example, in cosmology, the cosmic energy flux (and therefore information) appears as absolute transcendence in a singularity (i.e., the source of immense gravitational, or integrative, forces within massive black holes) as well as 'dark energy' which is theoretically attributed to the potentially limitless expansion, and differentiation, of the universe. In either case, $I = 0$ or ∞ (here both 0 and ∞ are described as informational empty sets, the difference being that 0 results from a theoretically infinite gravitational contraction of the universe while ∞ results from the converse, an infinite anti-gravitational repulsion and expansion caused by 'dark energy'). Equation [1] applies only between these extremes (i.e., $0 \gg T, I \ll \infty$); that is, as information approaches zero, transcendence approaches infinity.

In the human psyche, eqn [1] suggests that as information (e.g., schemas, memes, rules, laws, and paradigms) increases, Knowledge decreases; that is, when the mind clings to partial information (e.g., pet theories, strongly held opinions) it becomes crystallized and shallow, not transcendent. At the center of the information spectrum are stable patterns such as well-proven facts, inviolable laws, nature's constants and the concept of reality. Domain knowledge is crucial for both creativity and spiritual growth; however, if such knowledge becomes dogmatic or inflexible, both creativity and spirituality are stunted. In 2004, Dean Keith Simonton suggested that creative incubation involves a quasi-random, combinatorial process. In this respect, randomness expresses informational divergence (transcendence via the randomness pole) and harbors the potential for originality while combinations allow novel information convergences. Unique combinations developed during incubation may lead to insight, a phenomenon that approaches the singularity pole. The new information 'fits perfectly' (eureka!), coalescing with the existent informational field and with a great sense of certainty. Insights often stimulate further incubation. Equation [1] also suggests that information combinations which follow established paths (e.g., that lack transcendence) are not creative.

Spiritual traditions that embody a negative theology cut at the root of cognition and induce inspiration by overcoming the tendency to describe or name things. For example, the ninth century abbot Erigena declared that God is beyond all description and therefore the negative (herein inverse) of all that is perceived. Negative theology resembles the random, or divergent, pole of transcendence by negating information. Alternatively, other traditions, such as pantheism, sanction the singularity, or convergent, pole via a positive theology that condones one-pointed focus on a divine being, or essence, permeating everything. Both approaches challenge the mind to transcend itself. Adverse reactive tendencies like clinging to religious dogma obstruct the search for the sacred. The mathematical inverse of eqn [1] also applies:

$$I = 1/T \quad [2]$$

whereby an increase in transcendence (i.e., Knowledge) decreases information. For example, Albert Einstein's general theory of relativity unified space-time and gravity; but, when first published, found only a few physicists that could comprehend it. The theory's level of transcendence, or abstraction,

exceeded the capacity of those steeped in existing physical paradigms to grasp its meaning. The same phenomenon appears often in creative works or expressions that reject entrenched paradigms. Similarly, mystics describe unitary states as ineffable, as abstract to the point that language cannot capture them, whereby approximations such as symbols and metaphors serve as communication vehicles. The following equation mathematically emerges from either [1] or [2]:

$$TI = 1 \quad [3]$$

Here, the dynamic interplay of transcendence and information is synergized. Creativity was described by Todd I. Lubart, in 2001, as a dynamic, often recursive or cyclic, process involving many complex subprocesses gravitating around what Graham Wallas, in 1926, described as the four phase model of creative process involving preparation, incubation, illumination, and verification. Whereas preparation and verification phases center on information gathering and evaluation of the known, incubation and illumination focus on transcendent exploration and discovery of the unknown through novel associations. Spiritual process often follows a similar dynamic. Its preparatory phase, comprised of scriptural study and practice, is followed by inner work (spiritual incubation) and occasionally by an inspiring experience of unity, a deity, or communion which is then evaluated and implemented into everyday life. The '1' in the equation suggests a dynamic perfection, or balance that, depending on the nature and scope of the variables, manifests as anything from a new flower arrangement or momentary feeling of spiritual connectedness to powerful psychological encounters like *flow* (identified by Mihaly Csikszentmihalyi in 1996), *living in the Now* (described by Eckhart Tolle in 1999) and the *play of Consciousness* (*chidvilas*, illuminated by Swami Muktananda in 1978). If T or I , in eqn [3], ever reached 0 or ∞ , then $T = I$, an ineffable state in which all information is absolutely transcendent, a state described in many mystical accounts of an ultimate reality. Figure 1 is a four, spatial dimensional representation of eqn [3] in relation to its limits (i.e., 0 and ∞). The graphically-depicted fourth

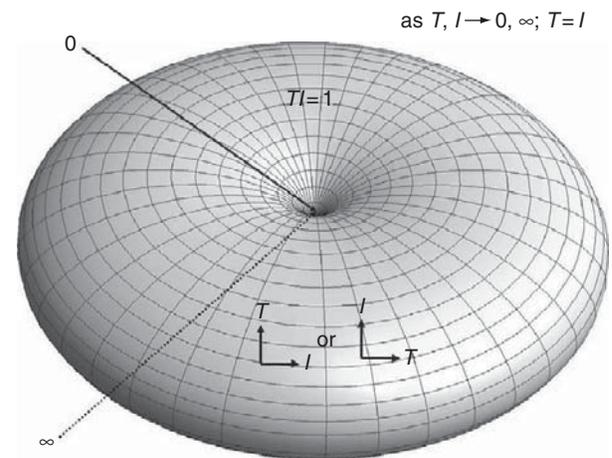


Figure 1 Movement from 0 to ∞ , and reverse, occur over the surface of the *sphorus* (sphere-torus). Simultaneously, both T and I , in four dimensional space, inverse their surface vector directions. The *sphorus*' surface represents all solutions except $T = I$ which appears in the singularity (i.e., the empty set).

dimension (embodied in an object herein called the *sphorus*) allows both *T* and *I* to have simultaneously inverted spatial directions thereby denoting the ultimately transcendent nature of all information as well as the information-potential inherent in transcendent states.

The 'TI' model furthermore serves the purpose of differentiating the complex relationships between science, art, religion and mysticism, provided that creativity is assumed to incline toward values incumbent in information (i.e., knowledge), objectivity, and its expression while spirituality is assumed to lean toward more transcendent values like Knowledge, subjectivity, and its expression. In 2005, Jan Tønnesvang defined self-actualization in terms of a bipolar self wherein one pole (sense of self) carries the properties of agency, assertion, and creativity while the second pole (sense of other) is attuned, or influenced, by ideals, values and sociality in the greater context of communion with something larger than the self. The interplay of poles, one creative, the other more spiritual, can result in a joyous dialectic that reinforces both. Creativity and spirituality interactions with the knowledge-objectivity/knowledge-subjectivity variables form a 'TI' matrix supporting the domains of science, art, religion and mysticism.

Figure 2 indicates that science and religion may differ in their approaches to knowledge, conflicting over the nature of objectivity by juxtaposing science's faith in evidence and nature's empirically-derived laws with religion's faith in revelation-derived scripture and religious dogma. At the same time, they both share a search for meaning and/or Truth. Science and art are related through creativity such that art inspires science and science informs art. Leonard Shlain, in 1991, discussed this accord in *Art & Physics*. He suggested that art has always foreshadowed breakthroughs in physics. To see how science informs art, one need only look at the technologies employed in modern film productions. The largest domain contrast lies between science and mysticism. Deeper investigations into cosmology and quantum physics have, however, provoked near-mystical awe (sometimes repression) in many scientists. The model predicts that science will eventually induce semi-mystical states, perhaps as treatment for pathological conditions like depression and anxiety. For example, Michael A. Persinger, in 1983, used transcranial stimulation of the temporal lobes to actuate altered states. Art and religion have had a close relationship for centuries with religious art dominant until the Renaissance and diminishing later with scientific advancement. Art's sublimity uplifts both heart and mind

while the sacred inspires art. Mysticism lies at the core of most religious traditions. There are Christian mystics, Sufis in Islam, Kabbalists in Judaism, Hindu yogis and Zen Buddhist practitioners. Many of the great religious transformers were mystics. Mysticism plays an important role in art. Zen mysticism, for example, finds expression in painting, calligraphy, tea ceremony, gardening, etc. Though differentially weighted, creativity and spirituality can be found in all four domains in accordance with an individual's propensities and his culture's relationship to both transcendence and information. Using the 'TI' model, empirical investigations of a creativity-spirituality connection may be facilitated through psychometric designs that bridge these knowledge domains and evaluate potential cognitive, social, affective influences on that connection as well as via experiments which explore the roles of arousal, attention, insight (including revelation) and other neuropsychological markers related to transcendence, recognition, and integration, of new information.

Conclusion

The relationship between creativity and spirituality is ancient. Empirical investigations into this relationship have been stunted by lack of a clear definition for spirituality as well as by the complexity in measuring both constructs. In order to provide a scientific direction in this regard, an inverse relationship, based on the concepts of transcendence and information, is suggested as a platform for gauging and extracting both neurological and psychological similarities and mechanisms driving both creativity and spirituality. Transcendence is depicted as the unique variable underlying the ability to create and the capacity to experience the sacred. The level of transcendence fluctuates with the mind's attachment to information, fixed notions, paradigms, etc. Various psychological phenomena are found to illustrate transcendence in both creative and spiritual individuals including openness to experience, sensitivity, absorption, synesthesia, dispassion, transluminance, unitive experiences of self and other, mysticism, moments of inspiration and psychological freedom. Further similarities exist in the nature of creative and spiritual contemplation, processes that involve focus, trust, letting go, listening and embodiment.

See also: Altered and Transitional States; David Bohm 1917–1992; Flow and Optimal Experience; Incubation; Mindfulness; Paradigm Shifts; Synesthesia; Unconscious; Zen.

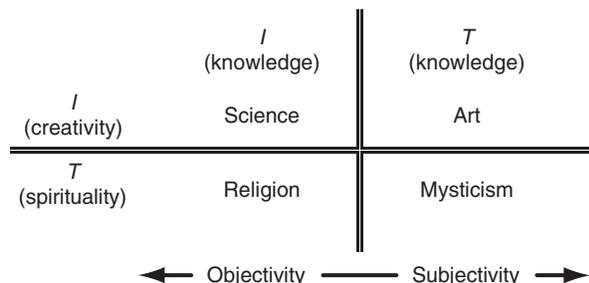


Figure 2 The relationship between *T*, *I*, and major knowledge domains.

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Sports and Creativity

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Glossary

Game analysis Game analysis software allows study of the individual tactical behavior of the players (e.g., feints in one-on-one-situations), the tactical interactions of a group of players (e.g., specific combinations in offensive play), and the general game strategy of a team (e.g., playing more defensively).

Game sport Team sports such as soccer, basketball, volleyball, and racket sports including tennis, table tennis, and badminton.

Game test situations Game test situations are simple game forms with clearly defined game ideas, fixed numbers of players, as well as defined rules and environmental conditions. The fundamental idea is basic constellations with clearly allocated roles in order to create recurring and consistent conditions with many repetitions for the participants. In order to analyze the creative actions, a video of the recorded behavior is subsequently rated with regard to specific concepts by several independent experts.

Inattention blindness Failure to detect an unexpected object if attention is diverted to another task or object.

Neural networks A neural network is a type of computer algorithm which consists of a grid or matrix of neurons.

The dimension of this neuron matrix determines the dimension of the network. Neurons are trained with data and so build clusters of similar input data, without needing any additional information. These clusters define types of input data and thereby help to recognize and identify test data after the training phase. A given test input is recognized by the net as corresponding to the cluster to which it is most similar and is therefore identified by the type (e.g., name, specification) of that cluster.

Regulatory focus theory Two modes of self-regulation are proposed in this theory: a focus on accomplishments and aspirations is labeled as a promotion focus to regulate pleasure, while a focus on safety and responsibilities is called a prevention focus to avoid suffering.

Tactical creativity (= divergent thinking ability) Tactical creativity is defined at the behavioral level as the unusualness, innovativeness, statistical rareness, or even uniqueness of solutions to a related sport situation in team ball sports.

Tactical intelligence (= convergent thinking ability) Tactical intelligence refers at the behavioral level to the ability to find the ideal solution to a given problem in a specific situation in team ball sports.

What Is Creativity in Sports?

Definitions

Sports is a worthwhile field to study behavior in a complex context. In particular, complex situations enable creative performance to be analyzed in an ecologically valid way. The distinction between expert decision making and creativity in sports are closely linked to the theoretical distinction between 'divergent thinking' and 'convergent thinking,' concepts which were first proposed and defined by Joy P. Guilford and first transferred to the world of sport by Klaus Roth.

Convergent thinking, or tactical intelligence, refers at the behavioral level to the ability to find the ideal solution to a given problem in a specific situation in sports. For example, basketball star Dirk Nowitzki may anticipate future moves of an opposing offensive player and step in front of him provoking an offensive foul. Divergent thinking or tactical creativity is defined at the behavioral level as unusualness, innovativeness, statistical rareness, or even uniqueness of solutions to a related sport situation. Therefore, tactical creativity can be regarded as a variety of rare and flexible decisions used in different kinds of situations. Basketball star Earvin 'Magic' Johnson became famous for his so-called 'no-look-passes,' seeming to be able to take in all relevant stimuli of a situation, and use this information to fool his opponents by looking in the direction of the most obviously free teammate while passing the ball to another player.

Practical Utility

Sport science literature frequently suggests that both game intelligence and tactical creativity are important for successful athletes in different kinds of sports. In order to generate decision possibilities and seek original solutions players must be able to perceive all important information from their environments (positions of team mates and opponents, players emerging unexpectedly, etc.) and consider this information when generating an action plan. Tactical creativity is increasingly significant for complex sport games because coaches are able to collect more information about their opponents. For example, with game observation and game analysis it is possible to study the individual tactical behavior of the players (e.g., tendency to move left or right in one-on-one situations), the tactical interactions of a group of players (specific combinations in offensive play), and the general strategy of a team (e.g., fast breaking at every opportunity). As [Table 1](#) indicates, several famous soccer coaches in Germany pointed to a lack of creative players in all leagues. With the development of versatile, and at times extraordinary solutions (tactical creativity), a significant and domain-relevant ability in sports games is recognized.

Evaluation: Game Test Situations

Different kinds of instruments have been developed to evaluate an athlete's tactical decision making skill. Currently, only a

few sport-specific tactical creativity tasks have been constructed and tested for objectivity, reliability, and validity (see Table 2) and these include game test situations which act as a type of compromise between standardized tests and game observation methods discussed below. Game test situations are simple game forms with clearly defined game ideas, fixed numbers of players, as well as defined rules and environmental conditions. The athlete's creative behavior is assessed without trying to standardize the ball paths and actions of team mates and opponents; hence, the fundamental idea is basic constellations with clearly allocated roles in order to create recurring and consistent conditions with many repetitions for the participants. In order to analyze the creative actions, a video of the recorded behavior is subsequently rated with regard to specific concepts by several independent experts.

Evaluation: Standardized Tests

Tactical creativity tasks are relatively highly standardized. Athletes view brief video sequences of a sports game (e.g., basketball, soccer) in which attacking players play against defending players. At the end of the video clip, the final image appears frozen with one player in possession of the ball. The participant takes over the role of the ball holder in the video clip, identifying all opportunities that might possibly lead to a goal/basket. The motor executions (e.g., pass with the non-dominant hand/foot, indirect pass) should also be mentioned. Athlete's answers were noted on a specially designed sheet that

Table 1 Statements of soccer coaches from the National Team and the '1. Bundesliga' in Germany

- "Imagination and creativity should be left to the Brasilians" (Franz Beckenbauer)
- "The midfield is not creative enough. We no longer have a Häbler or a Littbarski. Certain things have been neglected that need to be put right" (Jürgen Klinsmann, former German National Team Coach)
- "Technically and tactically, other countries are far ahead of us. That is why in many clubs the creative player is a foreigner" (Christoph Daum, Fenerbahçe Istanbul)
- "Whenever the Germans want to be creative they can't manage it. They are unable to control the game" (Jürgen Klopp, Borussia Dortmund)

Source: Grunz A, Memmert D, and Perl J (2009) Analysis and simulation of actions in games by means of special self-organizing maps. *International Journal of Computer Science in Sport* 8: 22–36.

Table 2 Description of sport-specific divergent thinking tests which evaluate tactical creativity in sport

Label	Task	Authors
Game test situation	This instrument contains a context-dependent real world setting that can directly provoke tactical tasks in ecologically valid situations. Participants' tactical behaviour is recorded on videotape and their tactical decisions are analyzed by expert coders using a subsequent concept-oriented expert rating system (criteria: originality, flexibility).	Memmert (2006, 2007, in press); Memmert and Roth (2007)
Video creativity task	In this decision task, participants watch sport-specific videos. The image is frozen after 1 min. The participants have to imagine themselves as the acting player and name all opportunities that might possibly lead to a goal. The answers are evaluated according the criteria of originality, flexibility, and fluency.	Johnson and Raab (2003); Memmert (in press)

Source: Grunz A, Memmert D, and Perl J (2009) Analysis and simulation of actions in games by means of special self-organizing maps. *International Journal of Computer Science in Sport* 8: 22–36.

contained all appropriate decisions. The same observation criteria of originality, flexibility, and fluency were used for the athlete's performance as in the usual divergent thinking tasks in psychology; originality of the proposed solutions were rated by experts. For flexibility, all possible tactical decisions in each situation were categorized into ten different kinds of solution options (e.g., perform a one-on-one action, no-look-pass, and pass with a feint). The number of appropriate answers given by a subject for each video scene was used to measure fluency.

Analysis: Game Observation

Technological advancements allow the automatic recording of position data of players and the ball enabling reconstruction of tactical patterns. Furthermore, it is now possible to classify action processes in soccer by means of neural networks and to check the identified process types with regard to their effectiveness. In particular, activities can be recognized which indicate creativity, i.e., activities which are original as well as adequate solutions to the situation. For example, in soccer, a rare combination of several passes which leads to a goal.

A central aspect of game analysis is to quantify the complex qualitative information of a game such as soccer or basketball. The focus of such quantification is on the frequency and success of specific actions such as passes or moves. Once the position-oriented tactical patterns can be recognized by means of a correspondingly trained neural network, it is no problem to automatically count transitions between such patterns with respect to the corresponding actions. This leads to a matrix of transition probabilities as is shown in Figure 1, matrix top-right. Moreover, if the corresponding trajectory network is calibrated to record the success of the represented process, a second matrix can be generated representing the success of those transitions, as is shown in Figure 1, matrix bottom-right. The probabilities of transitions and their success help analyze games and the information-theoretical relevance of actions can be estimated using their time-dependent frequency profiles. Under the assumption that a creative action is rare as well as adequate, the information-theoretic relevance, together with the semantic evaluation of adequacy, enables measuring and analyzing the creativity of actions in an ecologically valid setting. For example, Memmert and Perl showed that out of 5903 complex real-life behaviors in team sports only 1 per cent of the evaluated tactical decisions of all participants was a pass over the defenders to the opposite side (= loop shot).

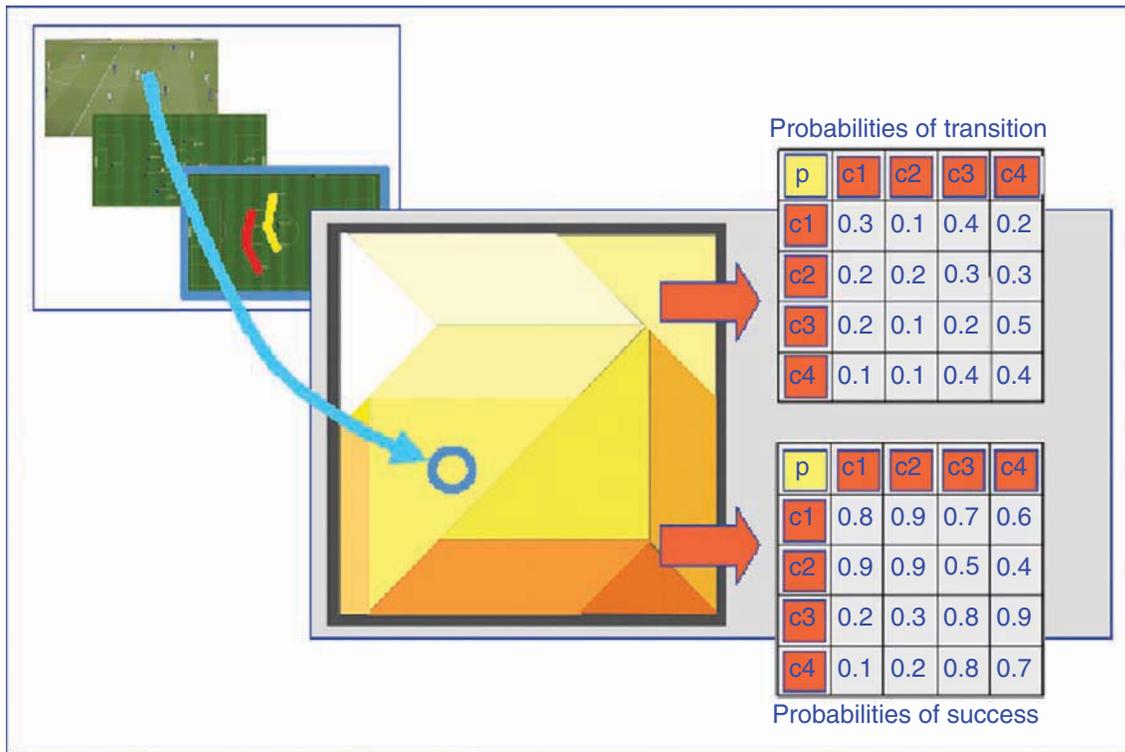


Figure 1 Process analysis resulting in statistic contributions. Grunz A, Memmert D, and Perl J (2009) Analysis and simulation of actions in games by means of special self-organizing maps. *International Journal of Computer Science in Sport* 8: 22–36.

Simulation

An advanced application of neural networks is the simulation of tactical behavior, creative actions, and dynamic learning in games. The current action such as tactical decisions in the game process or movement behaviors of the athletes is tested on the network, activating the corresponding neuron, which then returns information in different semantic categories such as type of activity, degree of creativity, probability of success, or probability of transition to other activities. The goal is to replace the current activity with a simulated one, which when activated in a game situation could be more creative or more successful. More specifically, the resulting simulated process could improve the team’s tactical behavior. Mapped to a network, this means that neurons should have the ability to represent not only frequent but also rare actions. If such a net is calibrated with respect to success or adequacy, then the time series of a process is mapped to a trajectory, where the neurons can be recognized to correspond to creative actions. For example new specific tactical combinations in soccer could be theoretically or practically developed and directly tested in a neural network simulation.

Factors Influencing Tactical Creativity

A theoretical framework is suggested in the next two main sections that contain several individual studies and experiments, which can be seen as the basis for the development of tactical creativity in sports. **Figure 2** outlines a theoretical framework resulting from extensive research and can be

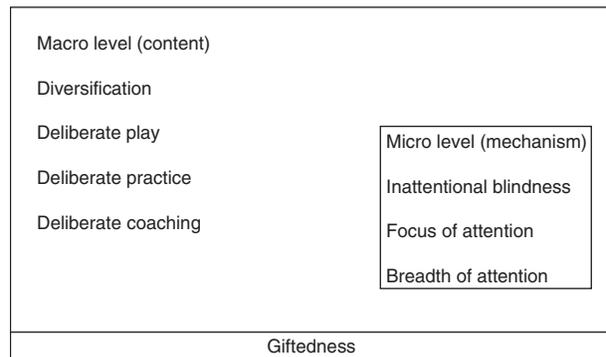


Figure 2 Theoretical framework for 3x4 environment-training-model of the development of tactical creativity.

seen as the basis for the development of tactical creativity. It distinguishes between a micro level (process) and a macro level (content). The micro level examines the mechanism and psychological processes in the respective training situation (micro rules) that lead to the generation of creative ideas. The macro level examines the environmental conditions that can be steered by teachers and coaches (macro rules).

On a micro level, there are three mechanisms that facilitate unexpected and original solutions:

1. by using fewer instructional options to focus attention in team ball sports (inattentional blindness, micro rule 1), and
2. by giving no external attention cues which point out ‘information rich areas’, the attention is not restricted and thereby facilitate creative behavior (micro rule 2);

3. with a large breadth of attention (micro rule 3) unexpected and potentially better alternative solutions can be perceived, used, and hence learned.

In addition, the genetic dispositions of athletes are important. While to our knowledge there exists only preliminary studies linking talent development (motor skill giftedness) and tactical creativity in sport, early evidence suggests cognitive giftedness is a valid predictor of faster development of creative solutions in sport (see [Figure 2](#), bottom).

On a macro level, environmental conditions are created and curriculum designs have to be implemented that correspond to the criteria of

1. diversification (macro rule 1),
2. deliberate play (macro rule 2),
3. deliberate practice (macro rule 3), and
4. deliberate coaching (macro rule 4).

Inattentive Blindness

As described above, tactical creativity is always associated with the ability to generate unexpected and unusual solutions in sports. For this reason, the inattentive blindness paradigm (if attention is diverted to another object, observers sometimes fail to notice an unexpected object, even if it is right in front of them) is ideal for the research of creative processes in sports, since attention performances are associated with the discovery of unexpected objects. Developmental research by Memmert makes a direct link between inattentive blindness, expertise, and creativity. Sport-specific trained adolescents with the ability to notice the free player could describe more original solutions in the sport-specific situation than the 13-year-olds who were 'blind' to the free team mate. At this point, it should be mentioned that the effect reported for the domain of sports was also found in the area of general psychology. Here, the untrained adolescents, who achieved better performances in a general inattentive blindness task, also fared better in the general creativity test in contrast to the participants who could not describe the unexpected object.

The above findings highlight the fact that the inattentive blindness paradigm also appears to play a considerable role in competitive sports. Team players often fail to find the optimal tactical solution to a situation because the coach narrows their focus of attention by giving restrictive instructions. Team members could, however, capture the attention of other team mates by waving their hands as important meaningful exogenous stimuli. This led to a major reduction in inattentive blindness. These findings show that current theories in the field of neuropsychology also have explanatory potential in more complex contexts. Motivational factors therefore control the direction of attention and influence information processing before players consciously perceive specific input.

Focus of Attention

Following the inattentive blindness paradigm, a series of experiments on attention focusing analyzed the influence of special kinds of instruction on tactical decision making in team ball sports. Players do not find creative tactical solutions if they receive attention-directed instructions, because of their reduced

attention focus. More complex and sport-related problems were constructed for a series of cumulative labor experiments. In a sport specific tactical decision making test, adolescents were given the primary task of naming the position of their direct opponent at the end of the trial (attention-demanding task), while also finding a totally open player (secondary decision-making task) that would most likely lead to a goal. Of the participants, 45% failed to notice the open team member. This result was confirmed in other sport-specific situations with adults. Completely open team members were missed by approximately 40% of male basketball players with more than ten years of competitive experience. Even in more realistic contexts with motor responses as well as a primary task closer to the field (triple selection task), this effect was unchanged. That means that instructions that give a narrow focus, for example, just mark a player, lead to players not seeing as many creative opportunities as when instructions are less specific.

Breadth of Attention

Breadth of attention is the term used to refer to the number and range of stimuli that a subject attends to at any one time. Results from attention-narrowing environment stimulation experiments indicated that with a narrow breadth of attention, not all stimuli and information that could lead to original and possibly unique solutions in a certain situation can be perceived. A wide breadth of attention, on the other hand, makes it possible to associate different stimuli that may initially appear to be irrelevant. Colin Martindale (1981, p. 372) explained this fact as follows:

The more elements that a person can focus on simultaneously, the more likely it is that a creative idea will result. [...] Thus, with three elements [...] there are three potential relationships [...] to be discovered. With four elements, there are six potential relationships, and so on.

Experiments in sports science supported the view that fewer instructions by the coaches during game play lead to a wide breadth of attention and therefore facilitated greater improvements in tactical creativity. Participants were confronted with exactly the same tasks as above (focus of attention) while one group received more, and the other group fewer tactical instructions (narrow/broad breadth of attention), in order to investigate the influence of these instructions on the tactical decision. The results indicated that too specific instructions prior to the tactical decision lead to inferior tactical decisions compared to fewer instructions.

Giftedness

Research also suggests that cognitively gifted persons (IQ > 130) seems to improve their tactical creativity more quickly than individuals with average IQs (IQ = 100). In contrast to a gifted control group (gifted children without a sport-relevant intervention) and a nongifted sport-relevant intervention group, the sport-specific creative performance of the gifted children significantly improved after a six month training program of tactical creativity. Here again, the influence of attention performance and inattentive blindness for the development of creativity was demonstrated.

Factors Supporting Tactical Creativity

Diversification

A longitudinal research talent program was designed to investigate the efficacy of various training approaches in team ball sports for the development of tactical creativity. The main assumption was that the perception of many different sport game situations and the acting in these situations has a positive influence on the development of tactical creativity. A total of 135 young athletes took part in a 15-month, field-based study, where they participated in either nonspecific treatment groups (tactical training with hand, foot, and implements); a handball group (tactical training only with the hand); a soccer group (tactical training only with the foot); a field hockey group (tactical training only with implements), and a control group (no training at all). General and specific sport-oriented tactical creativity as dependent variables were measured with game-test-situations. The analysis of treatment-related effects showed that the areas in which the groups were trained (e.g., soccer, handball, hockey), were precisely the areas in which they showed significant improvements. This could be interpreted as evidence for specific training effects; however, nonspecific experiences seem to be a promising alternative to specific treatments. Unlike motor competencies, it seems possible to train tactical creativity independently from motor skills. In summary, nonspecific and specific concepts are on a similar level in terms of tactical creativity development. In fact the nonspecific approaches can even prove to be more workable in the long term.

Deliberate Practice

The term 'deliberate practice' refers to targeted and task-centered training programs based on instructions. Studies of eminent athletes' early development indicates that deliberate environmental influences and organizational conditions benefit the generation of original thinking in sport. Trainers from different types of team sports selected the most creative and the least creative players from their teams. Creative, exceptional athletes in basketball, soccer, handball, and hockey trained significantly longer and more purposefully in their main sport before they were 14 than less creative top athletes ('deliberate practice'). In this case, specific experiences over a long time (ten plus years) are necessary for the attainment of expertise.

Deliberate Play

The term 'deliberate play' refers to noninstructed involvement in play-oriented and at first sight unstructured situations in sport games. In the past, children used to play in fields and roads without coaches and systematic training schedules. Today in Western Europe and North America, they miss the natural experience of playing in the streets for their creative development. As Jean Côté suggested, the sampling years (ages 7–12) are characterized by a high frequency of deliberate play. Self-determination theory and Vallerand's hierarchical model of sport motivation both support the notion that early deliberate play will have a positive effect on intrinsic motivation over time. It also showed that highly creative athletes played far more often in their early youth (up to 14 years of age) and

hence more intensely in many relatively unstructured (complex) team ball sports situations ('deliberate play') without guidance than less creative team players. The results suggested that unstructured play-like involvement plays a crucial role in the development of creative behavior in basketball, handball, field hockey, and soccer. At the same time, current theoretical approaches and empirical research regarding the development of creativity support this view that nonspecific experience over time, such as unstructured play, is an ideal medium for the development of divergent thinking.

The reported evidence provides a basis for the convergence of two prevalent research programs (expertise research, creativity research) that have not yet been discussed in the same context. Both results suggest that practice experiences and early play significantly influence the development of creativity. In this case, specific experiences over a long time (ten year rule) are necessary for the attainment of expertise. At the same time, current theoretical approaches and empirical research regarding the development of creativity support the view that diversified and even nonspecific experience, such as unstructured play, over time is an ideal medium for the development of creative thinking. It is possible that sports science in ecological settings can contribute to the further development of expertise models from developmental psychology.

Deliberate Coaching

As stated previously, research demonstrated that simple instructions lead to reduced attention focus and less effective decision making. Research on training examined if these results could be directly translated into practical training concepts. A six-month longitudinal study examined different kinds of instructions by coaches ('deliberate coaching') during training sessions on the development of tactical creativity in team sports. Creative performance was measured by a real-world sport-specific creativity task in which an attention-broadening and an attention-narrowing group of young athletes performed the same kind of exercises. The only difference concerned the role of the trainers who gave the attention-narrowing children explicit tactical instructions and corrections for each game type. In contrast to the teaching models of the attention-broadening program, this training program discouraged the young athletes from learning to direct their attention toward different kinds of stimuli. As a result of this narrow breadth of attention, not all stimuli and information that could lead to original and possibly unique solutions in a game situation could be identified and applied appropriately. In the attention-broadening training group, the coaches only defined the idea and the rules of the games, and no special tactical advice or feedback regarding attention focus was given. As a result, the young athletes learned to have a wide breadth of attention in complex situations which significantly improved their creative performance. Considered together, these findings highlight the opportunity to focusing attention on the coaching process while training creativity in sports. A wide breadth of attention makes it possible to associate different stimuli that may initially appear to be irrelevant. Giving children reduced instructions, offers athletes the possibility to seek out and recognize unexpected and possibly better alternative solutions.

Summary and Future Directions

Summary

In all sports, athletes have to absorb and process substantial amounts of information within a very short time. They have to pay attention to sensory impressions that are at first very new to them and, because of that, are often unexpected. This raises the question of how athletes can become more proficient at perceiving constant minor and major changes caused by the interaction of their opponents and team members when their attention has only been directed to a few specific aspects of the situation by their coach. Coaches are challenged to find ways of increasing their players' proficiency by identifying tactical solutions; however, it is not possible for any coach to mention all possible solutions for any situation or for the player to remember all of them. Phil Jackson has won more National Basketball Association titles than any other coach by teaching his players the triangle offense where they are trained to improvise and always pass to the open man.

Considered together, the findings discussed earlier highlight the fact that the 3×4 environment-training model can play a useful role in promoting the development of creativity in athletes. Research suggests that keeping conditions playful encourages greater learning for young children in team sport games. In addition, findings suggest that experiencing a number of different sports and games is an ideal medium for players' creative development. Young athletes appear to benefit from the different tactical situations encountered in sports games played during their childhood.

On a practical level, the research presented has implications for the design of tactically oriented training programs and curricula. Environmental conditions can be created and curriculum designs implemented that correspond to the criteria of diversification, deliberate play, and deliberate practice. There are also some methodological principles for training athletes . . . For example, attention focus in team ball sports can be broadened, through lessening specific instruction. With a wider attention focus, unexpected and potentially better alternative solutions can be perceived and executed.

Future Directions

Different types of motivationally oriented theoretical models from social psychology indicate that creative performances can be directly influenced by the simplest of instructions, for instance manipulating emotional states of the subjects. Tory Higgins proposed two modes of self-regulation, in order to regulate pleasure and suffering, that is, to direct behavior towards promotion or prevention targets ('regulatory focus theory'). More specifically, a focus on accomplishments and aspirations is labeled as a promotion focus, and a focus on safety and responsibilities is called a prevention focus. In addition, there is no prior advantage of either motivational orientation in terms of performance. According to this approach, the performance on a given task may depend on the fit between people's regulatory focus (promotion or prevention) and people's chronic regulatory orientation (promotion or prevention). This idea of better performance and a more positive effect via regulatory fit has already received some empirical support in the domain of cognitive tasks and sport-related settings.

Numerous studies show that different cognitive performances can be influenced through motivational states or the 'regulatory focus theory.' For instance, a series of experiments strikingly document that a happy mood can positively influence creative performances, encourage the generation of innovative ideas, and promote the generation of exceptional free associations. At the moment neurocognitive mechanisms underlying the flow experience like happiness or fulfillment are discussed and investigated. Beyond this, Ronald Friedman and Jens Förster presented further experiments that underlined the influence of attitude on achieving positive outcomes (promotion focus) and creative performances. Recent results of studies in sport science suggest that it is worthwhile examining in more detail, in sport-specific settings, the dependent-variable divergent tactical thinking in line with the 'regulatory focus theory.'

Aside from the aforementioned further studies necessary on the link between motivation and creativity, the largest gain in insight is expected in the future exploration and experimental examination of attention theories. Unconscious processes serve as an early selection mechanism, which favors useful or emotionally interesting information for further processing.

See also: Flow and Optimal Experience; Play.

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Alfred Stieglitz 1864–1946

L K Cartwright, San Francisco, CA, USA

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Introduction

Alfred Stieglitz was the preeminent photographer of the early twentieth century. He took many iconic photographs which are held in high esteem and included in major museum collections world wide. His influence on photography was formidable, transforming it from hobby status to fine art and in that process he mentored many of America's foremost photographers. At the same time, Stieglitz had a remarkable range of talents which went far beyond his acknowledged connoisseurship and reputation as a superb photographer and propagandist for photography as fine art. He was also an educator, an essayist, a key disseminator of esthetic practices, a gallerist, a collector, and a charismatic, if opinionated, raconteur. He established a unique, noncommercial gallery space, '291,' which became the center for launching American Modernism in the USA and for allowing many American artists, poets, and writers to gather, to influence and inspire each other, and to exhibit their work.

Family Background and the Early Years

Born in 1864 in Hoboken, New Jersey, he described himself as an American. The first born child of German Jewish immigrants, he hardly led a typical American life. His father, Edward, was a successful businessman who embraced the arts and conducted a salon in his home where artists, poets, and writers met. The family moved to Manhattan when Stieglitz was seven years old. Conversations about the arts continued in Lake George in upper New York State where the Stieglitzes spent their summers beginning in 1872. These group gatherings and spirited conversation accompanied by good food and wine offered him a template for creative environments. Never a fan of silence, Stieglitz later would voice his own ideas on art with undeniable, and often contradictory, authority.

The presence of twin brothers and three sisters gave the young Stieglitz a ready made group. He apparently envied the twinship of his brothers and some biographers think he was always looking for his twin or soul mate. Perhaps, a parallel story line is that he became especially gifted at getting his mother's attention despite the always present competition of bright and clamorous siblings as well as his not-to-be-overlooked dashing father. Hedwig Stieglitz called her son her 'little Hamlet' – sensitive, theatrical, moody, and hard not to notice. He developed a philanthropic narcissism early on, an unusually skillful way of managing both sibling rivalry and oedipal conflicts. One apocryphal tale finds him offering money and sandwiches to an organ-grinder who appeared many times at the family home during dinner. When asked by Hedwig years later, did he remember the indigent organ-grinder? He replied that of course he did and furthermore, he was not giving to the organ grinder but really giving to himself and he always knew this to be the case.

His father's influence on his development was complex: indisputably, he encouraged his son's creativity and love of the arts. Edward Stieglitz provided the whole family with a rich cultural life. At the same time, Edward Stieglitz was a successful entrepreneur and can be regarded as an early capitalist – he was in the wool business and was so financially successful that he retired at the age of 49. Most problematic for Alfred was his father's attitude toward money. Alfred remembered the constant wrangling and bickering about finance that seemed an everyday occurrence in the Stieglitz household, with his father accusing his mother of being a spendthrift. Alfred swore that money would never mean that much to him. His support of artists in his circle, particularly John Marin, as well as his purchase of so many artists' works, spoke to his generosity.

At the same time, let's not airbrush away his ease in getting others to fund his art enterprises – publications, luncheons, and gallery rent – his friends and wife, Emmeline, not only admired him but often supported him as well. The ambivalent relationship with his father's authority permeates his personality, his art, and close relationships: Alfred was most comfortable with the role of seer and he handled idolatry well. Not so with dissenting opinions where he often dropped people from the circle when their ideas or agendas challenged his. Although never especially interested in politics *per se*, he was a radical dissenter when it came to art. Like many of the creative individuals studied by psychologists, he preferred the new to the old and furthermore had the competency to make the new, to write about the new, and to sell it. Counterbalancing his autocratic style, was his ability to work prodigiously, to be intrinsically motivated, to demonstrate integrity, and to place an immensely high value on creativity. Even if you did not like him, you had to respect Alfred Stieglitz.

Education Abroad

Alfred attended private schools in Manhattan and enrolled at the then new City College. At this point, his father decided that a first-class education for his children could only be obtained in Europe where schooling was broader and more flexible. A surprising amount of anti-Semitism was present at City College which seemed to be the tipping point for Edward Stieglitz's decision to depart. In 1881, the still very successful Edward sold his holdings, and with wife, children, much luggage, and servants returned to Europe where he placed his children in German private schools and began himself to paint and tour the continent accompanied by his wife. During vacations, the family would come together and resume their close connections. This sojourn in Europe was pivotal in permitting Stieglitz to bridge cultures and relocate esthetic forms later in his life.

Alfred would remain in Europe for almost a decade. He, unlike his twin brothers, was not interested in the pure sciences although he studied briefly with Hermann von Helmholtz.

And by chance he took a course on photochemistry in 1883 with Dr Hermann Wilhelm Vogel. This meeting was a turning point for Stieglitz who finally connected with something challenging that was a perfect fit for his interests and personality – photography was new, precise, esthetic, and offered an unlimited experimental possibilities. Soon after, he bought his first camera. The rest is chronicled in the history of photography and in numerous biographical works on Stieglitz's life.

Briefly, he studied with Vogel and proved to be an amazing student: his work entered many competitions and quickly won prizes – over 100 – and recognition for technical and esthetic excellence. In Europe he traveled with friends to Italy, France, and Switzerland and took pictures of street urchins, peasant women, monuments, and the countryside. Self-portraits taken during this period reveal him to be striking and he continued to be visually intriguing throughout his life – an intense gaze, elegant bone structure, tousled, thick hair, a large mustache, and a serious manner. He had romances, loved Wagnerian opera, played cards, and enjoyed all kinds of theater including both Shakespeare and vaudeville. He led a bohemian life and from all accounts had a great time.

Return to the United States: The 1890s

His father who had already returned to the States a few years before began to think, perhaps, he was having too good a time and called him back to the duties/life tasks of a young adult. His younger sister had recently died in childbirth and the family needed to regroup and reestablish family bonds. Coping with the loss, reinforced the seriousness of life: it was time to marry, to settle down, to start a business. And Stieglitz did. In 1893 he married Emmeline Oppenheimer, his best friend's sister, ten years younger than he was. Emmeline admired him greatly but never shared his passion for adventure, art, and new ideas. She enjoyed the conventional life of a wealthy young woman in New York – fine clothes, traveling first class, and a well run bourgeois household. Retrospectively, the marriage was a fatally bad choice. Still it was primarily her wealth that provided Stieglitz with the resources to rent gallery space, to publish magazines, and to entertain poets, artists, and critics in good style. For five years, he followed his father's dictates and operated a printing house – Photochrome Engraving Company – with two partners in New York – and there he learned particular skills in printing which enhanced in his earliest photographic work. It will come as no news that the life of the businessman was 'unsuitable' – too boring, too commercial, and definitely not beautiful.

Camera Clubs and *Camera Notes*: 1890–1903

There were hundreds of camera clubs in the United States at the turn of the century. These were the days before the Polaroid and the digital camera and camera fans needed dark rooms to develop film and places to take portraits and advice on how to use the new and popular technology. Photo-making absorbed Americans from all walks of life. Stieglitz, because of his European education and recognized expertise, seized the leadership of a major camera club in New York, the Society of American Amateur Photographers, and became its president in 1890–1891.

The passion not filled by business found a creative outlet in writing and editing the club's magazine. However, he became increasingly dissatisfied with the stuffiness of the New York camera clubs and in 1897 combined the two largest clubs into the Camera Club of New York and expanded and transformed its publication, *Camera Notes*, into a beautiful magazine, the most significant photographic journal of its time. It was through this journal that his major contribution to photography was realized: he elevated the status of photography and by setting high esthetic standards he argued that photography could be on an equal footing with painting. Pictorial photography (i.e., soft focused, evocative, emotional, and personal), represented the ideal way of working the medium although years later he would change his preference away from the painterly to 'straight' photography.

Stieglitz's grand vision for photography absorbed him completely. He said on more than one occasion that he had all but killed himself for photography. Stieglitz wrote for *Camera Notes*, gave lectures and demonstrations at the Club, and managed the Club's exhibitions. Although being the voice for the advancement of photography was incredibly consuming, he found time to take elegant, heartbreakingly beautiful images of New York. In 1901–1902 he shot *An Icy Night*; *Spring Showers, The Coach*; and *Spring Showers, the Sweeper*. Also he began experimenting with his 'portraits in time,' believing that no one picture could convey the complexity of a person, he took a series of photos of the individual. Kitty, his daughter, was the first subject. The memorable series of portrait photos of O'Keeffe and later of Dorothy Norman taken decades later had their start during this period.

After 5 years at the club's helm, a fast-growing rift emerged between Stieglitz's high aims and some of the members' views. Some thought he was an elitist, an autocrat, and self-absorbed. The apocryphal tale of the young Alfred, the organ-grinder, and the monkey, may help decode this split: inarguably Alfred was giving away his time and talents – he took no salary for all his work. Yet there can be arrogance and tyranny to generosity. Disgruntled members may have felt like the monkey who didn't necessarily like the handout. Although Stieglitz left with a dramatic flourish ridiculing the amateurish attitude that seemed to take over the club, his critics did not take his criticism lying down.

Despite insulting exchanges, many highly trained and esteemed photographers, including Eduard Steichen, Gertrude Käsebier and Clarence H. White, sided with Stieglitz's preferences for pictorial photography and they exited with him, beginning an independent movement. The movement was dubbed the Photo-Seession, modeled after the Viennese Secession. His last edition of *Camera Notes* as editor was in July of 1902. Under a more 'understanding' editor, *Camera Notes* continued for only one more year. And Stieglitz soon published a new journal called *Camera Work* and simultaneously moved on to create one of the most interesting alternative art spaces of the early twentieth century. First of all, it was a physical space the Secessionist could call their own.

The Little Galleries of the Photo-Seession: '291'

On Fifth Avenue between 30th and 31st Streets, a row of brownstones stood. Once quite fashionable in the late nineteenth

century, by the time Stieglitz moved, the brownstones were taken over by small offices and shops. Elite New Yorkers had moved uptown. The urban landscape was fast changing – eight blocks away the just completed Flatiron Building transformed the skyline and would captivate photographers, including Stieglitz, for years to come.

It was the young Eduard (later Edward) Steichen who discovered 291. Steichen, a Lithuanian-born painter as well as a photographer, located a studio for himself that was reasonable in rent and allowed him a street level showcase for his photography – there he hung his shingle as a professional portrait photographer. He photographed J. P. Morgan, Eleanor Duse, and in France took many photos of Auguste Rodin and his statues of Balzac – quite revolutionary for their time and still today they are seen as some of the landmark images in establishing photography as fine art. As his reputation for portraiture grew, he expanded his studio space and rented 293, leaving 291 vacant.

Steichen, 15 years younger than Stieglitz, was admired much by the older artist who called him ‘his man’ when they met. Steichen became one of several key colleague-advisors who influenced him and helped him mount shows over the years. Stieglitz embraced him and welcomed him into his family. When Stieglitz separated from the Camera Club, he trusted Steichen’s judgment and took his advice about turning the Steichen studio into a gallery where paintings as well as photographs could be hung. Steichen planned to return to France and promised that he would get a Rodin drawing exhibition for 291 – the show, hung in January of 1908, marked the beginning of systematically initiating and expanding the public’s taste for modernism.

Now the Photo-Secession Group not only had a name but it had a place and a future. The formal name soon morphed into ‘291.’ The gallery opened in 1905 and closed in 1917 when World War I began. Stieglitz saw the space as a laboratory rather than a commercial art gallery. And what did this lab look like? Enter the narrow building and go to the top floor in a small, creaky, man-operated elevator. Step into a space defined by three rooms with a vestibule leading into a small art gallery, a 15 foot-square room, in the center is a table with a very large copper bowl holding dried flowers. The room is unpretentious but elegant. Steichen chose the colors for 291 – olive painted walls with warm olive-gray burlap pleated drapery covering the lower half of the walls; the two other rooms maintained the muted color palette and introduced pure white moldings and woodwork to offset the subdued color scheme.

A ‘spiffy’ space does not a creative environment make. What made this place special were the exhibitions. Starting with the 1905 opening exhibit of 39 Secessionist photographers including Stieglitz, Käsebier, Steichen, and White, 291 went on to exhibit the foremost photographers of the early twentieth century including Paul Strand and Paul B. Haviland. The gallery did not limit itself to photography but quickly expanded to include paintings and sculpture which ultimately surpassed the photography shows in number and attendance. Placing paintings in a photography gallery was a clever means of raising the status of photography. Although Stieglitz’s aim was to bring an American sensibility into the world art scene, he also brought to New York the work of the most innovative French artists which included not only the ones mentioned earlier but also

Henri de Toulouse-Lautrec, Pierre August Renoir, and Henri Rousseau. In addition African Sculpture and shows of children’s drawings were exhibited. All in all there were 79 shows mounted at 291 in 13 years. The gallery functioned as a museum of modern art – note that the founding of New York’s illustrious Museum of Modern Art occurred in 1929, more than a decade after the close of 291.

The People and the Ideas

Beside the art exhibitions, the people made 291 special – the artists, students, poets, critics, collectors, and the general public. The people provided and were the excitement. If you wanted to see something new and exhilarating you went to 291. And if you were lucky enough, you might watch Stieglitz hold court and experience his animated, charismatically charged comments on American Modernism or you might find him arguing with the students from the Art Students League, a rowdy group who mocked the high seriousness of Stieglitz’s ideas. At noon a group of artists and poets gathered – The Round Table – who would then proceed to lunch together at a local hotel. The place, although physical and tangible and architectural, represented something intangible – it was a home – a haunt – for those who felt like ‘the other.’

Others shared not only the space but an ideological perspective – a set of beliefs, preferences, and values. First, the Stieglitz circle favored the primitive. They agreed that sexual impulses drove artistic creation. Second, the credo of symbolism with its emphasis on the personal and the soul was very appealing. Capturing and working from inner states rather than analytic ones produced work that was universal. Last among the pivotal ideas were those focused on ‘Woman’ – the group developed a romantic rhetoric rhapsodizing the ‘woman-child’ – a pure, clean erotic woman, free of bourgeois guilt.

Stieglitz was ahead of his times in respect to exhibiting the work of women and homosexual artists. This sponsorship was not a political statement but an esthetic one. It is not common knowledge that Stieglitz sponsored many women artists before meeting O’Keeffe. Although O’Keeffe represented the iconic woman artist for him, he tried to find the ideal woman in art many years before meeting her. His views of the sexes were situated in early twentieth century gendered views – woman as pure, child-like, and sexually charged. Some saw him as a womanizer who rationalized seduction with flowery romantic rhetoric yet these women’s work merit attention and recognition. And recently they have been rediscovered and their work has been shown in several venues.

Stieglitz’ sponsorship of homosexual artists including Charles Demuth and Marsden Hartley was also progressive. Stieglitz was not a gay rights activist, but put talent first. Stieglitz’s connoisseurship extended to selecting colleague-advisors: Eduard Steichen, Marius de Zayas, and Max Weber to name but a few served as conduits to art and artists abroad. They informed him about new developments, advocated certain styles, and had the connections which made exhibitions possible.

Camera Work

The elegant magazine *Camera Work* (1903–1917) published by Stieglitz extended 291’s influence by presenting stunning

reproductions of the photos on exhibition and essays on art. *Camera Work* introduced works of such writers as Gertrude Stein to Americans. *Camera Work* blended both literature and the visual arts. Arbitrary boundaries among and between the arts were challenged in essays comparing, for example, Matisse and Isadora Duncan. The magazine's implicit mission was to unify all the arts illustrating the plurality of modernism and thus counterbalance the lack of soul in profit-mad materialism.

During this heady period of running 291 and editing *Camera Work*, Stieglitz himself took some unforgettable, iconic images. The most famous was 'The Steerage' taken in 1907. Here, he captured the lower level of the ship, where men, women, and children were crowded into a small space. The picture was taken from above, from the space of the wealthy whose pretensions he ridiculed. The interrelated shapes of the families in steerage were spellbinding for him and he was willing to stake his reputation and legacy on that one image. The second block-buster image taken in 1902 was 'The Hand of Man' where a locomotive spewing black smoke moves toward the viewer, train tracks elliptically crisscrossing and telephone poles in the background. The clout of industrial America loomed forebodingly large and the symbolism in the photo intrigued Stieglitz so much that he worked on it in multiple ways for many years.

Although he was to open other gallery spaces in the future, Stieglitz closed 291 in 1917. Why? The war and rising costs of running the gallery were central to the closing; subscriptions to *Camera Work* plummeted. Another more subtle factor was that 291 was no longer the center of art experimentation. The Armory Show in 1913 was pivotal in exposing US audiences to European vanguard esthetics and resulted in the opening of several new art galleries that showed American and European modern works.

The O'Keeffe Years: 1916–1946

Georgia O'Keeffe, then a struggling artist who was teaching school in Texas, had been aware for some time of '291' and the impressive, charismatic Stieglitz. Although she had not met him formally, she had visited the gallery with school chums from the Art Students League years before. She valued his opinions and artistry. Her school friend, Anita Pollitzer served as a conduit and brought to 291 some of O'Keeffe's drawings. Stieglitz was astounded by the beauty of the drawings and announced, or so the story goes: "At last a woman on paper." On 22 May 1916, Stieglitz exhibited ten O'Keeffe charcoal drawings in a group show. There was great enthusiasm for her work within the Stieglitz circle and in 1917 Stieglitz held the first solo O'Keeffe exhibition. He convinced her to join him in New York and offered her the opportunity to do nothing but paint and she grabbed the opportunity. She met Stieglitz when she was 29 and he 58. Some maintain, falsely, that this is when her life as an artist began. More accurately, he did not create her – she was already an excellent artist – but he discovered her and promoted her. With her consent and cooperation, they fashioned her iconic status and forged one of the most exciting collaborations in modern art. His great gift to her was the time to develop her then considerable talent and unique perspective; parenthetically he gave this gift to other artists as well

including John Marin. She in turn gave his work new life and direction, and upon his death in 1946 at 82 years old, she vigorously and systematically protected his legacy in American photography.

Knowing O'Keeffe inspired Stieglitz who was trapped in a loveless marriage. He was enamored with her genius and her person and took hundreds of photos of her – deconstructing her body, showing her torso, her breasts, her hands, and her face. These photos, taken over many years, reveal an evolution in his perception of her from girlish innocence to androgynous siren to a steely modern presence. His legacy is enhanced by these stunning images.

After his divorce, they married because he wanted marriage. She maintained her name. Several years into their relationship and after their marriage, O'Keeffe became severely depressed. She had already achieved considerable recognition and was financially secure yet her life and marriage unraveled. She recovered and her dependency on Stieglitz lessened; she knew the worst side of him as well as his genius for encouragement. She stayed in the marriage until his death but spent significantly less time in New York and found a second home in New Mexico. In 1929 he established his last gallery, An American Place, which remained open until one month before his death in 1946. He showed his own photographs and those of Ansel Adams and Eliot Porter as well as the regulars of the Stieglitz circle.

The Stieglitz Legacy

Stieglitz left us a body of photographic work which is memorable in vision, technique, and accessibility. His influence on photography was immense. He was tireless in his promotion of photography as fine art. Besides his leadership role in photography, he accomplished something few artists ever contemplate. He fostered a creative environment for others. His gallery, 291, served as a noncommercial space for the public and artists to gather and view and discuss art.

What did we learn from Stieglitz's life and the establishment of 291 that can be generalized to other creative environments? Foremost, you need a compelling, towering, creative person with a big vision to construct a viable space. That vision has to be coupled with a drive, a passion to fulfill the dream. The leader becomes the voice, the propagandist for creative activity. Attracting and keeping astute colleague-advisors should not be underestimated. So much of the formation and maintenance of 291 was spurred by Steichen's actions and connections. Resources are essential because somebody must pay the bills for the space. Besides vision, extraversion, finding wise colleagues, and resources, the ability to spot and nurture talent is absolutely necessary. Much of the time Stieglitz was inclusive and not divisive. If the person had talent and had something new to say, sexual orientation and gender were irrelevant.

Creative persons, creative processes, and creative products are routinely studied yet creative environments and the people who mount such spaces are given short shrift. In examining Stieglitz's life, we identify multiple factors associated with his ability to construct a creative environment which benefited artists as well as the public at large who now view his vast personal collection of European and American paintings and photography in major museums throughout America.

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Stress and Creativity

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Glossary

Creativity The way of thinking leading to creative products or ideas that are deemed to be novel or original and useful or adaptive.

Divergent thinking The kind of thinking that results in numerous ideas or solutions, as opposed to convergent thinking, which leads to one correct solution or idea through deductive reasoning.

Flow State of complete immersion in a task characterized by effortless performance, extreme task-engagement, and positive feelings. It usually results in creative products.

Personality traits Stable and enduring dispositions of behavior and beliefs.

Psychological states Transient internal conditions that are immediately accessible to the individual.

Stress state State experienced when individuals feel they lack psychological resources to respond to an external or internal stimulus and/or perceive it as a threat to their well-being.

Trait emotional intelligence (trait EI or trait emotional self-efficacy) A constellation of emotional self-perceptions located at the lower levels of personality hierarchies. It includes factors such as emotionality, sociability, well-being, and self-control.

Creativity and Affect: Two Lines of Research

Creativity

Although there is ongoing debate in the general psychological literature about the operationalization of creativity, the construct has been defined fairly consensually as a way of thinking that leads to novel and useful products or ideas. Despite the consensus about a general definition of creativity, the conceptualization of factors influencing creativity is often more complex and multicomponential. Cognitive ability, cognitive styles, personality, and motivation have all been suggested as contributory factors.

The study of the affect-creativity link, including work focusing on stress, has commonly used divergent thinking as an indicator or marker of creativity. It refers to the type of thinking that results in several ideas or solutions, as opposed to convergent thinking, which leads to one correct solution or idea. Divergent thinking tests are thought to measure idea generation and in particular, aspects such as fluidity, flexibility, originality, and elaboration. They have been shown to have certain predictive, convergent, and discriminant validity. However, apart from some methodological limitations, one of its shortcomings is that while they seem to work well for quantifying creative aspects such as originality, their ability to measure the usefulness of the responses has been contested.

There has been extensive empirical investigation of the more cognitive elements of creative activity, but less for affect-related components. Two main approaches to the creativity-affect link can be identified in the literature. The first is the study of affect-related personality traits in relation to creativity. This issue has been addressed indirectly using constructs from general personality theories such as the *Big Five* or the *Giant Three*, and more recently using specifically affect-related personality constructs such as trait emotional intelligence (trait EI or trait emotional self-efficacy). Trait emotional intelligence refers to a range of emotion-related self-perceptions and dispositions located at the lower levels of personality hierarchies,

including factors such as emotionality, sociability, well-being and self-control. The second line of research refers to the relationship between affect-related states and creative performance. Literature on the links between creativity and psychological states, or on state-task links in general, makes use of terms such as 'emotional state,' 'affective state,' and, more commonly, 'mood states,' which isolate a single dimension of the emotionality or affectivity of a state. The term *mood* has been used in several ways; first, as a summarising dimension for subjective states in general, emphasizing the emotional dimensions of states, examples being positive or negative *moods*. Second, moods may be defined as states that arise independently of identifiable triggers. Thirdly, moods can be conceptualised as states that are persistent enough to influence other states, behaviors and cognitions over time. Clearly, the uses of the term are somewhat varied in the literature, and do not form a single agreed definitional tool. Another important terminology clarification is that between *moods* and emotions. Generally, moods, contrary to emotions, are long-lasting, diffuse and global.

The two creativity-affect lines of research are partly reflected within a theory proposed and developed by Sandra W. Russ, where both general personality characteristics and affective states act as facilitators for the cognitive processes associated with creativity, such as divergent thinking.

Traits and States

Since affect-related personality traits have emerged as a focus of creativity research, it has become more important to be able to distinguish between the two concepts of trait and state. The literature defines personality traits as stabilities of behavior and beliefs about our enduring dispositions, while psychological states are transient internal conditions. Unlike states, which are directly experienced by the individual, traits reflect propensities toward particular feelings, thoughts, or behaviors. They can be measured indirectly via characteristics or responses which

describe or predict these tendencies. Traits can also be defined conditionally in terms of their likelihood of occurrence in specific situations and contexts. Traits and states are also theorized to have different relationships to behavior. Psychologists have generally recognized that behavior is influenced by an interaction between traits and situations. Subjective states are immediate elements of experience, and they are viewed, in turn, as the product of this interaction between personality traits and the external or internal situation. In other words, subjective states are determined wholly by a combination of psychological, physiological, and situational factors.

Having defined the key concepts under review, an overview of the two existing lines of research on the link between creativity and affect is provided below. As mentioned earlier, these are the study of emotion-related personality traits in relation to creativity and the role of subjective states in creative performance. Specifically, the focus on trait emotional intelligence and divergent thinking. After a review of the literature on valenced subjective states, research involving stress state dimensions is presented.

The Two Lines of Research

Affect-related traits and creativity: The case of trait emotional intelligence and divergent thinking

The literature on links between affect-related traits and creativity is informed mainly by empirical work based on trait emotional intelligence and divergent thinking. The studies conducted so far have generally found no overall correlation between global trait emotional intelligence scores and divergent thinking. However, this null correlation may conceal different relationships between divergent thinking and the separate factors underlying global trait emotional intelligence. In a recent study, María José Sánchez-Ruiz, Daniel Hernández-Torrano, Juan Carlos Pérez-González, and K. V. Petrides found certain trait EI factors such as *sociability* (i.e., assertiveness, emotion management, and social awareness) to be positively related to divergent thinking, while others such as *self-control* (i.e., emotion control, impulsiveness, and stress management) were related negatively to it. The latter finding is consistent with positive correlations found elsewhere between divergent thinking performance and emotional instability and between divergent thinking performance and affective disorders. Despite these results linking low self-control and creativity there are also some inconsistencies; for example trait anxiety – an aspect theoretically related to low trait self-control – has also sometimes been correlated negatively with originality and innovativeness. Some studies have also found anxiety to be negatively correlated with divergent thinking, or to be unrelated. In sum, results about the relationships between creative performance and the regulation of emotions and control of anxiety are rather contradictory.

The apparent contradictions in whole-population correlations may make more sense in the light of evidence that the relationship between creativity and affect also has a domain-specific component. Creative individuals appear to experience more anxiety, higher affect intensity, and show less control over their emotional experiences in the arts than in the sciences. In addition to the differences in personality and affect traits of individuals across domains, there may also be variation by domain in the relationship between those traits and

creative performance. In the arts domain, but not in other domains studied, high levels of emotionality and low levels of self-control seem to be good predictors of divergent thinking skills (see Sánchez-Ruiz et al. under review), although these findings require replication in future studies. Overall, the relationship between affect-related traits and creativity is potentially quite complex, and particularly for research specifically addressing stress.

Subjective states and creativity

The second strand of creativity-affect research deals with subjective states. Here attention has focused mainly on the valence of states, but the association between creativity and positively or negatively valenced states remains inconclusive. On the one hand, some correlational studies, experimental studies (using affect-induction methods), and meta-analyses suggest that positive affect enhances creativity. This is supported by research on bipolar disorder reporting that positively valenced states (moderate ‘mood’ elevation) are associated with creative performance. On the other hand, some studies find positively valenced states inhibiting creativity, and negative states facilitating it. A possible mechanism for this is that negatively valenced states enhance creativity through increased task persistence and perseverance, whilst positive states promote satisfaction and reduce motivation to seek better quality outputs (for further discussion on this suggestion see the next section).

However, even if definitive findings emerge linking creativity to the valence dimension of states, the positive/negative bipolarity may turn out to be too restricted to explain the complexity of affective state relationships with creativity. Some authors have already criticized the concentration of research on valence. States, particularly negative ones, can have complex dimensional structures and two ‘negative’ states can be different enough to have contradictory effects in relation to creativity. Other dimensions need to be considered, such as activation. Activating states such as anger, fear, or happiness may conceivably lead to more creative fluency and originality than deactivating states, such as sadness, depression, or relaxation as the former involve drive and motivation to act. Examination of the relationship between creativity and the underlying dimensions of stress state, considered to be a negative and activating state, may give new insights into the creativity-affect link and the specific associations between creativity and anxiety, self-control, and emotional instability.

Stress State and Creativity: Possible Relationships

A stress state is a psychological state which accompanies stressful situations and stimuli. It can be identified by subjective, contextual, and physiological indicators, and it is multidimensional as it has several underlying factors. In general, states are influenced by appraisals of environmental threats, opportunities, and personal capability. These states will in turn influence the individual’s situational response – actions, coping strategies, or avoidance. The overall process is a transaction between individual and environment, and states play a part in that process.

On this basis, a stress state (or response) is theorized as the dynamic relationship, or transaction, between an individual

and the situational stressors. Specifically, the stress state is the result of a relationship between the individual and the situation that is perceived as too demanding and threatening to his/her well-being.

The affective component of the stress response has been equated with the emotion of anxiety. The situational focus for this emotion is also a 'threat to the self,' and perceived lack of capacity to address that threat (lack of self-efficacy). By extension, trait stress is a propensity to experience, and be preoccupied by, an emotion relating to threat and inadequacy. The operationalization of stress state is complicated because it is identified with appraisal of threat, inability to respond, and incapacity due to introspection. The stress state involves aspects of cognition (appraisal or perception of the stimulus), emotion (negative mood), and motivation (e.g., task interest, concentration).

The association between stress state and creativity can have implications for different contexts (e.g., education, organizations). Many researchers have realized this and studied the topic but a number of aspects remain ambiguous. Stress reduction through relaxation techniques has been found to increase creative performance in experimental and nonexperimental settings. However, not all studies have found a definite relation between stress level and creativity. Other studies of creativity, categorization, and cue utilization tasks found no significant effect of negative stressful states, induced by techniques such as sensory deprivation or the use of distressing films.

Studies of stress and divergent thinking in particular have also led to conflicting results. Stress state appears to undermine performance in some studies, whilst in others positive state induction and reduced anxiety have been unrelated to divergent thinking on figural tasks. Some research indicate that divergent thinking is positively related to trait and state anxiety and negatively related to self-control (discussed in the opening section). Another set of results suggest an inverted U-shaped relationship between stress response and divergent thinking, whereby increases in stress state levels are associated with improved divergent thinking performance, up to a certain level, but that further increases are accompanied by a performance reduction.

Possibilities for the Stress-Creativity Link and Tentative Explanations

Negative stress-creativity relationship

Some physiological mechanisms have been proposed for a negative relationship between stress state and the divergent thinking aspect of creativity. Individuals in positive states appear to also have better access to memory than individuals in negative states (such as a stress state). In addition, valenced states tend to elicit memories of the same valence, and positive material is generally more extensive in memory than negative material, again allowing positive states to facilitate generation of creative ideas.

Some information processing models suggest that negative affect also impairs creativity by increasing cortical arousal, which leads to fewer active nodes in memory, and consequently fewer unusual associations. The increased arousal associated with stress, fear, or frustration creates a preference for a more predictable or conventional response over more unusual

responses and also for more constricted thinking and cue utilization. Confirming this, greater creativity on a task has been associated with lower levels of cortical arousal.

A further potential explanation for a negative stress-creativity association is that stress state demands attention and individuals have limited mental resources; therefore, when individuals experience stress state, fewer resources are available for other tasks such as creative tasks. The resultant use of simpler cognitive strategies undermines the production of original ideas.

In sum, some of the possible explanations for a negative association between stress state and creativity are that stress state elicits less material in memory, that it increases cortical arousal, which means fewer active nodes, and that it leads to a reduction of the attentional focus.

Positive stress-creativity relationship

Stress state may also promote creativity, as some research has found, through increasing task-engagement and motivation to seek solutions. Individuals under state stress may concentrate more during problem-solving strategies resulting in more new and valuable products. Stress reduces the tendency to satisfice or accept ideas as they come and so may be linked to more analytical elements of creativity, such as evaluation and systematization. This suggestion is in line with the theoretical framework developed by Mark Runco that argues for negative affect and tension as antecedent conditions for creativity, and for dissatisfaction as a factor driving and motivating relevant performance.

Dual pathway relationship

A positive impact of a negative state such as stress on creativity does not exclude the possibility of positive states being also beneficial to creativity. Some tentative explanations argue for a dual-pathway for the relationship between affect and creativity. This approach suggests that positive activating states may be linked to 'cognitive flexibility' and thus facilitate creative performance, and that activating states with negative tone may also be creativity-enhancing in terms of 'perseverance.' Positive moods may be supporting the divergent thinking component of flexibility, establishing more categories of response, while persistent hard work and thorough exploration driven by the stress state may lead to the divergent thinking components of fluency and originality manifested in the generation of many ideas within a few categories.

Curvilinear stress-creativity relationship

A nonlinear relationship has been found between creativity and stress in some studies. Specifically, divergent thinking performance (on verbal tasks) seems to be lower in individuals in conditions of high stress and low stress than in participants in moderate conditions, in an inverted 'U' shaped relationship (corresponding to the classic *Yerkes-Dodson law* relating arousal and general task performance). Similarly, fluency has shown to be highest in individuals in a condition of moderate stress activation. Research on bipolar disorder and its relationship with creativity has shown that the elevation of mood that comes with the disorder may enhance creative behavior. In sum, moderate levels of stress may provide the arousal needed for creative tasks without diminishing cognitive resources.

In general, research on stress states and creativity suggest that while intense stress state lessens creativity, especially for complex and demanding tasks, the effects of moderate and low levels of stress are less clear. One of the conclusions that can be drawn from various studies is that the relationship between stress state and creativity cannot be reduced to a 'negative or positive' issue, and may be influenced by a number of mediators. Some of these mediators are discussed in the next section.

Challenges in the Research on the Stress–Creativity Link

A number of specific challenges can be identified in the literature about stress–creativity links. First, the conceptualization of psychological states has involved a definition mainly in terms of positive or negative aspects, ignoring other dimensions on which creativity may vary. Second, little attention has been paid to the potential domain-specificity component of the relationship between creativity and affect states. Third, the link between creativity and affect has been measured, analyzed and presented in a way which assumes a unidirectional relationship of states to performance, while reverse and reciprocal directions of the effect have been less explored. Fourth, the literature has suffered from a dual failure in the operationalization of creativity. In many instances creativity has not been independently measured using a standardized and validated instrument. Also, where such instruments have been used, the range has often been narrow (focusing on divergent thinking without exploring other aspects of the complex phenomenon of creativity). Results from different studies have shown that the use of different creativity indicators may lead to different results. Finally, there is a paucity of research considering the influence of both personality traits and subjective states on creative performance.

The Role of Stress State Dimensionality and Type of Stressor

Much previous research into the creativity–affect link has defined states in terms of positive and negative categories. However, as noted earlier, some authors have pointed out the general desirability of moving beyond a one-dimensional construct of state in examination of task–state links. Other conceptualizations of states as multidimensional phenomena may open new doors to the study of creativity and stress. In this sense, holistic terms such as 'subjective states' may better describe the complexity of the term. This is particularly relevant for the example of stress because stress state is multidimensional and the view of negative or positive affect phenomena is thus too restricted. Gerard Matthews et al. have highlighted that the stress state has emotional, motivational, and cognitive components. As noted earlier, creativity is also influenced by each of these three aspects. In particular, these authors have identified three dimensions of the subjective state of stress: distress, task-engagement, and worry. Future research on the stress–creativity link should then go beyond the conventional positive/negative affect distinction in examining the creativity–state link. A multidimensional stress state conceptualization and operationalization will lead to a more complete picture of its relationship with creativity.

Experimental research on the effect of stressors on creativity has shown that the relationship depends on the type of stressor used and the intensity of its effect, as well as the type of stress that is provoked. Kristin Byron, Shalini Khazanchi and Deborah Nazarian investigated the effect of two stressors: social-evaluative threats (e.g., videotaping, presence of evaluative elements) and uncontrollability (e.g., time constraints, false negative feedback, noise) on creative performance. Social-evaluative threats were found to either increase or decrease performance while uncontrollability served only to impair it. Overall, low-stress inducing situations supported creative performance while high stress-inducing situations had the opposite effect. This shows how, in addition to considering subjective stress state dimensions, when appropriate, the specific type of stressor should be taken into account, since results may vary according to both variables.

The Role of the Domain Specificity of Creativity Correlates

Domain specificity has been increasingly recognized as a key issue in creativity.

In general, differences in personality traits across domains have been repeatedly evidenced in previous research. Specifically, artists have shown higher levels of emotional expressiveness and have shown to be more sensitive to their feelings than scientists. Also, artists tend to experience more negative affect, be more impulsive, and have shown lower levels of emotional control than scientists. In terms also of the relationship between affect and creativity, the results from the study by Sánchez-Ruiz et al. show that, when considering domain in the analyses, the negative relationship between divergent thinking performance and the trait emotional intelligence factor of self-control (which includes the stress management facet) is only true for artists but not for technical and natural scientists, and social scientists.

There is need to replicate these results at the psychological state level. The relationship between stress state and creativity may be similarly influenced by domain. It may also be the case that such relationships can vary by domain and by state dimensionality. To test the possible combinations of state dimensions and creative performance by domain, a multidimensional conceptualization of states is needed, as well as the inclusion of domain as a variable in the research design.

Also, there may even be an additional effect due to the relevance of the task itself to the domain. For example, arts students were more likely to experience a positive change in psychological states after completing a creativity task that is congruent with their domain as shown in a study conducted by Gregory Feist. This may suggest that domain specificity of task is more important in relation to performance for artists than for other groups.

In conclusion, a lack of focus on domain specificity in designing samples and analysis can cause problems for investigations of the creativity–affect link. Since traits and states are related to domains, some conflicting or ambiguous results in the literature on the relationship between psychological states and creativity may therefore be due to the use of differing domains or differently balanced samples. Future studies can overcome this limitation by including comparisons among various domains (beyond the traditionally considered: sciences and arts) and in any case, by specifying the participants' domains.

The Role of Temporality

Another aspect that has been a challenge for creativity-affect studies is dealing with temporal ordering, and there is now some recognition that ignoring this may lead to equivocal conclusions. Empirical studies on stress state links with creative tasks have typically assumed that psychological states impact upon creativity and are an antecedent of it. However, whilst prior states may be predictive of creativity, it is also possible that within-task states and creative performance both affect each other.

In terms of addressing this directionality, some suggestions and hypotheses have been advanced about the power of creative insight to provoke feelings of elation and some isolated empirical studies have measured psychological states before, during, and after a creativity task (e.g., Feist). Despite the paucity of research addressing temporal ordering in the association between subjective states and creativity, there is some theoretical support for models involving a two-way dynamic relationship between both phenomena. For example, the notion of the flow state, in which the individual focuses and totally engages in the performance of a task, and experiences affective states of enthusiasm and enjoyment whilst engaged in creative activity. A complementary explanation of the relationship between creativity and affect is that prior intrinsic motivation drives creative activity, which in turn feeds back into positively valenced states (i.e., enjoyment). However, these hypotheses are testable only through well-established measures and systematic empirical designs. Similarly, research allowing for temporal analysis of stress state dimensions can help explore possible pathways of influence of stress state on creativity and vice versa.

The Role of the Creativity Criteria

A general shortcoming of the literature on the link between creativity and affect is the widespread failure to use a standardized and validated instrument designed to measure creativity. In some cases, researchers have used context or domain as the creativity criterion, without applying any measure of creative performance, assuming that individuals are more or less creative merely due to their domain of performance. To date, where standardized measures have been applied, divergent thinking has typically been used to operationalize creativity which gives a quite restrictive view of creativity as a complex phenomenon with its other aspects being neglected. This is important because different criteria of creativity will demonstrate different patterns of association with other psychological constructs. As we have stated at the beginning of this article, divergent thinking tests also have their own limitations.

There is evidence that relationships between creativity and affect-related states vary across criteria of creativity. Not only the relationships between creativity and stress may differ according to the creativity criteria, but within one criterion, such as divergent thinking, variation may come from the different subscales. Several studies have shown that different aspects of divergent thinking, such as fluency and originality demonstrate different patterns of relationships with personality traits and with trait emotional intelligence. For example, when examining the link between divergent thinking aspects and overall valence of psychological states, positively valenced states were related to idea quantity (fluency), but not to idea

quality (originality). This is consistent with the argument that the relationship varies depending on whether the generative or critical functions are being considered. Similarly, Carsten De Dreu et al. argued that states and traits do not necessarily influence creative performance via one pathway, but instead can operate multidimensionally, with different factors such as valence or activation enhancing one or other element of creativity. Therefore, future studies will benefit from including different creativity criteria in the research designs. Also, researchers should avoid overgeneral conclusions being drawn from more limited studies, as it is difficult to establish assumptions for the construct of creativity in general when only one indicator of creativity has been used.

The Relevance of Trait-State Models

Creativity has been related to affect, and more specifically, to stress, in terms of both traits and states. There is nevertheless a need for research considering both lines of research simultaneously, that is to say, affect-related traits and states should be both linked to creativity within a single study. Affect-related traits and states have both been linked to creativity, but not, to date, within a single unified analysis. Traits and states can jointly predict behaviors more effectively than they do separately, therefore trait-state models to study behaviors are to be advocated in research on the relationship between affect and creativity.

Conclusions

In this article two main lines of research on the issue of affect and creativity are reviewed. The first focuses on personality traits, and specifically, on affect-related traits and creativity. This line has been dominated by the traditional measures of general personality traits. However, recent research in this line has successfully related creativity to the trait emotional intelligence framework. The second line centers on psychological states and their relationship with creative performance. Here the results so far show contradictions, and this extends to the relationship between stress state and creativity. As reflected in this review, research has not yet clarified whether stress states foster or decrease creativity performance (and vice versa). The stress-creativity link seems to be a complex one and is unlikely to be resolved by assuming that it is either positive or negative. In the previous sections of the article, some challenges and limitations regarding research on affect and creativity have been discussed, namely the narrow affect-state dimensionality, the poor differentiation of domain, the lack of temporal modeling of research designs, the use of a unique (and sometimes limited) criteria of creativity, and the underuse of trait-state models to research the topic. These issues may play a key role in the nature and direction of the effect in the creativity-affect relationship. Lastly, conclusions are drawn and some research and practical implications are provided.

Implications

Knowledge of the detailed relationship between stress and creativity and addressing the challenges presented may have implications for psychological, educational, and organizational contexts.

The study of the stress–creativity link brings recognition of the benefits of a multidimensional view of subjective states. These include allowing the domain specificity of the creativity–affect link to be more accurately identified and resolving some of the apparent contradictions affecting results for single-dimension state measures. Different relationships between different stress dimensions could be then identified across domains. Furthermore, the type and intensity of the stressor has proven to be relevant, and this has implications when managing the environmental factors that relate to creative process. Domain can be a major source of variation in affect-related traits and states, and also in the relationship between creativity and stress state. Research including the domain variable can validate and improve existing taxonomies of general and specific requirements for creativity in order to build a well-grounded theory of the domain specificity of creativity.

Examinations of domain specificity of the stress–creativity link at the state and trait level can support the understanding and promotion of creativity within domains in real life contexts, by revealing which individual characteristics and task conditions enhance creative performance within a domain and how stress dimensions can affect it. Effectively designed research can also identify barriers to creativity across domains, and challenge and dispel myths about which groups are more or less creative in different situations. Such understanding may serve to vocational training and support and may be of help, not only vocational, but also to academic counseling practitioners.

As stated in the previous section, the stress–creativity relationship may be bidirectional. It is important to consider the implications of the temporal sequencing of states and performance tasks. Psychological states can modify and be modified by performance in creativity tasks. Future studies may therefore find important effects of creative activity and behaviors on subjective states, and potentially on affect-related traits over the longer term. Experimental and longitudinal studies with repeated measures could provide more information about these interactions throughout the life span, thus helping establish causal relationships, if these exist.

There is evidence that relationships between creativity and affect vary not only across different affect phenomena, but across criteria of creativity. There are clear differences in the pattern of associations between two established creativity measures and affect-related traits and states. This strongly implies that it would be worth exploring different aspects of creativity within different creative and vocational contexts, to obtain better ecological validity.

Lastly, empirical research on creativity and states infrequently explore the creativity–stress association at the state level, whilst considering the trait level as well. Exploring trait emotional intelligence in relation to creativity provides insight into the influence of emotional-based self-perceptions and dispositions on creative performance. Considering trait emotional intelligence (and the effects of general personality factors) and subjective state effects in the same research design can also be helpful when the aim is to determine the predictability of the latter (e.g., stress state) controlling for the influence of the former (e.g., self-control). Future research may therefore need to explore the creativity–affect association at the state level, considering the trait level as well, through a

multidimensional conceptualization of states and the trait emotional intelligence framework, respectively.

Final Conclusion

In summary, it is clear that the development of a research line focused on the links between creativity and the stress state offers real theoretical and practical benefits. Experimental methodologies accounting for domain specificity have the potential to give a clearer picture of the bidirectional relationships between aspects of creative performance and long and short term affects. Multidimensional stress state components, which are also linked with general task performance, will play an important part in this work. Future research will need to examine the influence of personality traits on creativity, and the mediating and reciprocal relationship that subjective states (including stress) may have with the latter. Traits and states, when measured simultaneously, will provide a clear indication of their respective role in creative performance.

To conclude, there are still a number of challenges to meet and many issues to be clarified in relation to the creativity–affect link and the creativity–stress link in particular. The ways the study of these matters can move forward are through a structured and grounded theoretical framework, innovative and rigorous correlational and experimental research designs, and well-developed and reliable measures.

See also: Bipolar Mood Disorders; Divergent Thinking; Domains of Creativity; Emotion/Affect; Flow and Optimal Experience.

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Relevant Websites

www.emotionscenter.com – International Research Center for the Study of Emotions and Personality.
<http://www.psychometriclab.com/>

Substance Abuse and Creativity

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Glossary

Alcoholism Repeated intake of alcoholic beverages to an extent that causes repeated or continued harm to the drinker.

Hallucinogen Includes LSD, mescaline, and peyote. Causes hallucination by disrupting the interaction of nerve cells and the neurotransmitter serotonin. Psychological effects are similar to dreams, schizophrenia, and religious exhilaration.

Substance abuse A continuing pattern of using a substance such as drugs or alcohol to the point where it infringes on

the ability to function normally in social or occupational roles.

Substance dependence A state arising from the repeated administration of a drug on a periodic or continual basis to the point where an individual's activities are focused primarily on obtaining the substance and taking it. Tolerance can build up requiring higher doses of the addictive substance to achieve the same effect and failure to obtain the substance can lead to withdrawal symptoms.

Introduction

The relationship between creativity and substance abuse is complex and far from fully understood. There is a myth surrounding the use of alcohol and drugs that is sustained by the dramatic acting out of individuals under the influence and the high number of creative individuals who have been publicly identified with abuse and addiction problems. The fuzzy notion that somehow drugs and alcohol improve creativity is based on the romantic misconception that these substances release inhibition allowing insights and creative achievement to flow. Very little objective research or self reports from creative individual support this idea.

In order to understand whether substance abuse is higher than average in creative people we need to establish a baseline. On a worldwide basis this can only be done with alcohol. The World Health Organization in 2004 estimated 2 billion people drink alcohol with 76.3 million who have diagnosable problems. The estimate is that 1.8 million deaths (3.2%) are alcohol related. Consequences of heavy drinking include acute health problems, traffic injuries and deaths, accidental injury including alcohol poisoning, suicide, high risk sexual behavior, and violent crime. There are also serious social and economic ramifications related to alcohol use.

Many Muslim countries, where there are primarily abstainers, have a very low percentage of alcohol dependence while other countries have very high levels of alcohol dependence, especially among men. These include South Africa (27.6%), Poland (23.3%), Peru (17.8%), Brazil (17.1%), Canada (14%), France (13.3%), Iran (11.9%) and the United States (10.8%). The Russian Federation is not included on the list although it has very high alcohol dependence and abuse which has been a factor in low life expectancy.

The US Department of Health and Human Services Substance Abuse and Mental Health Services Administration conducts a national survey on drug use and health. In 2008 they estimated that 22.2 million people over the age of 12 (8.9%) were dependent or abused a substance. The majority, 15.2

million, were dependent or abused alcohol, 3.9 million were dependent or abused both alcohol and drugs, and 3.1 million were dependent or abused both. Drug and alcohol use trends downward as people get older but for addicts use can increase as more of the substance is needed to generate a high. Unfortunately there is no information on substance abuse by profession.

Since alcohol is the most abused substance, research regarding alcohol abuse by eminent creative people will be reviewed first. This will include the extent of use, families of alcoholic creative people, effects of use, and experimental research.

Use of Alcohol by Eminent Creative People

Extent of Use Among Eminent Creative People

Alcohol and creativity have been linked by the fact that many eminent creators have been heavy users and alcoholics. **Table 1** is a partial list which is impressive because there are numerous eminent writers, artists, performers, and musicians.

The largest scale attempt to identify the level of alcoholism in eminent creative people was done by Arnold Ludwig, who in 1995 reviewed the lives of 1004 eminent people who had a biography reviewed in *The New York Times Book Review* between 1960 and 1990. He assessed alcohol dependence or abuse on the basis of physical problems, work interruption or poor performance, personal and interpersonal problems, and arrests. He found: "among eminent people 26% experience alcohol related problems during their lifetime, 23% of women and 27% of men." Creators in the arts were much more at risk:

Actors or directors, musical entertainers, sports figures, fiction writers, artists and poets (29% to 60%) have higher rates of alcohol dependence or abuse than natural scientists, soldiers, social scientists, social activists and social figures (3% to 10%). (1995: 133–134)

These results are considerably higher than the 7.7% rate of combined alcohol abuse and dependence of alcoholics in the United States. Men greatly outnumber women and in contrast

Table 1 Eminent creative people thought to be alcoholic

Sherwood Anderson
 John Barrymore
 Bix Beiderbecke
 Robert Benchley
 John Berryman
 Mathew B. Brady
 Robert Burns
 William Burroughs
 Richard Burton
 Truman Capote
 Raymond Chandler
 Eric Clapton
 Stephen Crane
 e. e. cummings
 William de Kooning
 Theodore Dreiser
 T. S. Eliot
 William Faulkner
 W. C. Fields
 F. Scott Fitzgerald
 Gustave Flaubert
 Stephan Foster
 Mel Gibson
 Jackie Gleason
 Gluck
 Dashiell Hammett
 Lorenz Hart
 Lillian Hellman
 Ernest Hemingway
 O. Henry
 Dennis Hopper
 Victor Hugo
 James Joyce
 Frida Kahlo
 Buster Keaton
 Jack Kerouac
 Ring Lardner
 Charles Laughton
 Sinclair Lewis
 Jack London
 Robert Lowell
 Malcolm Lowry
 Dean Martin
 Carson McCullers
 Edna St. Vincent Millay
 Robert Mitchum
 Modigliani
 Mary Tyler Moore
 Modest (Petrovich) Mussorgsky
 Joe Namath
 Nick Nolte
 John O'Hara
 Eugene O'Neill
 Charlie Parker
 Dorothy Parker
 Edith Piaf
 Edgar Allan Poe
 Jackson Pollock
 Bonnie Raitt
 Frederic Remington
 Mark Rothco
 Jean-Paul Sartre

*(Continued)***Table 1** (Continued)

Ringo Starr
 John Steinbeck
 Elizabeth Taylor
 Dylan Thomas
 James Thurber
 Toulouse-Lautrec
 Mark Twain
 Maurice Utrillo
 Dick Van Dyke
 Tennessee Williams
 Robin Williams
 Thomas Wolfe

to eminent creators, rates of alcoholism declined with age rather than increased. Higher rates of alcoholism among creative artists, especially writers, have been found in a number of other studies. One study found that 30% of the Iowa workshop for creative writers had a problem with alcoholism at some point in their lives. Another study found that female writers had an alcoholism rate of 20% relative to a control group rate of 5%.

Albert Rothenberg pointed out that higher rates of alcoholism in the creative arts could be encouraged by the nature of the work, which is often isolating and allows the individual writer or painter to drink more easily. Alcoholism is found less frequently in scientific professions where personal vision is less important than producing objective data that can be replicated.

Cultural conditioning is an area which needs further investigation. It is obvious that alcohol and drug abuse is a serious problem in the entertainment business. High profile actors include Robin Williams, Mel Gibson, Ben Affleck, and Drew Barrymore. The list of rock and roll musicians include Elton John, Eric Clapton, Pete Townshend, Eminem, and Ringo Starr. Amy Winehouse wrote a song called Rehab and inevitably there is a group with that name. Unfortunately many people have not gotten to rehab, or rehab did not work, and the list of early deaths of highly talented individuals is a long one. Subcultures creating an atmosphere which encourages alcohol and drug use will be discussed later in this article.

Families of Alcoholic Creative People

Ludwig found 12.2% of the fathers and 2.4% of the mothers of eminent creative artists were alcoholic compared to 6.6% of the fathers and 0.5% of the mothers in other professions. Furthermore, 10.6% in the creative arts had alcoholic siblings compared to 6.3% of others. Other studies found that 11% of the writers had at least one alcoholic parent compared to 7% of the total sample. Examples of creative people who came from alcoholic families include Charlie Chaplin, Tennessee Williams, Orson Welles, and Truman Capote.

The coincidence of alcoholism and other addictions in families is confirmed by genetic research. Sarah Hartz and Laura Bieret stated:

Robust genetic associations have been found for alcohol dependence, nicotine dependence, and cocaine dependence. (2010: 107)

As genetic research becomes more sophisticated we may eventually be able to understand if there is a genetic link between substance abuse and specific creative talents.

There is a paucity of research looking at alcoholism in families. In a study on painters, the only characteristic which differentiated excessive drinkers from moderate drinkers was having the same profession as their father. In one case, the son of a successful father exhibited anxiety over competition with the father. In another case, the son pursued painting to satisfy his father's unfulfilled ambition "at the cost of inner development and constant strain."

Effects of Use

Physical Effects

Small doses of alcohol may help stimulate some aspects of brain function but alcohol is otherwise a depressant. *Encyclopaedia Britannica* online states that as more alcohol is consumed, an individual becomes more depressed, going on to sedation, stupor, and coma. The excitement phase exhibits the well-known signs of exhilaration, loss of socially expected restraints, loquaciousness, unexpected changes of mood, and occasionally uncontrolled emotional displays. This may result from an indirect effect of alcohol in suppressing the function of inhibitory brain centers rather than a direct stimulation of the manifest behavior.

Prolonged use of alcohol damages the health of many alcoholics. Consuming four drinks a day or more can cause high blood pressure, coronary heart disease and failure, and stroke. Prolonged alcohol use is also associated with brain damage and the development of neuropsychological disorders. Impairments may include deficits in short-term memory, disrupted cognitive and motor functioning, poor attention span, difficulties with problem-solving and learning new information, sexual dysfunction, and suppression of the immune system.

The lack of inhibition caused by drinking is directly linked to criminal behaviors, including physical violence and homicide. Legal problems as well as divorce also increase.

Alcoholism can cause death from cirrhosis of the liver and impaired motor ability relating in alcohol related fatalities in automobile accidents, falls, and drowning. High levels of alcohol are found in 36% of suicides.

Effect of Use by Eminent Creators

Some eminent creative people believed alcohol was a vital component in their success. The most common use was to overcome fear and anxiety. Aristophanes, in a play written in 424 BC, wryly commented on the benefits of alcohol: "When men drink, then they are rich and successful and win lawsuits and are happy and help their friends. Quickly, bring me a beaker of wine, so that I may wet my mind and say something clever." Dorothy Parker said, "Three highballs, and I think I'm Saint Francis of Assisi."

Other creative people drank to escape the difficulties of life. The sensitivity and awareness which made their work special also made them more prone to depression and a sense of isolation. In many cases, alcohol was used as a type of medication to dull the sharp edges of life. Tennessee

Williams seemed to be speaking for himself when he had one of his characters in *Cat on a Hot Tin Roof* say, "Mendacity is a system that we live in. Liquor is one way out an' death's the other."

In some cases, creative professions may be the only work an alcoholic could do. The individual has the freedom to drink and work as a writer or painter. Utrillo, according to Sandborn, was slightly below average in intelligence. His family kept him supplied with wine and painting supplies.

A sense that alcohol somehow contributed to their creativity (perhaps used as a justification for their drinking) helped demolish the long-term productivity or shortened the lives of many eminent creative people. Younger creative people still have the physical resilience to drink heavily and get their work done, but as they age it becomes more difficult, which is not surprising considering the physical effects of alcohol.

Of course, alcohol can deter productivity even when it is not used while an individual is working. Rothenberg defined three states of drinking for the writers he studied:

1. Early in their career, they only drink after work.
2. Drinking begins to occur during the day as the need for alcohol increases, which is the progression experienced by most alcoholics. In the case of writers, the loneliness of the job combined with the anxiety and uncertainty of the work can lead to a state of 'irritability.' Alcohol is used as a sedative which helps soothe frayed nerves.
3. The increased drinking results in a deterioration in the quality of the work.

Rothenberg cautioned that each case is individual and may be triggered by elements unconnected to writing such as genetics or family history. When the parent whom the writer lovingly and competitively identifies with is an alcoholic, then the dangers of alcoholism are particularly high. Examples include John Cheever and William Faulkner.

F. Scott Fitzgerald summed up the danger of drinking in his work and life: "First I take a drink. Then the drink takes a drink. Then the drink takes me."

Alcohol use peaked in 1980 and has been declining as awareness of the dangers of alcoholism and stricter drunk driving laws have been enforced. It will be interesting to see if the number of eminent alcoholic creators also declines.

Experimental Research

Results of research using noneminent subjects indicates that the perception that alcohol influences creativity is greater than any real benefit to creativity that alcohol may give. The drinking of alcohol may exaggerate an individual's self-assessment of his or her work. One study found that low doses of alcohol did not affect the quality of creative work, but subjects who believed they had taken alcohol *thought* their work was better. In another study, subjects who *thought* they had taken alcohol produced more creative combinations of wildflowers even if they had a placebo. This suggests that just thinking one has drunk alcohol may loosen some people's inhibitions.

A few researchers have attempted to determine if alcohol facilitates creative writing under laboratory conditions. There are indications that alcohol significantly increases the number

of words produced, confirming anecdotal accounts of writers who find alcohol an aid in producing work, but quantity does not necessarily equal quality.

One study measured the effect of alcohol on a control group, a placebo group, and an alcohol group during different phases of creativity. Moderate amounts of alcohol facilitated incubation and restitution in college students, while harming the preparation, illumination, and verification stages. The researchers tied this in to self-reports of professional writers indicating they used alcohol primarily during the incubation and restitution stages of writing. They also concluded that the difficulty of creative writing leads to increased drinking. Alcohol may reduce anxiety and tension for some writers, but there also appears to be a tendency for users to exaggerate the benefits, perhaps to justify its continued use. Because life circumstances are confounded with the propensity to use drugs, the causal relation of drugs to creativity remains uncertain. The fact that many creative people used alcohol moderately or heavily does not mean that alcohol *caused* creative solutions. None of these studies looked at how alcohol affects accomplished creative individuals under actual working conditions.

While many creative people have claimed that alcohol helped them, the truth of this statement in objective terms has not been determined. Ludwig concluded 9% of his sample had helped their creativity by using alcohol; however, he cautioned that the perception alcohol helps creative work could be exaggerated by the properties of alcohol. He pointed to John Cheever, Eugene O'Neill, and Jackson Pollock as examples of creative people who gave up alcohol and then did some of their best work.

Drug Use

Opium was used by doctors in Greece in 100 BC. In North America, drug use dates back to native tribes in the United States and Mexico who took mushrooms and peyote within the context of religious ceremonies. Coca leaves were used by natives as a part of social life, work, and worship for thousands of years in South America. These drugs were a part of the cultural fabric and have a genuine spiritual connotation for many practitioners.

Traditional and newer man-made prescription drugs have contributed to a situation where substance dependence and abuse have become widespread. The US Department of Health and Human Services Substance Abuse and Mental Health Services Administration survey mentioned in the introduction indicated that in 2008 4.2 million people representing 1.7% of the population were dependent on marijuana or hashish. 1.7 million on pain relievers, and 1.4 million cocaine. Hallucinogens, inhalants, and heroin had lower levels of use.

Concrete statistics on drug use among creative people is not available. Anecdotal evidence based on public disclosure indicates it is significant, but objective studies that delineate the relationship between creativity and drugs are difficult to execute.

Nevertheless it is clear that some creative professions participate in drug subcultures which vary according to the type of drug. J. Radenkova-Saeva (2008) defined drug subcultures as:

groups of people loosely united by a common understanding of the meaning and value (good or otherwise) of the incorporation into life of the drug in question. (p. 22)

These groups often form friendships that involve taking:

the drug together, possibly obeying certain rules of etiquette, to full-scale political movements for the reform of drug laws. The sum of these parts can be considered an individual drug's culture. (p. 22)

Next, some drugs will be reviewed in relation to what we know about its effects and culture. Many users take a variety of different drugs along with alcohol.

Opium and Heroin

Perhaps the oldest drug is opium which is produced using seeds from the opium poppy. Opiates include opium, morphine, and heroin which work on the brain and spinal cord lessening pain and creating a feeling of euphoria. Smoking opium did not come into vogue until the discovery of Indians smoking tobacco.

Symphony Fantastique by Hector Berlioz is an example of a classic work inspired by his opium use. The story is based on Berlioz's unrequited love for an Irish actress named Henrietta Smithson. Movements 4 and 5 occur after a young musician poisons himself in despair and experiences strange visions which are translated into his music. Smithson had left for London when Berlioz wrote the symphony but by the time it was performed she returned to Paris and attended it's opening by chance. Berlioz ended up captivating her heart and marrying her but sadly the marriage did not work out.

Charles Baudelaire, the French poet, and Alexander Dumas, belonged to The Club des Hashischins where hashish was taken every month at séances. Baudelaire clearly had addiction problems with alcohol and opium as well as hashish that may have contributed to his death. Coleridge is alleged to have written the *Kubla Kahn* under the influence of opium. Other famous opium users include Elizabeth Barrett Browning, Sir Walter Scott, and W. B. Yeats.

Escaping from the confines of life was used as an explanation for his opium use by Cocteau. Baudelaire wrote:

Opium magnifies that which is limitless
Lengthens the unlimited,
Makes time deeper, hollows out voluptuousness
And with dark, gloomy pleasure
Fills the soul beyond capacity (quoted in Largo, 2008: 24)

By the twentieth century stronger forms of opium including heroin had been concocted. A heroin subculture became prevalent in the jazz community from the 1930s to the 1960s. Talented musicians such as Billie Holliday, Charlie 'Bird' Parker, and Chet Baker's deaths were related to heroin. Others such as Miles Davis whose album *Birth of The Cool* is considered the best in history by many as well as Ray Charles also used heroin. Rock stars Janis Joplin, Jim Morrison, and Kurt Cobain died from heroin or morphine overdoses along with many others. Comics Lenny Bruce, John Belushi, and John Candy also died of drug overdoses. Lenny Bruce said "I'll die young but, it's like kissing God."

Cocaine and Crack Cocaine

Cocaine is a concentrated form of coca leaves which is usually snorted and absorbed quickly. It creates a very intense high. Eventually cocaine addiction can lead to severe problems in the nasal cavity, along with paranoia and insomnia.

Sigmund Freud wrote a paper called *Uber Cola* in which he experimented on himself a dozen times and noted the 'exhilaration and lasting euphoria.' He later changed his mind about benefits when a friend died from an overdose. Other prominent creative individuals who used cocaine include Elton John, Stevie Nicks, and Isadora Duncan.

Dr Jekyll and Mr Hyde is thought to be at least subconsciously about drug use and personality change. Robert Louis Stevenson was a cocaine addict who allegedly wrote the book while using. Sir Arthur Conan Doyle depicted the destructive aspects of cocaine in Sherlock Holmes who became addicted.

Nelson Algren's *Man with The Golden Arm* about a morphine addict won the National Book Award which was made into a movie starring Frank Sinatra.

Cannabis and Hashish

Cannabis (also known as marijuana, weed, pot, etc.), are the buds and leaves of the Indian hemp plant. THC is a psychoactive chemical which causes relaxation and reduced short-term memory. Continued use can result in increased anxiety and paranoia in some individuals. It is a milder form of intoxicant than hashish which is a hardened form of cannabis that is eight times stronger. Cannabis was used as early as 3000 BC in Egypt.

Louis Armstrong started smoking in the 1920s and used it all his life on a daily basis. He even planned to write a book about it called *Gage* but his manager thought it was a bad idea and the manuscript was put away. Armstrong was arrested once for possession but never went to jail. Actor Robert Mitchum was not as lucky – he spent two months in the Los Angeles county jail for possession.

In the 1960s and 1970s marijuana became a commonly used drug as it still is today. The pot subculture includes hundreds of pop songs that praise grass. Stoner movies became a minor genre which included *Up in Smoke* starring Cheech and Chong, *Pineapple Express* and *Harold and Kumar go to White Castle*. Sean Penn became a star playing a stoner in *Fast Times at Ridgemont High*.

Today some creative individuals such as comic Bill Maher and Willie Nelson publicly admit smoking cannabis regularly. It has reached acceptance to the point that President Barack Obama mentioned he smoked grass in his autobiography. Richard Branson, the Chairman of Virgin Airlines and Mayor Michael Bloomberg of New York also publicly disclosed they had used grass.

Lysergic Acid Diethylamide

Albert Hoffman, a research chemist, had a hunch that lysergic acid diethylamide (LSD) might have some special properties in 1943. In his book, *LSD: My Problem Child*, he described what happened when he was preparing some concentrated LSD for the first time. He suddenly became dizzy and felt he had to go home and lie down. In the next two hours he experienced intense colors, fantastic pictures and a pleasant intoxication. He knew he was on to something special and likened his

recognition to Louis Pasteur who said "luck only happens to those who are prepared."

There was immediate interest in researching the power of LSD by psychiatrists working with schizophrenia, alcoholism, and patients in therapy. Oscar Janiger completed an 8½ year study in Los Angeles which ended in 1962. He eventually recruited 930 individuals; initially half were in psychotherapy and half were in the general population. So many professional artists volunteered that he added a substudy. Janiger discovered artists:

somehow found a way to harness the LSD state to the creation of art and were able to increasingly control the physical expression of their subjective experiences. (de Rios & Janiger, 2003: 24)

According to de Rios and Janiger:

The heightened aesthetic sensibilities of the psychedelic experience clearly broaden the individual's subjective sensitivities. In the great majority of reports we see instances in which moral values were affirmed, emotional conflicts were resolved, and participants appear to have been better able to cope with human predicaments. (p. 42)

There was also a strong spiritual component – 24% of participants experienced "a mystical or spiritual encounter" (p. 115). No negative effects were reported. One of the subjects, movie star Clark Gable, gave an interview in which he said he had a psychological breakthrough with the help of LSD.

In 1963 LSD moved out of the lab and into the popular culture with a huge splash as Timothy Leary and Richard Alpert were thrown out of Harvard for advocating LSD use for everybody. By 1965 it was illegal in California but the genie was out of the bottle. Acid helped inspire the hippie movement which began with the summer of love in San Francisco and continues in spirit today at the Burning Man festival.

Musicians wrote and performed in a short-lived genre in the 1960s called psychedelic rock which was sometimes referred to as acid rock. Beatles songs included *Day Tripper*, *Tomorrow Never Knows*, and *Norwegian Wood*. Jerry Garcia and The Grateful Dead, The Jimi Hendrix Experience, Pink Floyd, and Jefferson Airplane were part of psychedelic rock. Jim Morrison named his band The Doors after the *The Doors of Perception*, Aldous Huxley's book about mescaline. Brian Wilson of the Beach Boys took LSD which probably influenced *Good Vibrations*.

Ken Kesey toured the country in a colorful old bus taking acid and writing about his experiences. Tom Wolfe's *The Electric Kool-Aid Acid Test* was about Kesey. LSD inspired a minor art movement with a recognizable style. Peter Max claimed he never took drugs but his extremely popular paintings were considered psychedelic art.

Prescription Drugs

Prescription drugs including painkillers, sedatives and tranquilizers, and stimulants have been abused for many years. Drugs such as Valium, Xanax, Vicodin, OxyContin, and methadone show up frequently in ER emergency situations. In a National Survey more than six million Americans over the age of 12 stated they used prescription drugs for nonmedical uses.

Prescription drugs have been implicated in the deaths of Marilyn Monroe, Jimi Hendrix, Elvis Presley, Heath Ledger, and Michael Jackson among others. Celebrities may be more at risk for prescription drug overdose because they have easier

access from Dr Feelgoods who in some cases are on their payroll. Prescription drugs have not inspired many creative products.

Summary and Conclusions

Theories about why the use of alcohol and drugs are more prevalent in creative professions include:

1. *Genetic predisposition*: A higher percentage of fathers, mothers, and siblings of eminent creative people were alcoholics.
2. *Self-medication*: More people have affective mental illness so they may be self medicating with alcohol and drugs.
3. *Opportunity*: Writers, artists, and composers often work alone so they can drink or use drugs more often without anybody knowing about it.
4. *Subculture*: Performers live in a subculture where alcohol and drugs are easily available and are a part of the culture. Previous stars who died dramatically and publicly from use of alcohol and drugs may be idolized and emulated by the next generation.
5. *The difficulty of the work*: Creative work is tough and uncertain, and the road to success is paved with disappointment and rejection. Creative artists suffer blocks at times. Alcohol and drugs may provide escape from the pain.
6. *Stress*: Success brings its own pressure. Creators often feel they must match or exceed their previous work. Simonton proposed alcohol use may provide the user with a self-handicap, a convenient excuse that justifies failure. For performers such as musicians, comedians, and actors, the pressure of having to be at the top of your game because the stakes are so high can encourage some creative people, especially live entertainers, to start taking drugs and alcohol to:

overcome their performance anxieties, to loosen their inhibitions and to wind down so they can sleep after being energized by their performances. (Ludwig, 1995: 136–137)

7. *As an aid*: Some creative people have stated they felt alcohol helped their work, especially in overcoming anxiety during the initial stages of creation.
8. *Widening consciousness*: The idea, reinforced by some creative individuals, that they are using alcohol and particularly drugs in an attempt to widen their consciousness and seek new perspectives.
9. *Spirituality*: The explanation that some creative people are seeking a spiritual experience through the use of drugs.

The fact that so many influential creative people have been drug users and abusers inevitably led to their inclusion of songs, books and films that talk about drugs. In the case of musicians, there may also be an element of trying to be a part of the culture of their younger audience as they found themselves aging. Whether these works inspired drug and alcohol use among fans is still not proven.

The strength of the drug culture in popular legend can also be measured by the hundreds of films dealing with drugs both from an individual use and dealer standpoint. Dying from drugs seems to inspire film-makers imagination with biographies already made of many of the stars already mentioned including Billie Holiday, Marilyn Monroe, Jim Morrison, Janis Joplin, Charlie Parker, and Lenny Bruce.

Contemporary authors such as Carrie Fisher in *Postcards From The Edge* and Stephen King in *On Writing* wrote frankly about their drug and alcohol problems. King said:

The idea that creative endeavor and substances are entwined is one of the great pop-intellectual myths of our times. (in Hyde and Zanetti, 2002: 210)

He acknowledged that:

Creative people do probably run a risk of alcoholism and addiction more than those in some other jobs, but so what? We all look pretty much the same when we're puking in the gutter.

The number of variables involved leave the relationship between creativity and alcohol with many unanswered questions. Far more work needs to be done to understand the physiological effects of using drugs as well as the psychological dynamic. Innovative methods are needed to research this challenging field.

See also: Mental Health: Affective Disorders; Suicide; Writing and Creativity.

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Suicide

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Glossary

Attempted suicide Suicidal actions that the person survives. This is also called parasuicide and deliberate self-injury by some suicidologists.

Bipolar affective disorder A severe psychiatric disorder characterized by periods of extreme depression and extreme excitement known as mania.

Completed suicide Suicidal actions that result in the death of the person.

Gifted people People who typically score high on tests of intelligence.

Suicidal behavior encompasses a wide range of behaviors, including both fatal suicidal behavior (commonly called completed suicide) and nonfatal suicidal behavior (including attempted suicide, suicidal threats, and suicidal ideation). In addition, some scholars view other forms of self-destructive behavior as suicidal in nature. Alcohol and drug abuse have been viewed as chronic suicidal behavior and behavior such as self-mutilation and self-castration as focal suicidal behavior. This article focuses on fatal and nonfatal suicidal behavior and creativity. A discussion of suicidal behavior in creative people is intimately related to the issue of psychiatric disorder because in general the majority of suicidal individuals have a diagnosable psychiatric disorder, over 90% in some studies. People who have been psychiatric inpatients have higher suicide rates subsequently than people who have been psychiatric outpatients who, in turn, have higher suicide rates than the general population. Suicide is especially common in those with mood disorders and schizophrenic disorders, disorders which are also associated with creativity.

Is Suicidal Behavior More Common in Creative People?

Anecdotally, it has often been claimed that creative individuals are at high risk for suicide. For example, writers in the former Soviet Union, Great Britain, Japan, and the United States committed suicide in large numbers during the twentieth century. The suicides of Soviet Union writers have been attributed to the oppressive Soviet regime and the suicides of British writers to poor sales and high taxes. It is more likely, however, that it is the profession of writing rather than local conditions that leads to this apparently high suicide rate in writers.

Estimates of the percentage of deaths from suicide in eminent people range from 0.3% to 13.3% with a median of 2.9%. The percentage seems to be higher among literary figures. A study of 1000 eminent people of the twentieth century found that a suicidal death was more likely among artistic individuals in general (especially poets) and less common among public officials, explorers, architects, and social figures.

Attempted suicide was also more common among artistic individuals.

Artists as an occupational group in general and certain subgroups of artists in particular, for instance writers and poets as well as female artists, have higher suicide rates. Steven Stack in an analysis of suicide rates among occupational groups in the US (based on the standard federal occupational codes) found that artists, along with doctors, dentists, mathematicians, and scientists, were an occupational group with an increased suicide risk, even after controlling for age, gender, marital status, and race. Artists were twice as likely to die from suicide than the rest of the working-age population, probably due to high prevalence of psychiatric disorders and high occupational stress linked to their profession. In the early 1990s, the suicide rate in the United States for artists in general (33 suicides per 100 000 artists) was almost three times the national average, and suicide rates for subcategories of artists ranged from 23 per 100 000 for actors and directors to 44 per 100 000 for visual artists, such as painters and sculptors.

Antonio Preti and Paola Miotto studied over 3000 internationally eminent persons in the visual and literary arts such as writers, poets, playwrights, painters, sculptors, and architects and found 59 suicides in that group. The prevalence of suicide was particularly high among poets and writers, and in female artists (a rate of 4.3%; compared to 1.75% among male artists). Female poets were at the highest risk: six out of 42 female poets included in the sample died from suicide. Self-destructive behavior in this group of eminent artists was not limited to suicide; there were several deaths directly related to alcohol abuse, for example, Dylan Thomas and Edgar Allan Poe.

Felix Post, in his study of psychopathology and creativity among 291 world-famous men, found five cases of completed suicide (Ernest Hemingway, Ludwig Boltzmann, Vincent van Gogh, Adolf Hitler, and Pyotr Tchaikovsky) and eight suicide attempts in writers (16.0% of the sample), five among composers (9.6%), four in artists (8.3%), three among scientists (6.7%), and two in the subgroup of scholars and thinkers (4.0%); altogether 22 suicide attempts. There was no suicide attempt recorded among eminent politicians.

Research on Writers

Following an earlier study on almost three hundred world-famous men which showed high levels of alcoholism and pathological personality traits in creative writers and visual artists, Felix Post looked at a group of 100 eminent British and American writers divided into subgroups of poets, prose fiction writers, and playwrights. There were significant differences among the three groups on several measures of psychopathology, such as high levels of alcoholism and affective illness in playwrights and prose writers and a high prevalence of bipolar affective disorder in poets. There were eight cases of suicide: six poets (John Berryman, Hart Crane, John Davidson, Randall Jarrell, Vachel Lindsay, and T. O'Hare) and two prose writers (Ernest Hemingway and Jack London), and seven suicide attempts. The attempts, usually closely related to depression, were found in the life history of three novelists (Joseph Conrad, Scott Fitzgerald, and Evelyn Waugh), three poets, who also wrote prose (Robert Graves, Walter Savage Landor, and Edgar Allan Poe) and one playwright (Eugene O'Neill).

Nancy Andreasen compared 30 creative writers at the University of Iowa workshops with 30 controls, and found that two of the writers and none of the controls committed suicide, while 3% of the primary relatives of the writers committed suicide versus none of the relatives of the controls.

David Lester examined the lives of 13 famous novelists and poets who killed themselves. He noted that two of them had fathers who completed suicide. Three others lost parents during childhood while another lost the grandmother who had raised him. Two others lost siblings. Six of the writers had engaged in prior nonfatal suicidal acts. Five were judged to be alcohol abusers, three had been hospitalized in order to receive electroconvulsive therapy, and seven were judged to have suffered from a mood disorder. Only one writer was judged to be schizophrenic, although five showed signs of paranoia. Problems associated with their writing appeared to be present in the majority of them and may have contributed to their suicides.

Research on Visual Artists and Musicians

A list of painters and visual artists who died by suicide is extensive. Fred Cutter compiled a list of 41 artists from the mid-sixteenth century to 1975, and Kay Jamison provided names of 14 artists who died by suicide (including Vincent van Gogh, Arshile Gorky, and Mark Rothko) and three who attempted to take their lives (Paul Gauguin, George Innes, and Dante Gabriel Rossetti). Karolina Kryszynska identified over 100 Western artists who died by suicide over the last 500 years. Joseph Schildkraut and his colleagues found two suicide deaths (Arshille Gorky and Mark Rothko), two instances of paternal suicide (Philip Guston and Franz Kline) and two single vehicle accidents (Jackson Pollock and David Smith) in a group of 15 Abstract Expressionist artists of the New York School. Schildkraut's study also found a strikingly high prevalence of mental disorders, mostly depression and other depressive disorders, as well as alcohol abuse among the artists. Overall, in comparison to men in the general population, the Abstract Expressionists were three times more likely to die before they reached the age of 60 (almost half of them died before that age)

and the main cause of death in that group was heart disease, followed by suicide combined with accidental death. The high premature mortality in this group might be related to high prevalence of depression and negative childhood experiences (i.e., absence or early loss of a father).

Antonio Preti and his colleagues compared over 4000 eminent nineteenth and twentieth century artists representing three types of artistic creativity: visual (sculptors, architects, and painters), linguistic (dramaturgians, writers, and poets) and musical (i.e., opera singers, composers and instrumentalists). They found 63 suicides in the overall sample, including 53 in literary artists (comprising 2.3% of the sample), six in visual artists (0.7%), and 4 among musicians (0.2%). Among musicians, there were no suicides in instrumentalists, while one opera singer and three composers died from suicide. Preti suggested several protective mechanisms against suicide operating among musicians as compared to other categories of artists: higher social and financial status, the necessity to acquire high levels of technical skills which may be incompatible with the severe mental or medical disorders that are linked with risk of suicide, and the nature of the work, including the need to interact with others and to develop relevant social and relational skills. Working with music may also have a specific therapeutic effect: music may involve artistic material closer related to the 'self' and more 'healing' than the graphic or verbal symbols used by visual and literary artists.

Despite Preti's findings on the low incidence of suicide among musicians, several classical composers killed themselves or attempted suicide, mostly in the context of severe mental disorders, such as depression, although in some cases it is not possible to provide a reliable psychiatric diagnosis based upon available biographical data. An English baroque composer Jeremiah Clarke (1670–1707) and an Anglo-Welsh composer and music critic Philip Haseltine, a.k.a. Peter Warlock (1894–1930), died by suicide, and it has been speculated that a Russian Romantic composer Pyotr Tchaikovsky (1840–1893) took his own life. Suicide attempts by drowning were made by Hugo Wolf (1860–1903), an Austrian composer and Robert Schumann (1810–1856), a German composer and an influential music critic. Both of them died in psychiatric hospitals.

Geoffrey Wills looked at mental health issues in a group of 40 eminent jazz musicians from the classic era of American modern jazz 1945–1960 ('bebop'). He found two suicides in this group: trombonist Frank Rosolino, who died at the age of 52 and shot his two sons, and trombonist J. J. Johnson who committed suicide at 77 after months of severe physical illness. There were many cases of heroin-related disorders in the jazz musicians: half of them were addicted to heroin at some time during their lives (which was most probably related to the anti-establishment character of both drug use and jazz music at the time). There was also a high prevalence of alcohol-related disorders and mood disorders.

Creative Women

Lester also examined the lives and deaths of six creative women who killed themselves, comparing them with six creative women who died of natural deaths and with six creative men

who killed themselves. For the women, the suicides and natural deaths did not differ in birth order, substance abuse, or loss of parents early in life, but the suicides were younger at the time of their death. The suicides were more likely to be divorced or separated at the time of their death. Not surprisingly, more of the suicides had made nonfatal suicidal actions in the past. The most striking finding, however, was the presence of psychiatric disturbance among the suicides. Five of the six suicides had a mood disorder or depressed mood versus none of the natural deaths.

Comparing the suicidal women and men, Lester found no differences in age at death, prior suicide attempts, or birth order. Like the women, the majority of the men were experiencing marital problems (separation or marital discord). The men seemed to have more experience of early loss than the women, though the numbers in the sample were small. Both the men and women had a high incidence of mood disorders, but the men appeared to have a greater incidence of alcohol abuse. As with the women, problems with their creative work was common.

Suicide and Affective Disorder

Kay Jamison documented the association between manic-depressive disorder, suicide, and creativity. In a sample of 36 British and Irish poets born between 1705 and 1805, she found that 27 had clear signs of depressive and psychotic disorders and two had committed suicide, both manic-depressives.

Rather than the depression and mania simply increasing the risk of suicide in creative people, the greater incidence of suicide may be a result of a greater lack of impulse control since recent research has indicated that serotonergic dysfunction in the central nervous system may lead to impulsive behavior rather than depressive syndromes.

Attitudes Toward Suicide

George Domino compared samples of creative and noncreative college students. The two groups were similar in age, gender, college major, and vocabulary level, but creative students performed significantly better on objective tests of creativity. When given an inventory to measure attitudes toward suicide, the creative students differed significantly from the noncreative students on seven of the eight scales. The creative students perceived suicide as more associated with mental illness and less as a cry for help, felt more strongly that people have a right to die, disagreed more that a lack of religious values was associated with suicidal behavior, perceived suicide as both a more normal behavior and as a greater reflection of aggression, and judged suicide to be less of a moral evil. Domino's results indicate that creative students perceive suicide as a more readily available behavior and efficacious solution to life's problems.

Are Suicidal People Creative?

Several studies have explored whether suicidal people are good at solving problems. The general conclusion seems to be that they are impaired in their problem-solving skills.

Suicidal Behavior in the Gifted

Gifted people are not necessarily creative, although they may be. Typically giftedness is measured by intelligence tests, which penalize creative responses by scoring them as incorrect. However, there is some overlap between the gifted and the creative, and research on suicidal behavior in the gifted is of interest.

The academically gifted have been thought to be more susceptible to depression and suicide, not only because of the typical suicidogenic risk factors (such as psychiatric disturbance, drug and alcohol abuse, and dysfunctional family backgrounds), but also because of factors associated with their giftedness.

1. Gifted adolescents may be prone to perfectionism, a trait that has been linked to suicide.
2. They may be more sensitive to the world in general and to the stressors encountered in adolescent life.
3. They may have greater problems adjusting to the school system, which is not usually designed to meet the needs of gifted and creative students and often lacks appropriate educational resources and support for their abilities. As a result they may feel bored and alienated.
4. They feel more pressure from others to achieve, which may result in unrealistic expectations for themselves.
5. They may feel frustrated by their impotence to produce real-world change.
6. They may find themselves more socially isolated and alienated, partly because they prefer solitary and single-friend activities, which may result in poor relationships with their academically average peers.
7. Their development may be more uneven, particularly their emotional development, which often lags behind their intellectual development.

Methodologically sound studies of suicidal ideation and behavior in gifted children and adolescents have not found that the incidence of suicidal behavior is greater than among average people. At the college level, however, there is some evidence to suggest that suicide rates are higher at the most prestigious universities.

One of the most important samples of gifted children studied is that created by Lewis Terman in California in 1921, consisting of 1528 children with a mean age of 9.7 years and an IQ score of over 140. By 1987, 25 men and nine women had killed themselves. The proportion of deaths due to suicide up to 1987 was 8.7% for the men and 5.2% for the women. The strongest predictor of suicide in this sample appears to be poor mental health, although the suicides have more often lost their fathers as children, had problems with alcohol abuse, experienced more stress in their family of origin, and had worse physical health.

The Role of Other Factors

It has been noted that there is a high incidence of alcohol abuse in creative individuals, such as artists and writers. This association may mean that alcohol intoxication (and perhaps abuse) increases creativity (perhaps by providing inspiration), that the creative lifestyle makes alcohol abuse more likely (alcoholism

may be a disease of loners and individualistic individuals), or that some third factor (childhood experiences or psychosocial influences) increases the likelihood of both creativity and alcohol abuse. Regarding the first possibility, there is some research evidence indicating, for example, that alcohol intoxication does not increase creativity in average individuals. Whatever the reasons, the association of creativity and alcohol abuse does provide a possible explanation for the association between creativity and suicidal behavior because alcohol abuse has been shown clearly to be associated with the likelihood of both fatal and nonfatal suicidal behavior.

Other psychological and social factors may increase suicide risk in creative people. Stack proposed a multicausal model of occupation-related suicide risk encompassing demographic factors (e.g., gender and age of individuals usually engaged in a profession), internal occupational stress, psychiatric morbidity (i.e., the extent to which a profession may attract or retain individuals at psychiatric risk for suicide), and opportunity factors (i.e., access to means of suicide). In the case of the artistic professions, the high suicide rate seems to be related to high levels of occupational stress, especially the risk of rejection of personal products, and psychiatric morbidity, especially affective disorders. For instance, several occupational stress factors operated among American jazz musicians mentioned earlier which might have increased their vulnerability to mental health problems: racial issues, low wages, extensive touring, and the easy availability of drugs (especially heroin), alcohol and casual sex.

Sensation-seeking or the tendency to seek novel, varied, complex, and intense sensations and experiences and the willingness to take risks for the sake of such experiences is a personality trait linked to borderline and antisocial personality disorders, as well as to creativity via a preference for complexity and abstraction in art and a tendency for divergent thinking. It may also predispose creative individuals to disinhibition and thrill and adventure seeking: social drinking, experimentation with drugs, and a liking for parties, casual sex, and other risk-taking, impulsive, and self-destructive behaviors which, in extreme cases, may lead to suicide.

Treatment

Kay Jamison, Nancy Andreasen, and Ira Glick pointed out that although mood disorders can be counterproductive and may disrupt creative process, sometimes euphoria and increased energy levels linked to hypomanic or manic states may support and nourish creativity. Consequently, treatment of bipolar disorder in creative individuals presents particular ethical and clinical challenges. Does the patient feel better or worse while taking medication? Is creativity enhanced or decreased by the medication? They suggested that a responsible clinician working with bipolar creative patients should simultaneously ensure assessment and amelioration of symptoms of the disorder (suicide risk in particular), normalization of mood cycles, and maintenance of creativity cycles which may (or may not) be associated with mood cycles. In order to achieve such goals, both overtreatment and undertreatment should be avoided. With the correct psychopharmacological treatment of bipolar disorder, the gains outweigh the potential negative side effects and ameliorate the risk of suicide.

Mogens Shou looked at artistic productivity in a group of 24 artists suffering from manic-depressive disorder who were undergoing prophylactic lithium treatment. In this group, the lithium treatment significantly attenuated or prevented recurrences of the illness, and half of the artists reported increased artistic productivity, six unaltered productivity and six lowered productivity during the treatment. Shou concluded that the effects of lithium on creativity are dependent upon several factors, such as the type and severity of the illness, the sensitivity of an individual, and his or her habits of productively utilizing manic episodes.

Andrew Slaby argued for the early recognition and treatment of depressive disorders in creative people in order to decrease their suicidal risk. He stated that electroconvulsive therapy (ECT) and medications were useful in this regard and claimed that creativity is not affected by these treatments. However, although hard data are not available, anecdotal evidence suggests that these approaches may not be the best. Both Anne Sexton and Abbie Hoffman were diagnosed as having bipolar affective disorders and given lithium. Both disliked the side effects of the medication so much that they stopped taking it, and both completed suicide. Sexton, in particular, found that the lithium affected her ability to write poetry. Ernest Hemingway tried to commit suicide while being taken to the Mayo Clinic for the second course of ECT and killed himself the day after his release. In those days, psychiatrists suppressed the knowledge that ECT led to memory loss (sometimes permanent), and memory loss may have contributed to Hemingway's motivation to kill himself.

Slaby also urged that society take pains to reduce the stigma of being different, including being creative, bright, or sensitive. Although this is desirable, it is far from clear how society can remove this stigma.

Does Creative Writing Help Suicidal People?

Is writing therapeutic for creative writers or is it a stressor that contributes to their psychological disturbance? Although there may be merit in both positions, David Lester and Rina Terry argued that writing poetry can be useful with suicidal clients. Writing poems per se may not be helpful to the client, but the revision of the initial drafts of poems may be therapeutically useful. Revising poems may serve a similar function for clients as the journal assignments devised by cognitive therapists, which give the clients intellectual control over their emotions and distance from the traumatic memories. The researchers illustrated their thesis with Anne Sexton's life and suicidal death. Plath's life and death can also be used to illustrate this thesis.

Sexton revised her poems extensively and, in the process of revision, had to concentrate on form rather than content. This allows for both the action that therapists deem to be therapeutic and the distancing of the self from one's problems. Because Sexton ultimately chose the moment of her death, one should not discount the therapeutic help her writing afforded her. Anne Sexton illustrates the dialectic in poetry as therapy, between expression and catharsis on the one hand and cognitive control on the other. Sexton, as long as she was able to stay psychiatrically stable, applied the craft of poetry to her creative

productions. Both Sexton and Martin Orne, her first therapist, believed that her poetry had helped her recover. Only toward the end of her life, as her ability to craft her poems declined, did her mental stability dissipate.

Interestingly, Sexton showed manic trends prior to her suicide. She would write poems furiously, poems with more emotional expression and less poetic crafting. Rather than arguing that writing poetry contributed in part to her suicide, it makes much more sense to say that, in her final breakdown, poetry was no longer able to help her deal with the intrapsychic conflicts as it had in the past. As her inner turmoil increased, she wrote feverishly, almost like a safety valve letting out the steam under pressure in a boiler, but to no avail. The pressure was building up faster than she could release it.

But this final failure of the craft of poetry to keep Anne Sexton alive does not signify total failure. She was an outstanding poet and functioned quite well given her affective disorder. The craft of poetry may have kept her alive for many years after her self-destructive impulses first manifested themselves and so signifies success.

Suicide as Subject of Creativity

In a comprehensive review of the iconography of suicide, Cutter identified six self-injury themes prevalent in the Western art after the Renaissance (i.e., after 1350). The heroic theme (1484–1844) presented suicide as a rational and reasonable solution to contemporary dilemmas and a good behavior affirmative of virtue. The viewers' reaction was admiration for the hero or the heroine, and they were encouraged to follow this virtuous example. This theme was based on historical or mythological accounts of suicide in the context of loss of a lover and such values as patriotism, self-sacrifice, devotion to ethics, honor, and dignity. The theme of suicide as a stigmatized act (1660–1854) seems to be an opposite of the heroic theme. However, both coexisted quite comfortably for almost two centuries. The stigmatized suicide was conceptualized, in line with the Church's view of suicide as a mortal sin, as an evil end befitting an evil life motivated by a pursuit of immoral goals. The intended reaction of viewers was rejection and contempt. Good examples of the genre are found in the eighteenth and nineteenth century British art by William Hogarth, Thomas Rowlandson, and William Powell Frith.

The advent of the irrational theme (1827–1880) followed the Industrial Revolution and the changing conceptualization of mental illness, especially the consideration of social and psychological factors in its etiology and in the treatment of psychiatric patients. These changes resulted in the adoption of a more neutral and relative moral position towards suicide, reducing the stigma, and placed emphasis on the irrationality of the act, now viewed as an unreasonable means to a desired end. The viewers' reaction was sympathy or pity towards the victim rather than condemnation. Examples of the irrational suicide theme in the arts include paintings of the drowning Ophelia.

Representations of suicide in twentieth century art can be grouped into three partly overlapping themes: the depressive theme (1887–1927), the ambivalent theme (1930–1961), and the theme of suicide as a 'cry for help' (1938–1967).

The depressive theme presented suicide in a morally neutral manner and considered apathy as the main motivation behind the act. The viewers' reaction was a feeling of regret, sadness, and pity. The emphasis was put on the sadness of suicide victims, their lack of energy and lack of enthusiasm for life. The other two themes presented suicide in a morally neutral manner and viewed the motivation behind the death either as inexplicable (ambivalent theme) or obscure ('cry for help'). The ambivalent theme stressed the shock value of the act, evoking mixed reactions in viewers and drawing their attention to the painful sense of unhappiness experienced by the suicides and their ambivalent wish to live combined with the desire to die. Suicide is presented as a morally neutral act with obscure motivation, evoking a feeling of confusion in the viewers and demands their attention.

Visual representations of suicide can also be found in Asian art and in Indian cultures from Mexico and South America. For example, scenes of ritual self-disembowelment (*seppuku*) and lovers' suicide (*shinjū*) were frequent in Japanese *ukiyo-e* paintings (*uki* – floating, *yo* – world, *e* – pictures: 'pictures of the floating world'), woodblock prints, and book illustrations showing life in the great urban centers in the Edo or Kokugawa period (1615–1868). In Indian art, the self-burning of the goddess Sati, Shiva's wife, and other images of the Vedic practice of self-immolation of a widow on her deceased husband's funeral pyre (*suttee* or *sati*) can be found frequently. Ixtab, a Mayan goddess of suicide, is represented in an image of a deceased woman with a rope around her neck in an ancient book of the Yucatecan Maya in Chichén Itzá, the *Dresden Codex* (*Codex Dresdensis*, eleventh to twelfth century).

Suicide was frequently used as a dramatic ploy by William Shakespeare. In his 15 tragedies Larry Kirkland found 21 suicides: 13 definite (e.g., four suicides in 'Antony and Cleopatra' and four in 'Julius Caesar') and eight possible suicides, for instance Lady Macbeth in 'Macbeth.' Suicide in Shakespeare's tragedies was often a release from suffering and an escape from an impending misfortune and, despite a negative view of suicide and its victims propagated by the Church and the legal system in England at the time, there was an attitude of acceptance and even glorification of such a death in some of his works.

In the nineteenth century opera, suicide along with tuberculosis was a popular ploy to provide a suitably dramatic ending to a story with a dying character giving detailed reasons for her or his decision in a (long) song between the act and the death. A review of over 300 opera plots revealed 77 suicides, including seven cases of murder-suicide and 12 suicide attempts. For instance, in Giacomo Puccini's 12 operas composed between 1884 and 1924 there are four suicides: Tosca, Madam Butterfly, Suor Angelica, and Turandot. The conceptualization of opera suicides has changed over time: from the seventeenth and eighteenth century notion of a 'heroic suicide' often shown in an ancient Greco-Roman setting (e.g., Purcell's 'Dido and Aeneas') to nineteenth century 'romantic suicide' (e.g., Wagner's 'Tristan and Isolde') and a 'realistic suicide' related to mental illness and distress. Contrary to epidemiological data, the majority of opera suicides are committed by women (all Puccini's suicides are young women!) and end in death; in the general population, the attempts greatly outnumber completions, and male suicide rates are higher than female.

Operatic attempts at suicide are usually presented as an instrumental gesture with an appeal motive, for instance in Mozart's 'Cosi fan tutte.'

Suicide Imitation and Contagion

Interesting questions arise regarding the impact of suicide-related creative products, such as plays, music, or books on suicidal behavior of the audience. Could there be imitative suicides? Could people who are attracted to such artistic products be at an increased risk of suicide themselves? Does the audience imitate suicides of creative people they admire?

The phenomenon in which a book, play, song, or film provokes a number of people in the community to commit suicide is commonly called the Werther Effect after the publication of Goethe's 'The Sorrows of Young Werther' in 1774, which purportedly led to young lovers committing suicide in imitation. According to anecdotal evidence, there have been other such 'epidemics,' such as the rash of suicides in young Jewish females after the publication of Otto Weininger's 'Sex and Character' in 1903 and an alleged increase in suicides in the 1930s related to probably the best known song concerning suicide, 'Gloomy Sunday,' the 'Hungarian suicide song.' An earlier recorded epidemic occurred in the early 1700s in Japan in relation to kabuki plays, often presenting thwarted love with the suicides of the lovers as a common plot. These double suicides (*shinju*) presented on stage were imitated by many young people, leading to an epidemic of suicides. It is interesting that an epidemic of double suicides has never been reported after Shakespeare's 'Romeo and Juliet' was first performed. Perhaps national character or the social and religious prohibition of suicide plays a role in the appearance of contagious suicide.

Steven Stack conducted a series of studies on the relationship between suicide and preference for music which frequently expresses suicide-related themes such as honor, hopelessness, and alienation – opera, heavy metal, country and western music, and blues music. He found a higher acceptance for suicide related to dishonor (a frequent opera topic) in opera fans than in nonfans. However, opera fans were not more accepting of suicide related to other motives, such as terminal illness or being tired of living. An accepting attitude towards suicide was also found among heavy metal fans, and this relationship was mediated by their lower levels of religiosity. Low religiosity was positively correlated with suicide acceptance among fans of blues music, but there was no significant difference between blues fans and nonfans in levels of suicide acceptability. Stack also found that the greater the airtime devoted to country music in 49 metropolitan areas of the United States, the higher was the suicide rate among the white population (an effect independent of poverty, gun availability, divorce, and southernness), while the per capita subscription to heavy metal magazines was associated with youth suicide rates in 50 states. It is still unclear, however, whether individuals at risk of suicide or accepting of such behavior are attracted to suicide-related music and lyrics or whether such types of art may increase suicide acceptability and risk in vulnerable people.

Suicides of people considered celebrities may be linked to increased suicide rates in members of the general population, especially in individuals of the same gender, age, and race as

the deceased. Although it has been found in the United States that the imitation effect holds for entertainers (such as actors and television stars) and political celebrities, this effect has not been reported for other categories of celebrities, including artists and the economic elite. It is possible that the number of people who can strongly identify with elite artists and imitate their self-destructive behavior is too small to have a significant impact on rates of suicide. The exception may be stars of popular music and writers who have gained a wide fame and recognition, such as Ernest Hemingway. It is of interest to note that the suicide of Kurt Cobain, the lead singer-guitarist and lyricist of the grunge group Nirvana in April 1994 did not lead to an epidemic of suicides among his fans despite his worldwide fame and the excessive media coverage of his death. A few cases of imitative suicide were found in the United States and Australia immediately after Cobain's death and an increase in the number of calls to the local suicide crisis center was recorded in Seattle. However, outreach, education, and support by the local community, an attempt at responsible media reporting of the suicide, as well as Courtney Love's (Kurt Cobain's wife) message to the grieving fans which made the death real and disturbing might have de-romanticized the death and decreased the risk of imitation and contagion.

Conclusions

The study of suicide and creativity, and the possible links between the two phenomena suffers from several limitations plaguing most biographical research, such as the use of soft journalistic and biographical resources, making retrospective psychiatric diagnoses based on nonclinical data, and the impossibility of a prospective study. Also, due to the prevalence of males in creative and artistic professions, mostly a result of historical and social circumstances, there is a paucity of knowledge about suicide in creative women. It can be concluded, however, that suicidal behavior appears to be more common in creative people, particularly writers. It has not been proved that creativity per se is responsible for an increased risk of suicide. The most likely explanation for the association of suicidal behavior with creativity is that creative people are more likely to have an affective disorder, typically manic-depressive disorder, and to abuse alcohol, characteristics which are associated with a higher risk for suicide. Particular occupational stress factors and personality traits may also mediate the link.

See also: Eminence; Giftedness and Creativity; Problem Solving; Substance Abuse and Creativity.

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Relevant Websites

- <http://www.suicidology.org> – American Association of Suicidology.
- <http://www.afsp.org> – American Foundation for Suicide Prevention.
- <http://www.iasp.info> – Interventional Association for Suicide Prevention.
- <http://www.sprc.org> – Suicide Prevention Research Centre.
- http://www.who.int/mental_health/prevention/en – World Health Organization Suicide Prevention.

Synesthesia

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Glossary

Concurrent The synesthetically induced sensory attribute (e.g., color).

Eidetic imagery The ability to retain a relatively accurate and detailed visual image 'out there' and not 'in the head.'

Hallucination Perception of an event (e.g., someone calling out your name, or an image suddenly appearing in a mirror) 'out there,' having no objective basis, which is accepted

by the percipient as being veridical. A dream is a hallucination.

Inducer The inducing event (e.g., tone) for a synesthetic experience.

Physiognomic perception The fusion, or dedifferentiation, of perception and affect (e.g., 'sad moon,' or 'angry sky').

Poetic synesthesia The depiction of a synesthetic experience (e.g., 'sweet silence,' or 'yellow cocktail music').

History and Recent Developments

Synesthesia, derived from the Greek *syn* ('together' or 'union') and *aesthesia* ('sensation' or 'perception') is a term that came into use in psychology in the late 1890s. Certain individuals had the most *peculiar* perceptual experience of *colored hearing*, namely on hearing a melody they simultaneously experienced a train of colors – particular notes triggering particular colors. Was this an indication of arrested development, or degeneration, one of the 'hot topics' in the Parisian and Viennese salons at the turn of the twentieth century? Was this an indication of a sublime, esthetic state of transcendence? Do these *synesthetes*, who seem to be quite imaginative and sensitive, actually exhibit *creativity*? Certainly, some of the contemporary music of the time entailed the matching of particular tones to particular colors. In fact, *synesthesia* came into use in literary criticism in the 1930s (i.e., in the guise of *literary* or *poetic* synesthesia) – just when experimental psychology was shifting away from this topic – and the two fields have subsequently generated their own literatures separately.

During the first quarter of the twentieth century, synesthesia was one of the mainstream topics of investigation for experimental psychology, one of whose major tools for research was systematic introspection. Various papers on the topic appeared in the flagship *American Journal of Psychology* of Edward Bradford Titchener's introspective school. For example, one report from 1923 was made by a synesthete, who documented in detail various forms of color hearing, and other forms of synesthesia, that he experienced. One question that he investigated in this single-subject design is that of the relationship between a mixture of *inducing* stimuli (e.g., tones) and their *concurrent* experience (e.g., colors): What distinguishes a *blend* from a *clash*? Introspection reveals that when the inducers *blend*, the concurrent color experience entails a mixture of the colors of the components of the blend, whereas when the inducers *clash*, the concurrent color experience entails the side-by-side appearance of the colors of the respective components. Although this article was not cited by proponents of Gestalt psychology, which was gaining ascendancy in experimental psychology at that time, there is certainly a focus on molar forms of cognition here, one suggesting a distinguishing characteristic of a *gestalt* (blend) from a mosaic

(clash) which was easily accessible to synesthetes for further investigation.

Other papers appearing in that *Journal*, while not specifically having synesthesia as their focus of inquiry, nevertheless had recourse to discussing synesthesia as an inherent aspect of the subjective experience under investigation. Thus, a paper appearing in 1927 discussing 'felt experiences' (e.g., to cold), presents introspective reports describing the experience as being 'bright and cold.' The feeling of heat, in contrast, was described as 'flat like pressure and bright like pain.' One view of these reports is that systematic introspection of the sort employed by Titchener and his followers essentially entailed introspective sensitization, wherein the observer becomes sensitive to his or her subjective experience and exteriorizes what is essentially the common synesthetic background to his or her cognition. This, in turn, suggests that synesthesia is not necessarily a peculiar, idiosyncratic phenomenon, accessible only to a select few, but rather reflects a common substratum of cognition – one that enables us to function in a world requiring the blending of vision and audition, and vision and taste, and so forth, that comprises our multimodal perceptual experience. This is essentially the distinction between what has been termed 'weak synesthesia,' whereby we all lie on a continuum of synesthetic experience, and 'strong synesthesia' which is *constitutional*, or *typographic*, and which is certainly more dramatic than the commonplace association that we all have between 'red' and 'danger,' and 'black' with 'scary.'

The history of the field is of course a history of its protagonists. Titchener (1867–1927), who had made a very forceful argument for the *sensory* basis of all cognition, was publishing reports in the *American Journal of Psychology* indicating that, as expected, such was the case. The introspectionists of this school were providing detailed reports of their subjective experience, wherein vivid imagery – and especially vivid synesthetic imagery – played a major role. It perhaps may come as no surprise to learn that Titchener himself was probably a synesthete.

Introspection, however, was not the only tool of experimental psychology during those years. There was, of course, also psychophysics, and it is notable that even when introspection was considered to be *passé* (at best) or *unreliable* (at worst) as experimental psychology took on a Behaviorist orientation for the next 30 years – with the untenable argument that the study

of mind (hence, the study of synesthesia and creativity) was not the proper goal of the science of psychology – a psychophysical study in the lab was considered to be acceptable. Synesthesia, especially weak synesthesia, which implicated some lawful relationship among the various modalities of perception, was thus amenable to continued research within psychophysics. Since the 1970s, it has been Lawrence E. Marks with his students and colleagues, who have presented a psychophysical approach to synesthesia. From these studies on colored hearing, for example, we have learned that the *higher* the frequency of the inducing tone, the *brighter* is the concurrent experience (this was also an established correspondence at the very beginning of experimental work on synesthesia). Marks has focused on weak synesthesia, including the study of poetic synesthesia.

George Domino's chapter for the first edition of the *Encyclopedia of Creativity* is one of the items appearing in the bibliography to the present article, and provides a useful resource for the literature until 1999. What has happened since then? Using the *ISI Web of Knowledge* resource, one may note that in the four years prior to the appearance of the first edition of this encyclopedia, interest in the field of synesthesia (or synesthesia) was somewhat marginal. In the past decade interest has notably increased (see **Figure 1**).

Research over the past decade has stressed that synesthesia can inform the rest of cognitive psychology and cognitive science. Among the issues researched in this connection are numerical cognition and automaticity. Consider, for example, the notion that for a particular synesthete the number four triggers the experience of *red*, while the number six triggers the experience of *green*. If the digit '4' is printed in the color *green*, while the digit '6' is printed in the color *red*, one can investigate a Stroop-like situation at the individual level, wherein the synesthete is asked to state the color of the ink (*green*, or *red*) in which the digit is printed, while ignoring the digit itself (4 or 6). While this should be an easy task for a nonsynesthete, the synesthete should experience Stroop-like

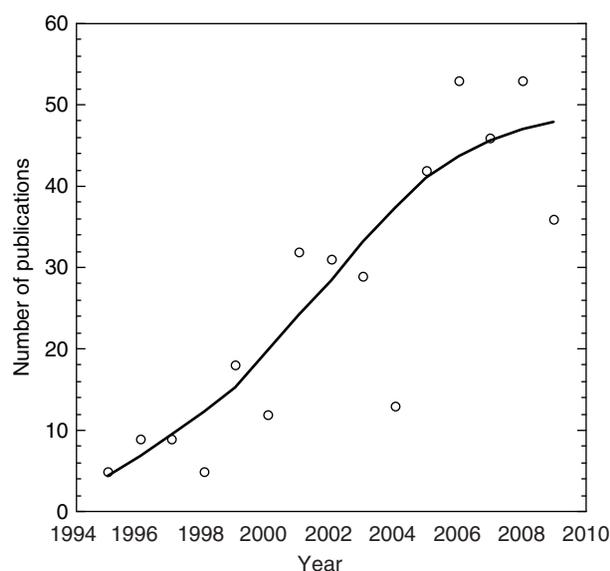


Figure 1 Increasing interest in the field of synesthesia over the past 15 years. Source of data: *ISI Web of Knowledge*.

interference. This research notwithstanding, what have we learned about the relationship between synesthesia and creativity? In Domino's chapter, he cites a single empirical study providing evidence of a relation between these domains. More recent research is not overabundant, and will be discussed further on. What seems to be happening in the literature is that there is a focus on synesthesia as being a productive inroad into studying various issues of topical interest, while at the same time helping to further establish the field as a viable one in itself. However, the synesthesia–creativity relationship does not seem to fall within the main focus of such research. One way out of this impasse is to look at synesthesia as it is related to other phenomena, and indeed to reconsider a *Gestalt* approach to both fields of inquiry.

Synesthesia and Related Phenomena

Synesthesia was one of the phenomena considered by theorists having a *Gestalt* orientation. This line of thought stretches from the early twentieth century to the present, and bridges between perceptual and literary (or, poetic) synesthesia. This section is devoted primarily to discussing such a heritage, which has important implications for the study of synesthesia and creativity. As is apt for such a Gestalt orientation, the reader is invited to test himself or herself on a series of tests for synesthesia that can be found at the following site: <http://www.synesthete.org>. As noted above, one might consider synesthesia and synesthetic experience as lying on a continuum, with one pole marked by the type of 'strong,' 'constitutional,' 'classic,' or 'typographic' synesthesia that has been discussed by Richard E. Cytowic. In fact, one might further consider that synesthesia is but one of a family of what have been termed *syncretic* phenomena by Heinz Werner (1890–1964) – that is, together with eidetic imagery and physiognomic perception – where by 'syncretic' one is referring to the fusion, or *dedifferentiation* of perceptual qualities in subjective experience. Synesthesia entails the dedifferentiation of the sensory modalities (as in colored hearing) – what others have referred to as a 'break-down of modularity.' Eidetic imagery entails the dedifferentiation of imagery and perception, allowing for a hallucinatory or pseudo-hallucinatory form of subjective experience (i.e., the experience of a visual image which is relatively accurate in detail, but within which there is room for subjective elaboration). Physiognomic perception entails the dedifferentiation of affect and perception (e.g., a young child's depiction of thunder as looking like her own angry face with brows drawn together).

Eidetic imagery and synesthesia have been noted in the same individuals, leading one to believe that *eidetikers* and synesthetes are one and the same. This has implications with respect both to a question regarding the prevalence of synesthesia (and eideticism) in the normal population, and to the defining characteristics of the synesthetic (and eidetic) experience. Prevalence estimates wax and wane with the times. Prevalence estimates of between 10 and 15% of the adult population most probably refer to the weak form of synesthesia. Current estimates of the strong form of synesthesia might be in the vicinity of 0.04–5%. Turning to the literature on eideticism, one finds that in the adult population the

prevalence of typographic eidetikers might be in the vicinity of 0.1–1%. And yet, recalling (1) that synesthetes might very well be typographic eidetikers, (2) that both synesthetes and eidetikers might score high on the personality trait of *absorption* (see below), (3) that both synesthetes and eidetikers might be fantasy-prone, which is a trait positively correlated with that of absorption (see below), and (4) that typographic eidetic imagery might be recovered using hypnosis in such fantasy-prone individuals, it seems at least a fair working hypothesis to assume that this overlap in experience is indicative of the fact that it is the same target population of unique individuals that is being tapped, in the two fields of research. In fact, when these phenomena are viewed in unison, one also finds support for the weak form of synesthesia. Just as with respect to synesthesia, there is also a weak form of eideticism, termed structural eidetic imagery, most probably apparent to some degree in all individuals. Again, this is similar to Werner's notion that synesthesia could be induced in everyone, given the right conditions (e.g., the use of drugs – note further the relationship between drugs, the induction of altered states of consciousness, and creativity).

The three forms of syncretic phenomena are related. An example used by the Gestalt psychologists to demonstrate the correspondence between shape and sound can be freely translated into the problem appearing in Figure 2. One of these figures is termed *staccata*, the other is termed *galooba*. Which is which? And is this an example of synesthesia (as some authors write) or of physiognomic perception (which is the 'correct' answer)? And how is all this related to creativity? Let us construct the bridge: according to Werner, metaphoric thinking develops out of physiognomic perception. Indeed, physiognomic perception is said to serve as a base from which a poetic metaphor could be subsequently generated (e.g., "The approach of a storm is the windblown hair of a frenzied woman"). Physiognomic qualities may help to foster an 'as if' mode of perception and thinking required for comprehending a metaphor. This is the experiential, perceptual-like base that a Gestalt-oriented approach to metaphoric thinking posits. However, this is exactly the same line of thinking underlying a Gestalt-oriented approach to creativity.

It is perhaps no surprise to realize, therefore, that all three forms of syncretic experience can be used in the pursuit of

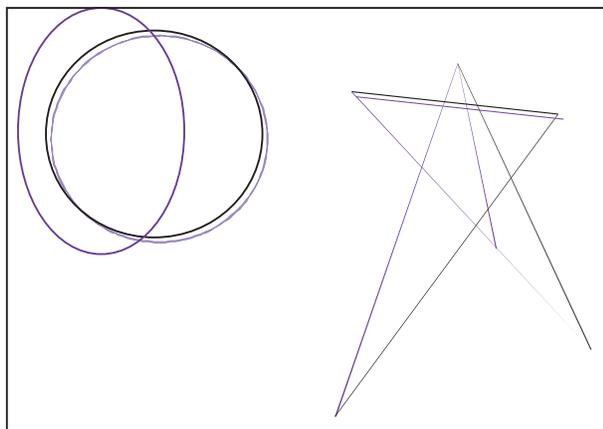


Figure 2 Which figure is *staccata*, and which is *galooba*?

creativity – artistic, literary, musical, scientific or whatever. Various studies have indicated that synesthetes are likely to be involved in artistic pursuits (e.g., painting, photography, music). It is also of no surprise that all three forms have been argued to reflect an arrested (or, derailed) development, a breakdown of normal modularity, or a dedifferentiation of modalities – all of which are variants on a common theme – and all of which could very well foster creative thought, if by this one means being able to restructure the perceptual field and hence find a novel solution to some problem. Indeed, various studies have indicated a relationship between physiognomic perception and creativity. Some authors have argued for an alternative route, namely that creative individuals have access to primary process modes of thought, and that both synesthesia and physiognomic perception are aspects of such primary process thought. In fact, both options have much in common, especially when viewed within the perspective of a *microgenetic* or *perceptogenetic* approach to cognition and consciousness. Microgenesis refers to an unfolding of a cognitive process (e.g., perception, thinking) that occurs in *developmental* sequence. Developmentally, one is progressing from a stage of global diffuseness to a state of "increasing differentiation, articulation, and hierarchic integration," in line with Werner's *orthogenetic* principle of development. Note that syncretic experience in general, and synesthesia in particular, is indicative of a developmentally early level of cognition, in this Wernerian sense. If creativity involves a 'regression in the service of the ego,' or a 'reordering of experience,' then the synesthesia-creativity relationship is one such route.

One notion that has appeared in the literature is of a developmental sequence, whereby physiognomic perception precedes synesthesia. Thus, an individual could be initially perceived in affective terms – say, 'he seems to be resisting,' which is subsequently described synesthetically – he's a 'cold' fish. While synesthesia has been reported in various altered states of consciousness (especially, but not necessarily, following the use of drugs), it is also the case that physiognomic perception is elicited. In Werner's terms, "the whole world becomes physiognomically alive."

Much effort has been exerted in establishing reliable criteria for synesthesia. First, in order for a synesthete to be considered 'genuine' he or she must be consistent over time in reported synesthetic experience (e.g., consistent matching of color to tone in colored hearing). Such consistency assessments are remarkably high (>90% after retesting a year later, in one study). More importantly for our present concerns are the following two criteria for strong synesthesia, which are identical to those advanced with respect to eidetikers. (1) The externalization of the image (eidetic image or synesthetic experience) – hence in *lexical* synesthesia, if the letter Q induces the concurrent color red, this color appears 'out there' (and not 'in the head'), and is located in the immediate vicinity of the printed letter, but is not necessarily confined in space by that letter.

(2) Use of the present tense in the subjective report – hence the synesthete reports seeing in real time colors, or hearing tones, or smelling fragrances, or feeling sensations, and does not recall some commonplace association to the inducing stimulus. And yet, even these criteria are at present being reassessed. Synesthetes are now being classified as being either 'projectors' (i.e., 'seeing colors in external space', as required by

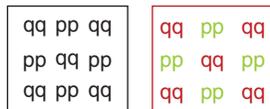


Figure 3 The similarity of form (*p* vs. *q*) in the display on the left can impede figure-ground differentiation – that is, when all elements appear in the same color. For synesthetes, if the letters have corresponding colors, as shown here, the embedded figure will pop out.

the criterion of the externalization of the image), or ‘associators’ (i.e., ‘experiencing colors in their mind’s eye’). Projectors are clearly typographic synesthetes of the sort discussed by Cytowic and others; associators are clearly exhibiting weak synesthesia – and whether this is genuine synesthesia, or the ‘experience’ of commonplace associations, is one issue that will have to be resolved by future research. If the two categories of synesthetes have any bearing on their degree of creativity is a further question.

Research over the past decade on synesthesia has utilized a number of perceptual phenomena – and especially those pertaining to perceptual grouping, as governed by the familiar Gestalt laws of perceptual organization – to provide convincing evidence that the phenomenon of synesthesia is genuine. Consider, for example, the display appearing in [Figure 3](#), which could easily be used to study lexical synesthesia. Various studies have employed such tasks to show either that lexical synesthesia can inhibit a response – for example, requiring a longer reaction time to respond to the color in which the letter is printed, in a Stroop-like situation – or can facilitate a response – for example, eliciting a faster reaction time to detect a form embedded in the display – which for synesthetes just ‘pops out’ due to their particular form of lexical synesthesia. While all of this is quite interesting *per se*, there is nevertheless a hidden assumption here – namely, that the projected color is coincident with the physical characteristics of the letters displayed. However, as various synesthetes have reported, the projected color can be blob-like, and can be composed of different colors. For example, the synesthete IW, as reported by Cytowic, describes a letter as being half dark red and half light red. Phenomenology should certainly not be discarded in the interest of methodology.

Six decades after the appearance of the paper investigating the *blend* of inducing stimuli, noted earlier, there appeared a paper looking at a similar question. In this case, a synesthete reported specific colors to specific letters (e.g., *U* = *yellow*). For her, the color of a word was unique to that word, and not to its constituent letters. In contrast, when presented with a nonsense word, she reported a compound color, derived from the combined evoked colors of its constituent letters. Evidently, the word was viewed neither as a blend nor as a clash, but as an *emergent gestalt*, having a unique concurrent experience.

Synesthesia and Absorption

Answer the following two questions (‘yes’ or ‘no’ in terms of your own subjective experience): (1) “If I stare at a picture and then look away from it, I can sometimes ‘see’ an image of the

picture almost as if I were still looking at it”; (2) “Textures – such as wool, sand, wood – sometimes remind me of colors or music.” The first pertains to eidetic imagery, while the second pertains to synesthesia. Both are items from a questionnaire assessing the trait of *absorption* – which is clearly related to both forms of syncretic experience. One would expect for synesthetes to score highly on the trait of absorption, if this is indeed a scale, and that is the case. As the authors (Rader and Tellegen in 1987) of one influential study write, “A capacity for absorption, that is, for engaging diverse representational resources, including one’s imagination and feelings, may be integral, possibly as a necessary rather than a sufficient condition, to the ability to experience synesthetically.” They further consider the notion that such individuals scoring high on absorption may be adept at reinstating the conditions (introspective sensitization?) under which synesthetic functioning occurs, and that this should be related to creativity. So, what do we know about synesthesia, absorption, and creativity? First, we should note the family resemblance underlying the personality traits of absorption, *openness to experience*, and *fantasy proneness* – such that their respective relations with creativity and synesthesia should all be considered. Forty years ago, Frank Barron noted that creative individuals possessed more ‘perceptual openness’ – this at a time when these particular personality traits were being formulated. Thirty years ago, it was found that individuals scoring high on fantasy proneness also scored high on absorption, imagination, and creativity. Such individuals, it should be stressed, scored within the upper 2–4% on a measure of imaginative involvement (hence were probably eidetikers and synesthetes). Further support for the relationship to synesthesia was reported in studies showing that individuals scoring high on absorption exhibited both synesthesia and eidetic imagery.

A number of studies over the past decade have documented the relationship between creativity and openness to thinking in both visual artists and student populations (assessing psychometric creativity). Visual artists have also been found to report the frequent incidence of altered states of consciousness (again, as predicted by absorption). Individuals actively engaged with the induction of altered states of consciousness, such as those related to contemplative (absorptive) meditation, report a higher incidence of synesthesia. One recent study reported that among long-term meditators, the prevalence rate of synesthesia was found to be 86%. A current notion is that the long-term practice of meditation “involves an attunement to a background field of consciousness” (that of synesthetic functioning?) that is necessary for creativity.

There is also a ‘dark side’ to absorption, just as there is a ‘dark side’ to creativity. With respect to absorption, this refers to an interaction with trait anxiety in the manifestation of intense negative emotion, which might well be detrimental to creativity. This is an issue worth further considering.

Unidirectionality, Bidirectionality, Synesthesia and the Brain

Progress into the study of synesthesia and creativity may be furthered once an unresolved problem regarding synesthesia is addressed, namely the suggestion or assumption that

synesthesia is inherently *unidirectional* (i.e., a particular letter evokes a particular color in lexical synesthesia, but that particular color might not be indicative of only that letter). However, there is the distinct possibility of *bidirectionality* here, and this has implications for synesthesia (or, perceptual synesthesia), literary synesthesia, synesthetic metaphor, and metaphor in general. Let us define our terms here. If synesthesia is viewed as entailing a fusion of modalities – hence of an *interaction* of separate cortical areas of the brain, say one area related to the processing of letters, another related to the processing of colors (see **Figure 4**) – then both cortical areas are implicated in (lexical) synesthesia, and unless one form of processing necessarily precedes the other, as unidirectionality implies, then both areas should be coactivated, hence resulting in bidirectionality. Some supporting evidence for this option has recently appeared in the literature using a Stroop-like situation, and the hunt is now on for further examples of such bidirectionality.

As Harry T. Hunt has recently argued, the notion of unidirectionality is rather puzzling for such an interactive process, but is instantly recognizable “as a variant of the directional asymmetry between vehicle and referent in all metaphoric usage.” Given the fact that at least some poetic metaphors are derived from synesthetic or physiognomic perception, unidirectionality thus becomes a common property of metaphoric thinking. Indeed, it is commonly accepted that in a metaphor, such as ‘the ocean is a harp,’ the ocean, which is the referent of the expression (or, ‘tenor,’ or ‘target,’ or ‘primary subject’) is being viewed in terms of the vehicle (or, ‘source’ or ‘secondary subject’) of the expression, namely the harp. It is also commonly accepted that our understanding of this directional expression is different from that of its inverse, ‘the harp is an ocean.’ However, as with synesthesia, various theorists of metaphor have considered a bidirectional view, which must be considered if indeed the metaphor is an emergent gestalt of its two subjects. Indeed, as Bipin Indurkha has noted with respect to this metaphor, there is a degree of symmetry here “in the sense that the perceptual resonance between the source and the target make them appear similar to each other. As the ocean looks like a harp, the harp also looks like an ocean.” Furthermore, adopting a Gestalt-oriented interactionist approach to metaphor, one notes as does Indurkha, that interactionism implies “that either component may serve as an interpretive base” and further that “the reciprocity of influence need not be completely equivalent, but some changes in both terms should

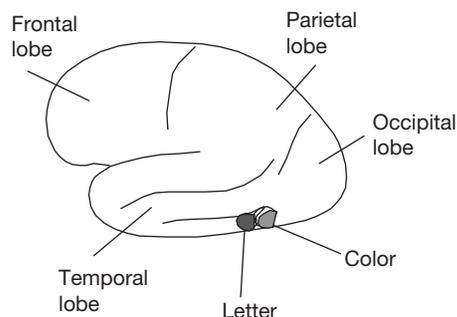


Figure 4 Cortical areas implicated in the processing of letters and the processing of colors.

be observed.” Further research on both synesthesia and metaphor will need to consider this unidirectional versus bidirectional issue.

It has been suggested that research in cognitive neuroscience should be guided by basic questions regarding cognition, and not by basic questions regarding the brain. It has also been argued that the present preoccupation with various brain-imaging technologies is more of a hindrance than an asset to resolving such basic issues. The study of synesthesia and creativity (and indeed of metaphor) has in the past decade attracted the attention of cognitive neuroscience. The question of unidirectionality versus bidirectionality in both synesthesia and metaphor seems to be one that could foster productive cognitive-neuroscientific research into synesthesia and creativity. Note that the Wernerian notion that synesthesia entails a dedifferentiation of modalities (or, a ‘breakdown in modularity’) is complemented by a contemporary view that synesthesia is indicative of a dedifferentiation in the brain.

Synesthesia and Creativity

What have we learned during the past decade about the synesthesia–creativity relationship? Admittedly, not much more than we knew at the time of the first edition of the *Encyclopedia of Creativity*. Nevertheless, the case has been made in the literature by two prominent researchers (Ramachandran and Hubbard), that number–color synesthesia may be caused by “hyperconnectivity between colour and number areas at different stages in processing” and that such “extensive cross-wiring between brain regions that represent abstract concepts . . . would explain the link between creativity, metaphor and synesthesia (and the higher incidence of synesthesia among artists and poets).” As noted above, such hyperconnectivity should implicate bidirectionality and not unidirectionality in synesthesia, and needs more research attention. Nevertheless, hyperconnectivity would be a strong candidate for creativity, and could certainly serve as a neural correlate for the synesthetic background to which the creative individual may be introspectively attuned to, as alluded to before. The individual who scores high on absorption could very well be able to exploit this background as part and parcel of his or her creativity.

A recent study has indicated, however, that synesthetes might be more engaged in art than in creative thought, though the one form of activity might not necessarily rule out the other. Indeed, one should distinguish between the various forms of creativity and its assessment. Musical creativity might well be related to colored-hearing synesthesia, and not necessarily to psychometric creativity as assessed using a measure of verbal divergent thinking. One should further consider the difference in both form of creativity (convergent, as in innovative though focused problem solving, or divergent, as in open-ended problem solving) and corresponding cortical areas (dorsolateral prefrontal cortex, and temporo-occipitoparietal cortex, respectively). It would surely be of interest to see a study on synesthesia – say one employing synesthetes exhibiting colored hearing – wherein the colors and tones themselves are to be used in problem solving. The reader is encouraged to follow up this suggestion.

See also: Altered and Transitional States; Analogies; Brain and Neuropsychology; Crime and Creativity; The Dark Side of Creativity; Imagination; Metaphors; Mindfulness; Music; Perception and Creativity; Poetry; Substance Abuse and Creativity.

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- <http://www.cytowic.net/> – Richard E. Cytowic on Synesthesia.

Synchronicity and Creativity

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Glossary

Formative causation A hypothesis proposed by biologist Rupert Sheldrake: all biological and chemical systems at all levels of complexity are organized by morphic fields. Under standard conditions anywhere in the world, permutations in one morphic field will occur more readily over time in similar organisms through inheritance of habits.

Implicate order A theory by physicist David Bohm. The universe is organized from within as well as from without. The implicate order underlies and enfolds all matter.

Morphic resonance According to Rupert Sheldrake in 1994, "Formative causation is the kind of causation responsible for form, structure, and pattern, and the causal influence on this is the morphogenetic field, morphic field, from the Greek word *morphi* meaning form. Each kind of thing has a field which gives its form, pattern, field or structure. This field is like the plan, the shaping influence has the kind of form it does because of its memory by the

morphogenetic fields. An influence of similar things on subsequent similar things. Fields have a kind of inherent memory within them that is nonmaterial but physical. The gravitational field is physical, it has physical effects, part of nature, but it's not material in the sense it's made of matter" (p. 18).

Synchronicity Synchronicity is the simultaneous or near simultaneous happening of coincidental events which have no cause. The odd events, because of their occurrence so close in time, are instilled with meaning by those who recognize them.

Trickster A mythological character found in many cultures, who transforms aspects of the world and who plays pranks. Often in the form of the raven, the coyote, the spider, the mink, the blue jay, or the rabbit, in North American Indian cultures; of the monkey in Asian cultures; of Hermes and Prometheus in Greek mythology; of Loki in Norse mythology.

Introduction

Synchronicity has several domain-based relationships with the concept of creativity – through psychology, through biology, through chaos theory mathematics, and through the new physics. In psychology, synchronicity is defined as the occurrence of meaningful coincidences that seem to have no cause; that is, the coincidences are *acausal*. The underlying idea is that there is unity in diversity. In psychology, Carl Jung introduced the concept in his later works (1950s). In biology, Rupert Sheldrake's work on morphic resonance has principles similar to those of synchronicity. In systems theory, Ernst Lazlo's work on chaos theory has also affirmed the idea of synchronicity. In modern physics, Bohm's work on the holographic cosmos is most consonant with the concept of synchronicity. Creativity and synchronicity have to do with these four concepts.

Synchronicity and Psychology

Jung waited until late in his career to focus on synchronicity because of its controversial and nonempirical implications – that effect does not logically follow cause, even though he first used the term publically in 1930. Among his experiments, he tallied the similarity in married couples' astrological profiles. Mathematicians and scientists were shocked and dismayed that he would give such credence to astrology. His editors urged him not to publish his 1955 monograph on synchronicity in his *Collected Works*, but after a long delay, in which Jung questioned the very premises of empiricism, the work was

published, with few changes. In it, he cited Kammerer's work on multiples, Schopenhauer's work on the first cause, the work of Davies, Richey, and Hammerian on probability calculus, Wilhelm Von Scholz on how lost or stolen objects come back to their owners, Herbert Silberer's on how chance functions from a psychological angle, and J. B. Rhine's experiments with extrasensory perception as evidence of a force called synchronicity. He focused on Rhine's work, saying the experiments show that events may be meaningfully correlated but not causally correlated, and therefore meaningful coincidences have archetypal roots. Jung also worked closely with physicist Wolfgang Pauli, who was interested in synchronicity as an explanation for the behavior of atoms in quantum mechanics. Jung defined *synchronicity* in several passages:

- Simultaneous occurrence of two meaningful but not causally connected events.
- A coincidence in time of two or more causally unrelated events which have the same or a similar meaning.
- The simultaneous occurrence of a certain psychic state with one or more external events which appear as meaningful parallels to the momentary subjective state and in certain cases, vice-versa.
- Synchronistic events rest on the simultaneous occurrence of two different psychic states. One is the normal, probable state (the one that is causally explainable) and the other, the critical experience, is the one that cannot be derived causally from the first.

Synchronicity does not only show its effects in the present, it shows its effects in the past and the future. Synchronicity has

to do with the physical principles of time, space, and causality. Jung asserted that people who are able to perceive in the present, events that occur in the future, with what is called 'extrasensory perception' or 'precognition' proves that such events are synchronistic, having to do with a relationship across time, and not synchronous, taking place at the same time. They fall into the same category whether they are separated by space or separated by time. Jung gave three examples that he said showed that space and time are, in their essence, one and the same:

1. A woman in therapy dreamed of receiving a scarab pin. While she was describing the dream, Jung heard a buzzing rap at the window. There, simultaneous with the woman's story, was a golden beetle, similar to the Egyptian scarab beetle, which is a symbol of rebirth in Egyptian mythology. This was an example of synchronicity in which a psychic state simultaneously occurs with an external event that coincides with the content of the state.
2. A woman saw birds gathered outside the rooms in which her grandmother and mother died. Jung was treating her husband for a neurosis. The man seemed to exhibit signs of heart trouble. Jung sent him to see a doctor. The man was given a clean bill of health. On the way back home after his appointment with the doctor, with the papers in his pocket, the man collapsed of a heart attack. The woman reported that soon after her husband had gone to the doctor, she saw a flock of birds land on their house. She remembered what had happened at the deaths of her mother and grandmother, and was very fearful. Her fears were justified. Jung said this was an example of synchronicity where the woman's unconscious had already perceived the danger to her husband. The first two incidents of birds landing were coincidences that set up a correspondence in her that could only be proved when the man's dead body was brought home.
3. A man in Europe dreamed the death of a friend in America. The next morning he received a telegram that the friend had died an hour before the dream occurred. Jung said that such experiences commonly happen almost simultaneously with the event, just before, or just after it happens. The person had unconscious knowledge of the event.

The two necessities for synchronicity to take place are (1) the presence of emotion and (2) an unconscious image which comes to consciousness either directly or indirectly. The melding of space and time are crucial and how the energy is transmitted is not known, and perhaps unknowable. Jung said that there is no explanation for the transmission of energy in these cases. The experience of synchronicity is indelibly interwoven with a sudden emotional recognition that something is momentous, important, consequential, and thus carries great weight. The surprise interrupts what we take for granted as cause and effect.

Jung conjectured about three different ways of understanding synchronicity, focusing on how intuition has worked in a way that is statistically significant.

1. One could look at the ESP experiments, which provided statistical empirical evidence that such events exist. In the ESP experiments, the subjects did better when the tasks

were fresh and their emotion and interest was focused. As the tasks repeated, boredom set in, and they did not do as well. This shows that emotion is indeed necessary for synchronicity to occur.

2. If we look at the Chinese way of holistically seeing the world, rather than the western way of seeing the world by analyzing small parts and generalizing to the whole, we can see that the concept of synchronicity is more explainable. The ancient Chinese practice *I Ching*, based on the concept of the Tao, where one throws stalks of yarrow (or, in the west, three coins) in order to grasp the meaning of an event or to predict the future, is based on intuitive principles. (Jung did much work with the *I Ching* and first used the word synchronicity at the funeral of his friend Richard Wilhelm, who had translated the *I Ching*.) When an intuitive person who understands the 64 mutations of Yin and Yang interprets the tosses, the interpretation taps into the inner knowledge of the person, which is the same as the person's psychological state at that time. This state is synchronous with the chance falling of the coins or sticks. Thus the results are meaningful, but there is no cause or explanation for the meaning.
3. Jung settled on another intuitive technique based on ancient science, and that was astrology. He conducted an experiment with 80 married couples and found that their signs were compatible to a degree that was statistically significant. A mathematician colleague of Jung's looked at the data and found that 25% of the couples had signs that were compatible. Of course, the other 75% did not. Jung said such astrological coincidence has little chance of being proved by mathematical law, and that astrologers would argue that probability mathematics is not subtle enough to decipher the many permutations that influence the married couple's charts and signs.

Jung reviewed historical antecedents to the idea of synchronicity, cautioning that the rationalistic view of people in the West is not the only possible explanation for events, and in fact, the rationalistic view shows short-sightedness, prejudice, and bias. He cited the western practices of astrology, alchemy, and mantic practices such as tarot and *I Ching* as being open to synchronicity.

Jung referred to Schopenhauer's idea of the unity of primal cause, Leibniz's idea of preestablished harmony, and Kepler's idea of a geometrical principle that underlies the physical world. Jung said there must be some girding idea or principle which can explain these seemingly coincidental happenings. Noting that both primitive and medieval people did not doubt the existence of synchronicity as explanation for seemingly acausal events, Jung asserted that it is the role of psychology and parapsychology to take into account the fact that synchronicity might explain such events.

Jung pointed to dream analysis, and focused on his principle of the collective unconscious, which is an underlying species memory, common to *Homo sapiens*, that is expressed in archetypes, overarching mythic figures which appear similar in myths and fairytales in all societies. They are primordial images that exist in the unconscious and surface in dreams, images made in art forms such as poetry, painting, and music, and in fantasy, delusions, and delirium states of people alive today.

In 1961 Jung stated that the form of archetypes is comparable to the form of a crystal, which is preformed in the liquid from which it rises, even though it does not exist materially by itself.

Jung worked with physicist Wolfgang Pauli, who postulated that synchronicity is the fourth pole in a unity of time, space, and causality. Pauli pioneered with his explication of the exclusion principle, which stated that electrons cannot share the same path of orbit in an atom. This led Pauli to assert that quantum physics did not uphold the idea of universal principles and thus began the era of 'new physics.' Pauli and Jung proposed an addition to classical physics, that of synchronicity.

Arthur Koestler described synchronicity as even more enigmatic than extrasensory perceptual phenomena such as telepathy and precognition. Humans have been infatuated with such riddles since the beginning of mythology. These riddles contain the perhaps accidental and coincidental meeting of unrelated events which seem to have no cause, but which also appear to be very important and significant. Koestler applauded Jung for working in concert with the physicist Pauli as he developed his theory. While Jung used Pauli as a quasi tutor in theoretical physics, Koestler faulted Jung for not following up on Pauli's ideas, but rather descending into the obscure by attributing synchronicity to the collective unconscious and to archetypes. Koestler noted that synchronicity has reached cult status.

Synchronicity in Biology

Synchronicity is expressed by the principle of morphic resonance in formative causation described by Rupert Sheldrake. According to Sheldrake in 1994, "the hypothesis of formative causation suggests that self-organizing systems at all levels of complexity including molecules, crystals, cells, tissues, organisms, and societies of organisms are organized by 'morphic fields'." These fields include morphogenetic fields which have to do with the how organisms, molecules, and even crystals inherently remember what previous bodies have done.

The case of the blue tits is an example. Over time, ornithologists noticed that small blue tit birds learned to pierce the tops of milk bottles left on the doorstep in the morning in Great Britain. The phenomenon was first reported in 1921. By 1947 the behavior had been noticed throughout Europe. Blue tits do not usually travel far from their homes and live only two or three years. In the Netherlands, milk delivery had been all but stopped during the Second World War. When milk delivery resumed in 1947 and 1948, the blue tit behavior also resumed. Sheldrake used this as an example of how organisms remember habits established by previous generations.

Sheldrake said that space and distance do not matter to morphic resonance, for information and not energy is exchanged. That is, the universal principles of space and causality do not apply. The hypothesis of morphic resonance explained by formative causation explains the patterns and events in nature to be "understood as regulated by inherited habits and not by universal and eternal underlying principles."

Mechanistic science after Descartes took for granted that there were universal principles that were inviolable, and that the task of science was to discover these principles. Thus

memory was 'stored' in cells in the brain or body; Sheldrake said this was not true; memory is part of a collective memory of the species inherited from former members of the species. In 1994 Sheldrake said that this is a concept similar to Jung's concept of the collective unconscious:

The hypothesis of morphic resonance enables the collective unconscious to be seen not just as a human phenomenon but as an aspect of a far more general process by which habits are inherited through nature. (p. 117)

Sheldrake commented that these two hypotheses – of formative causation and of morphic resonance – may seem mysterious, but the mechanistic idea that there are laws of mathematics that transcend nature are more mysterious, as they also rely on a metaphysical explanation for what happens in nature.

Synchronicity in Chaos Theory

In 1987 Ernst Laszlo formulated a hypothesis about mathematical wave functions that assemble themselves into forms and nested patterns or psi-fields. Laszlo theorized that once patterns are made, they probably will occur again. This is an expression of creativity in the universe, or cosmos.

In 2003, a biologist, Richard J. Bird, challenged the dictum of evolutionary biology, that random selection is order arising from disorder. Mathematically speaking, randomness is order. Since the Enlightenment, biological science has ignored and diminished coincidence, chance, and chaos, and has thus disenfranchised those, like Jung, who argued for meaning in coincidence and chance. Bird stated that chaos implies an endless order. Evolutionary biology rests on the assumption that although events are fundamentally random, some are selected because they are better adapted than others to the surrounding world. Bird said that synchronicity can be explained if we view the world not as random-selective, but as iterative-sequential. In a world view that is iterative-sequential, coincidence would be expected. His theory would then encompass the presence of coincidence and chance as being part of a mathematical recursiveness, an order of infinity.

Synchronicity in the New Physics

In physics, the principle of correspondence was cited by Niels Bohr to illustrate the discontinuum between the particle and the wave. Bohr later changed the term to "argument of correspondence." The idea of correspondence is related to the concept of the natural philosophers of the Middle Ages, who talked of the "sympathy of all things," and to the Greek philosophers such as Plato who postulated an underlying ideal form.

David Bohm expressed the theory of the implicate order, which is the order that underlies what is external, or the explicate order. The implicate order is part of and contains the explicate order. Bohm saw the universe as a hologram, where each part is enfolded into each other part. The synchronicity in this theory is that locality disappears. Time, space, and causality are not evident in events that happen. What may seem to be creativity may instead be the expression of synchronicity.

Bohm also proposed a superimplicate order, which may contain a unifying principle. Intuition may be an expression of the superimplicate order functioning to perceive the implicate order and therefore the explicate order. The notion of the 'sixth sense' is similar to the notion of synchronicity.

Synchronicity in Cosmology

In 2006 Richard Tarnas noted that synchronicity throughout history has provided for those who listen, a "dawning intuition" with great emotional and personal import, especially spiritually. He said that such experiences carry with them "a certain numinosity, a dynamic spiritual charge with transformative consequences," that are so powerful that people usually keep the insights hidden in order to avoid ridicule. Tarnas used the example of Petrarch climbing Mount Ventoux in 1336, and randomly reading a passage from St Augustine which directed him to pay attention to natural phenomena, an event that has been credited with the symbolic beginning of the Renaissance. Tarnas cautioned against the shadow side of the idea of meaningful coincidence, the "exaggeration of the trivial to discover a self-inflated meaning," a narrowness of self-involvement that may signal selfishness and even psychoticism (p. 51).

Tarnas also took up the thread that Jung had begun, that of using astrological science to describe and understand events of recent history. The use of astrological science remains controversial to empirical scientists, and thus Tarnas' work is often relegated to the mystical and idiosyncratic by mainstream psychologists, but it has had an influence on analytical and depth psychologists. Thus, the literature on synchronicity is rife with opinions and explanations that have psychological import. The connection of synchronicity and psychology is very strong.

Synchronicity and Creativity

While synchronicity has been taken to heart in analytic psychology, and has been viewed with bemusement by physics and biology, what does synchronicity have to do with creativity? These and other theories evolving simultaneously from many branches of knowledge converge in the root definition of creativity, which means 'to make.' The root of the words 'create' and 'creativity' comes from the Latin *creatus* and *creare*. This means, 'to make or produce,' or literally, 'to grow.' Creativity is discovering the unity in diversity and making something new – an invention, a theory, a concrete object, a temporal illusion.

The Dictionary of Developmental and Educational Psychology published in 1986 defined creativity as "man's capacity to produce new ideas, insights, inventions or artistic objects, which are accepted of being of social, spiritual, aesthetic, scientific, or technological value." The *Random House Dictionary of the English Language, Unabridged Edition* published in 1988 noted that creativity was an ability, the ability to "transcend traditional ideas, rules, patterns, relationships or the like, and to create meaningful new ideas, forms, methods, interpretations, etc."

Thus synchronicity has two relationships with the concept of creativity. First is that seemingly acausal coincidences may jar a person or a group to have new ideas, to see the old in new ways, and force a person or a group to pay attention and perhaps change the old ways of behaving, acting, doing,

making. Second is that in the new cosmology where universal principles give way to unpredictable models (except perhaps in Jung's concept of the collective unconscious and in Bohm's of the superimplicate order) creativity is found in the constantly evolving and perhaps accidental forms and patterns that are being developed.

The former may be illustrated with the following: A woman wakes up. Last night she dreamt about a coyote coming out of a cave and licking her hand. At the dentist, she flips through a fashion magazine and sees there a new perfume called Coyote, in which the model is dressed in American Indian fashion, petting a coyote. She goes to work and receives a letter from a man called William Coyote who wants her to give a speech at his school. At lunch she tells her friend about these unforeseen coincidences. Her friend pulls from her purse a novel she is reading. It is called *Coyote Justice*. By the fourth coincidence, the woman has a strong feeling that there is something going on. She and her friend talk about the coyote as trickster in American Indian mythology. This begins a search that leads the woman to a life change as she begins to embrace the significance of the trickster figure in her life. These coincidences with no seeming cause are called 'synchronicity.'

An example of the latter is the following, as explained by Sheldrake. When random mutations occur, organisms must react in new ways. Organisms adapt to the genetic mutation by making a creative leap which synthesizes into a new pattern. These patterns are instituted by morphic fields, which get more powerful and instill habits into the organism if the organism is preserved through natural selection.

Thus the creativity that gives rise to new bodily forms and to new patterns of behavior is not explained by the random mutations alone. It involves a creative response upon the part of the organism itself and also depends on the ability of the organism to integrate this new pattern with the rest of its habits. (p. 141)

Thus synchronicity is basically creative whether at the level of the atom, the molecule, the cell, the organism, or the system. Enigmatic, inscrutable, mysterious, seemingly acausal, playful and funny, synchronicity makes us laugh, cry, pay attention, and shake our heads in amazement. In 1996, Combs and Holland stated it well:

Nothing is closer to the heart of the experience of synchronicity than the feeling that the world itself expresses creativity in synchronistic coincidences. Such coincidences often have more the feel of poetry than physics. (p. xxxiii)

Another way that synchronicity is related to creativity is that the concept of synchronicity itself has influenced many creators in their creative works. The surrealists, the expressionists, and the symbolists in art, music, and literature, created many works by paying attention to coincidences that had meaning in their lives. A song by the rock and roll musician Sting entitled "Every Breath You Take," from their 1983 album *Synchronicity* illustrates this concept: "With one breath, with one flow / You will know / A sleep trance, a dream dance / A shared romance / Synchronicity."

A new field, quantum aesthetics, has emerged, based on synchronistic principles, including Sheldrake's idea of morphic resonance. Those who advocate quantum aesthetics are poets,

novelists, visual artists, filmmakers, psychologists, and the like. A manifesto stated that the quantum aestheticians proposed that the dualism and rigidity in previous theories should give way to ambiguity, uncertainty, vagueness, and the interpenetration of opposites. They sought to throw out the dictates of previous generations, and to adopt the principles of quantum physics in their crossover work. Rather than differentiating reality into naturally exclusive levels, quantum artists believe that these levels are intertwined and thus inseparable. The use of collage, constellation, montage, and hologram provided media suitable to the synchronistic idea.

Intercultural synchronicity has also been discussed. How do people geographically separate come up with identical ideas and inventions? What can account for the simultaneous production of multiples in different lands and different cultures? Often cited is the theory of evolution, contiguously advocated for by Charles Darwin and Alfred Russel Wallace. Some argue that such creations are 'in the air,' in the *Zeitgeist*. Social psychologist Dean Keith Simonton has called this *sociocultural determinism*, and has argued that the creations are not identical, but result from the process that the well-trained scientists have undergone; he said that many such discoveries are not recognized by their creators – that is, the discoveries are peripheral and accidental and not central ideas to the scientists; that the discoveries are not truly simultaneous, but are separated by years. Other critics of the idea that synchronicity enhances the creative process call synchronicity an 'illusion,' a type of 'creative idealism,' which is too fanciful and which will lead to inventions and products that are not probable. In 1995, cognitive psychologists Thomas Ward, Ronald Pincke, and Steven Smith said:

This has often led to the development of fanciful theories about paranormal forces and the like, which tend to promote creative idealism; that are undergoing. (p. 86)

Thus, almost a century after the term was first mentioned by Jung, the concept of synchronicity is still controversial, with many proponents and many critics.

See also: David Bohm 1917–1992.

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Systems Approach

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Glossary

Complexity theory The study of interconnected, interdependent, dynamic systems.

Cybernetics The art of steering, or the study of dynamic circular interactions and recursive patterns of organization.

System A group of interrelated and interacting elements that form a complex whole.

Transdisciplinarity An approach to inquiry that moves across disciplines to find pertinent knowledge to address a specific question, using the language of cybernetic, systems, and complexity theories.

Historical Overview

It is not possible to speak of a single systems approach. There are rather of a number of systems approaches, each loosely drawing on different aspects of a family composed mainly of, general system theory, cybernetics, information theory, chaos theory, and complexity theory. Systems approaches have been used in most of the social sciences, particularly sociology and management, but their use has extended into the arts and humanities.

Creativity researchers have used systems approaches drawing on very different sources and in very different ways. The main focus has been to highlight creativity as a phenomenon that occurs in the context of multiple systems, and therefore involves a network of interactions.

General System Theory

General system theory originated in the 1940s in the work of the biologist Ludwig von Bertalanffy who initially sought to find a new approach to the study of life or living systems. More broadly, Von Bertalanffy envisioned general system theory as a way to address the increasing complexity of the world's problems. General system theory emerged as an alternative to the dominant form of inquiry and way of thinking, reductionist analysis, which was criticized for being unable to address wholes, interdependence, and complexity. Reductionism is based on the assumption that scientific explanation of complex phenomena should be in terms of component, simpler phenomena, and that the whole is explained from the knowledge of its parts. General system theorists argued that reductionism abstracts a subject from its environment, with the isolation of a variable in a laboratory being the classic example, and that by studying an element of a larger whole in isolation reductionism is unable to account for systemic and emergent properties, or the way relationships and interactions form the organization of the life. General system theory was presented as a new way of thinking that allows for the study of interconnections among systems and accounts for the nature of 'open systems' which interact with their environments.

General system theory introduced key concepts such as *open and closed systems*, stressing the role and importance of context and environment, *equifinality*, or the way systems can reach the same goal through different paths, and *isomorphisms* or

structural, behavioral, and developmental features that are shared across systems.

General system theory positioned itself as transdisciplinary rather than interdisciplinary. Interdisciplinary refers to *interaction* between disciplines, whereas transdisciplinarity refers to going beyond or across disciplines. General system theory would be the common language across diverse disciplines. Central to this language was the concept of 'system,' defined as a group of interacting, interdependent elements that form a complex whole. It also pointed toward a new world view that emphasizes such key concepts as every system's embeddedness in other, larger systems, and the dynamic, ever-changing processes of self-organization, growth, and adaptation. It is not surprising therefore that systems concepts have been central to the rise of ecology as a field of inquiry, with such concepts as ecosystem. In creativity research the systems approach has also at times been referred to as an ecological approach, because of the emphasis on the larger ecosystem in which creativity emerges.

General system theory was generally interpreted to be equilibrium-oriented, and fundamentally static, particularly as interpreted in mid-twentieth century functionalist sociology. This focus on order and equilibrium was also one of the main sources for the initial critiques of general system theory's application in the social sciences, most notably in the functionalist sociology of Talcott Parsons. This was viewed as being fundamentally politically conservative and oriented toward maintaining the *status quo*, rather than open to creativity and change.

Cybernetics

In its early years, general system theory engaged in fruitful exchanges with information theory and cybernetics, most notably at the classic Macy conferences from 1946 to 1953. Concepts such as negative and positive feedback, entropy, and self-organization became part of the systems lexicon. Negative feedback is deviation-reducing feedback, which can be found in a thermostat. A decrease in temperature below a certain threshold kicks in the heating, so that a relatively stable temperature is maintained. Positive feedback occurs in so-called 'self-exciting' or 'runaway' systems when, for example, one person's rude behavior leads another person to respond even more rudely and the whole thing escalates until the arrival of the police acts as a negative feedback. Positive feedback can be

found both in vicious and virtuous cycles. People who do not exercise tend to feel more and more out of shape, and therefore feel less and less like exercising, which makes them even more out of shape, and therefore even less likely to move, and so on. Alcoholism and drug addiction also work through runaway positive feedback. But positive feedback can also kick-start a situation that has become stuck – the more somebody exercises, the better they feel, and so they keep exercising. With its focus on deviation amplification, positive feedback is also associated with creativity and innovation. If negative feedback maintains a system on course and in equilibrium, positive feedback's deviation amplification takes it toward disequilibrium and change.

Process

Cybernetics focused on process, on navigation (the Greek origin of the word, *kybernetis*, means steersman), and the connection and communication between events and concepts. A classic example is the relationship between order and disorder, or stability and change. Many paired concepts such as order and disorder were traditionally viewed as opposites and referred to as 'paradoxical.' From a cybernetic perspective they are viewed as forming part of one larger ongoing circular process (much like day and night), rather than static opposites. The connection between creativity, madness, and emotional instability dates back at least to Aristotle. It has become part of popular culture to believe creative people are a little (if not a lot) crazy. Research shows creative individuals score higher on measures of psychopathology and on measures of psychological health. They are therefore *both* healthier and more unstable, experiencing periods of instability but also having the ego-strength to rally from setbacks, and in the process experiencing a wider range of human possibilities. This is a more complex formulation than the simple suggestion that creatives are a little crazy, and one that, with a few exceptions (Frank Barron in 1995 and Edgar Morin in 2008) has not been fully explored in terms of its general implications for psychological health, the nurturing of creative potential, the importance of supportive environments for creativity, the role of 'positive disintegration,' and the role of disorder in the generation of novelty. Creative individuals, with their preference for apparent disorder, draw on disorder, in the form of the unconscious and the irrational as sources of novelty in their own work. Rather than fear disorder, they actively court it and believe an encounter with it can allow them to generate a higher, more inclusive ordering principle.

Cybernetic Epistemology

Cybernetics evolved into in what came to be known as 'second-order cybernetics,' which went beyond the useful but mechanistic concepts of negative and positive feedback. Second-order cybernetics moved from the study of *observed* systems to the study of *observing* systems. The fundamental role of the observer or inquirer in every inquiry became central, as cybernetics moved into the field of epistemology. Cybernetic epistemology was later to make a considerable impact in the field of family therapy, and in the sociology of Niklas Luhmann. Cybernetic epistemology holds that every statement is always made *by somebody*. The speaker/knower cannot be left out of

the equation, and there is no 'God's eye view from Nowhere.' One of the more radical interpretations of cybernetic epistemology holds that any statement tells us more about the speaker than about the event, object, or person she/he is describing. In the context of creativity, this leads to the view that creativity is always an attribution made by somebody. Certain more sociologically inquiries into creativity have in fact shifted the research toward those that make the judgment about what is, and what is not, considered creative in a field.

Chaos and Complexity Theories

In the 1980s chaos and complexity theories introduced important new dimensions to systems approaches. Whereas in general system theory the focus had been on systems in equilibrium, researchers now began to incorporate cybernetic concepts and study systems in states that were far from equilibrium. As a result they began emphasizing the role of self-organization, emergence, and unpredictability. These developments in science led to what has been called the 'challenge of complexity.' The irreducible complexity of phenomena ranging from atoms to star systems, from cognitive systems to human societies is increasingly clear. This complexity, which takes the form of interconnectedness, interdependence, and unpredictability is not amenable to reductionistic approaches. Eliminating the interconnectedness, interdependence, and unpredictability also eliminates many of the most important dynamic features of the system. Complexity is now being recognized as a basic fact of existence, whereas in traditional, reductionist approaches to research it was considered an exogenous, chaotic element that interfered with the 'purification' of the variable to be manipulated.

The term complexity is generally defined as the length of the minimal program required to compute a number. But this is an algorithmic definition, and another definition might be a measure of how hard it is to put something together starting from elementary parts. Complexity has also been described as a recognition of complex causality, where complexity entails a shift in our description of phenomena, which at minimum recognizes the cybernetic dimension of mutual, recursive, and circular causality. Central to our understanding of complexity is that it emerges out of the inclusion of relationships as a dynamic, constitutive process dimension of the phenomena we want to understand rather than viewing them as static elements in isolation from their environment.

Key Concepts

System

Central to the systems approach is the concept of *system*. Traditionally, science saw the world as made up of 'things,' reduced to the smallest significant variables, such as atoms or individuals. Both atom and individual mean *indivisible* or that which cannot be broken down further – the smallest significant variable. Scientific inquiry involved finding the smallest significant variable and isolating it from its environment to study it, preferably in a laboratory setting. With general system theory, the concept of system emerged as an alternative. A system is defined as a group of interrelated elements that make up a complex whole and exists in an environment. Open systems

interact with their environment, exchanging matter, energy, and information. Closed systems do not interact with their environment in any meaningful way. Rocks, for instance, are closed systems. They do not take in matter, energy, or information. Living systems need interactions and exchanges with their environment for their survival.

In a systems approach, the individual is understood as a system, interacting with a number of other systems, which may include family, workplace, neighborhood, and so on, depending on the nature of the research and the context. An understanding of the various systems an individual is embedded in is necessary in order to understand how a creative idea in somebody's head becomes a product. In order to understand creativity in organizations, for instance, we need to look at a series of interacting complex systems: the individual, the group, the department, the organization as a whole, the wider business environment (e.g., economic climate, trends, competition), and so on.

The traditional scientific reductionistic view saw the world made up of atoms, or things, that were not interconnected. The world was made up of what the systems approach would call closed systems. Closed systems do not require any exchange of matter/energy or information with their environment. Their context and interactions are not significant or epiphenomenal. A closed system view is inappropriate in the study of living systems, because no living system can be a closed system. Every living system exists in a network of relationships and interactions with its environment.

The concept of open systems offers us an entry point to understand the role of change and creativity. Open systems tend to be far less stable than closed systems, which are by definition systems in equilibrium, with no exchange with their environment. The openness of the system leads to constant interactions and exposure to difference and novelty, and therefore potential disequilibrium. The equilibrium of open systems is only relative because this structure is gradually, and sometimes quite rapidly, transformed by exchanges with the environment, leading to alternating periods of equilibrium and disequilibrium. The more complex the systems, the further from equilibrium they become, which means they are increasingly unstable, and therefore require great adaptability and resilience. This is especially true of human systems, which are modified by their experiences with their environments.

In a systems approach, everything that exists, exists in an environment. The traditional (or reductionistic) approach to inquiry focused on understanding the subject of inquiry by removing it from its environment. The ideal setting for research therefore was the laboratory. A systems approach stresses that every system is part of a larger series of systems. Every part exists in a larger whole, which in turn is part of a larger whole. In an organizational setting, the individual is a part of a group, which is part of an organization, which is part of a national economy, which in turn is part of the larger global system. Every system is part of a larger system, in a series of endlessly nested systems.

Closed systems are in equilibrium. They do not change, grow, or transform. The traditional view, dating back to Newton, held that the Universe was made up of closed systems. And from a perspective that views all systems as essentially closed, equilibrium is the norm. Change and creativity are

the exception. Historically, the dominant view of creativity reflected this position.

Once we start seeing the creative process as occurring in a network of open systems, our understanding of creativity and change are transformed. From a systems approach, it is not the case that open systems change. Systems *are* change. The problem is that our traditional way of knowing does not allow us to see that, because we have seen individuals and organizations as fundamentally static, and creativity change as an exception.

Open systems have an ongoing relationship to their environment, and have to react to, or initiate changes in, that environment. As they face environmental challenges, they experience periods of disequilibrium. Traditionally, it was believed that equilibrium was a vital goal for any living system, and disequilibrium was viewed as a temporary aberration to be avoided. In a systems approach, the role of disequilibrium is viewed as potentially constructive. An excessive focus on equilibrium stresses the importance of staying the same, and not changing. But research has shown that periods of disequilibrium are essential for change, creativity, and innovation for all systems, whether they are individual persons or organizations.

In 1995, Frank Barron wrote that we should think of "the person as a dynamical natural system, bounded yet open, that is in a continual state of disequilibrium (p. 11)." He went on to argue that the creative person, process and product were "Each, in a sense, is a 'field within a field' – a field that never closes, for we really are talking about open systems, delineated for purposes of abstraction as product, process, and person." (1995: 32).

Mihalyi Csikszentmihalyi (1997, 1999) has been a prominent proponent of a systems approach in creativity research. His 'DFI model of creativity' has three systems as its major components: the domain (D), the field (F), and the individual (I). Culture, he writes, is made up of a set of domains such as music, engineering, religion, and so on. What is considered creative in these domains is decided by the field, which is made up of the gatekeepers who decide what is and is not creative. Both domain and field are necessary to understand what we mean by creativity.

The visual arts are a 'domain,' and connected to this domain is a 'field,' made up of gallery owners, art critics, museum curators, important buyers and other key figures who decide what is and is not creative and valuable. They make the judgments that matter. These 'gatekeepers' are the individuals and groups who decide whether an idea is worth pursuing or not. They play a key role in the life or death of an idea, and learning how to influence these gatekeepers is often a necessity in organizational life. Having an idea is not enough – the idea also has to be "sold" and accepted, and this entails both social and influence processes. This view has led some researchers to argue that the 4Ps of creativity research – person, product, process, and press (the environment) need to be augmented by persuasion, the process whereby an idea is convincingly presented to the field. The 5P view extends the concept of creative process to include not just the emergence of an idea, but the larger process whereby that idea makes an impact in the field in order to be accepted as a creative contribution.

Another related implication of the systems approach is that creativity training which focuses exclusively on the development of individual creativity provides only a partial solution to the task of fostering creativity in organizations. If an

organization wants to become more creative, it is not enough for individuals to have more creative ideas. If management does not support creativity, and the gatekeepers are very risk-averse, or believe that “we’ve always done it this way, and there’s no need to change,” then training individuals with workshops that foster creative thinking may actually be counterproductive and frustrating, because the ideas may never see the light of day organizational creativity and innovation are systemic processes.

Focusing on only one part of the system is not enough to foster organizational creativity. A systems approach is transdisciplinary. It does not reduce creativity to one discipline or dimension. Using the DFI model requires going beyond psychology and into such disciplines as the sociology of art, aesthetics, cultural studies, and more. Focusing on one dimension, such as the role of brain hemispheres in creative thought, or the group process of an R&D group, without taking into account the larger organizational systems they operate within, provides us a partial view with potentially limited applicability.

A systems approach does not necessarily shift the focus on the sociocultural dimensions of creativity. Gruber’s evolving systems approach focuses on three interacting systems that in their interaction make up the creative act, namely knowledge, purpose, and affect which is essentially a cognitive approach. Amabile’s three interacting systems of intrinsic (or task) motivation, creative thinking, and expertise, form a componential model that can also be viewed as a system mode.

Beyond Either/Or: The Cybernetic Paradoxes of Creativity

A systems approach stresses the limitations of an either/or, binary logic, and emphasizes a cybernetic, recursive, process way of thinking. A reductive approach isolates and separates, whereas a systems approach distinguishes and unites. When we *separate* A and B, we state that there is no connection between them – they are literally separated. When we *distinguish* between A and B, when we make a distinction as opposed to a disjunction, we say there is a difference between A and B, but they are not necessarily separate or opposed. Between A and B there may be a spectrum of possibilities, in the same way that to say night and day are separate or opposites does not take into account the entire 24 hours, and ignores, for instance, dusk and dawn. When researchers who are methodological individualists argue that a person’s environment is epiphenomenal to our understanding of his or her creativity, they are essentially arguing it is not relevant to the inquiry and will not help us understand that person’s creativity. There is a strict separation between ‘inside’ and ‘outside,’ and inside is where the action is. An inquiry informed by systems approach would argue that while it is possible to emphasize the cognitive process, eliminating the importance of the context completely provides a partial and arguably mutilated view of the phenomenon. The individual is always interacting with his or her environment, and those interactions are significant and have an impact on the person’s ‘internal’ process.

One fascinating characteristic of much of the creativity research is on the role of paradox. This is found in the creative process in so-called Janusian thinking which involves holding seemingly opposed or self-contradictory ideas, or in the need for both convergence and divergence, in the characteristics of

creative groups, and most notably in the ‘paradoxical personality’ of creative person. Summarizing the extensive research on the characteristics of the creative person, Csikszentmihalyi stated in 1996 that:

1. Creative people have a great deal of physical energy, but they are also often quiet and at rest.
2. Creative people tend to be smart yet naïve at the same time.
3. Creative people combine playfulness and discipline, or responsibility and irresponsibility.
4. Creative people alternative between imagination and fantasy, and a rooted sense of reality.
5. Creative people tend to be both extroverted and introverted.
6. Creative people are humble and proud at the same time.
7. Creative people, to an extent, escape rigid gender role stereotyping.
8. Creative people are both rebellious and conservative.
9. Most creative people are very passionate about their work, yet they can be extremely objective about it as well.
10. Creative people’s openness and sensitivity often expose them to suffering and pain, yet also to a great deal of enjoyment.

Central here is the fact that these characteristics are not commonly found together in individuals. We usually say a person is *either* conservative *or* rebellious, passionate *or* objective, humble *or* proud, not both. When these characteristics are found together in one person, the term paradoxical is used to describe them. The term paradox means ‘contrary to received opinion’ or self-contradictory. In other words, this is not what we are used to, it goes against our expectations, and it is essentially puzzling to us because unusual and hard to understand.

The paradoxical nature of the creative personality and the creative process have been well established, and confirm that creativity involves a cybernetic process that goes beyond simple dualities (Mark Runco in 2007). Barron argued that, “The paradoxical must be accepted as part of human design. Without stability, we can have no flexibility; without discipline, no freedom; without knowledge, no creation; without subjectivity, no objectivity” (1995: 35).

Paradox, in other words, is an aspect of humanness, that is highlighted in creativity. Instead of holding key systems dimensions such as equilibrium and disequilibrium, order and disorder, as opposites, with an either/or logic, a systems approach views them as having a cybernetic relationship of both/and. In the traditional view, which originated in modernity, equilibrium, and disequilibrium, order and disorder were viewed in a hierarchical opposition, with equilibrium and order privileged, and disequilibrium and disorder considered to be problematic. A systems approach shows they are interrelated like yin and yang, and provide a potentially generative interaction. Complexity theorists in particular have been showing that this cybernetic relationship between order and disorder is central to the more interesting natural and social phenomena (Morin, 2008). The now popular term ‘on the edge of chaos’ shows how far this relationship has been taken, a cybernetic process of navigating on a razor’s edge of chaos, and has remarkable parallels to the way which creative individuals explore a wider range of human experience and appear to have more dramatic highs and lows, greater mental

health yet higher scores on psychopathology, more destabilizing experiences and yet using them to reach higher and more integrated equilibria.

Creative individuals have a generalized preference for disorder, and see in disorder (the unconscious, the irrational, the unknown) the source of potential novelty. Creativity researchers have criticized the focus on equilibrium and frictionless, self-esteem adaptation, and argued that in the healthy and creative individual, order needs to be confronted and challenged by disorder to lead to growth and creativity.

A systems approach assumes that all open systems in an environment must adapt to environmental changes, and therefore undergo periods of disequilibrium in which a new level of adaptation is found. This suggests that living systems engage in an ongoing process of learning and change. They are not static, but in a constant process. Open systems do not just respond and change in response to their environment: they also initiate change. They change their environment. They do not only respond to unforeseen changes in their environment, but they also cause events that for others are unexpected and unpredictable.

The traditional approach to scientific inquiry and social science focused on *prediction* and *control*. This reflects an understanding of the world, and of the organization as a stable, equilibrium-oriented, predictable machine. Machines are designed to be predictable and controllable, and are reliable because they are not supposed to deviate from very clearly set parameters. With input A, they reliably deliver output B. Clearly such an approach is problematic when applied to creativity, where the whole point is the generation of surprise emergent properties. Tellingly, the subtitle of a major book on complexity theory, John Casti's *Complexification is Explaining a paradoxical world through the science of surprise*. This gives us a clear indication of the shift from a Newtonian view, and shows how these new sciences are aligned with creativity research in its many forms.

From Control to Self-Organization

The systems approach has introduced the important concepts of *emergence* and *self-organization*. The term emergence is related to the popular systems concept that "the whole is more than the sum of its parts." The whole is an organized network, and as such has characteristics that cannot be reduced to single individuals. It is also true that the whole can be less than the sum of its parts. Indeed, it is clear that historically in the United States, unlike in Europe and Japan, groups have been viewed as less than the sum of their parts. Whereas there is a sizable literature on creative individuals, it is not until recently that there has been an interest in creative groups, and to this day there is still a strong trend in creativity research that holds individuals working alone are fundamentally more creative than groups. The assumption is that groups lower creativity – and therefore that the whole is less than the sum of its parts. Regardless of whether the whole is less or more than the sum of its parts, *the whole is an emergent property of the interactions of the members of a group or, more generally, the interacting parts of a system*.

The importance of control is challenged by the phenomenon of self-organization and gives some insights into the

creative group process. When new teams are brought together to work on a task, they have a tendency to self-organize. There may be a desire to control or micro-manage them, but in the context of creativity and innovation, self-organization refers to a system's capacity to develop its own values, criteria, and ways of working. A tightly controlled and micro-managed team can work well for routine tasks, but in the case of creative, nonroutine tasks, self-organization means allowing the system's members to develop their own ways of doing things, their own ways of getting from A to B. In the same way, rigid programming of our lives without being open to the possibility of change and widely differing perspectives, without being open to what emerges in the relationship between self, our task, and our environment, can drastically limit the potential for creativity.

The concepts of emergence and self-organization both reflect a recognition and valuing of *spontaneity*. This is not to be confused with chaos. A comedy improvisator group has a clear task, to be entertaining and funny. The group's performance emerges as the group members interact and surprise each other. In those situations the group members have to self-organize, and know when to take risks, try new things, and at times react to challenges and opportunities without even the time to think. Spontaneity and improvisation require a generative framework for the group to operate in, and both individual and collective skills. Jazz has provided a particularly rich source of examples of self-organization, spontaneity, and emergence for social scientists.

Emergence and self-organization are characteristics of open systems that are adapting to their environment in new ways. These two concepts move the emphasis away from centralized, hierarchical leadership in groups and organizations to more distributed leadership and interactions. Emergence and self-organization are also characteristics of creative processes. In the context of human organizations, these concepts pose challenges to the traditional notions of prediction and control, and suggest that managing creativity at all systems levels requires a recognition of greater openness to outcomes, unpredictability, individual and collective responsibility, and trust in the creative process and in the systems involved in that process.

Science, Systems, and Creativity

The systems approach connects individual creativity to the larger cosmic context, according to Frank Barron:

The human person is a form in constant process of change. From birth to death, that process is a creative one. It partakes of the creative process in all Nature. It is evolutionary as the forms of Nature are. In the individual case we speak of development and growth, in the general case we speak of evolution, but both are aspects of creativity. Indeed, psychogenesis is best understood in the context of cosmogenesis. (1995: 30)

He goes on to state that:

The psychology of creativity specifically, by asking how and under what conditions the phenomenon of distinct novelty may appear in human psychical functioning, links itself to the general scientific enterprise of describing the evolution of forms in the natural world. (1995: 33)

The psychology of creativity is therefore part of a larger enterprise of situating human beings in the cosmos, and the systems approach has been instrumental in creating this connection. It has also been central to a shift in the sciences toward a view of the Universe itself as a creative process. In the traditional Newtonian scientific paradigm, order was king, privileged above disorder, chaos, and 'noise.' Our understanding of the relationship between order and disorder was in terms of a binary opposition, and indeed a hierarchical binary opposition. Disorder was viewed as a function of human ignorance, something that would, eventually, with better knowledge, be integrated in the larger master-plan.

Order came from the Creator's master-plan. A perfect order is unchanging. But Darwin's theory of evolution documented change: in fact, it was all about change, and how it occurred over time. We have to keep in mind that before Darwin the assumption was that the design of all of the planet's creatures was God's doing. The design did not change over time. The new, emerging worldview articulated by scientists and even several leading theologians today has a radically different perspective on the role of order, organization, and the nature of creation. Creation is not the result of God's design, but of the generative interactions between species and their environment in a form of creative self-organization.

A number of important works in theology have stressed the importance of creativity, in many cases drawing on the work of Alfred North Whitehead in whose 'process' vision of the world creativity played a central role. In 2004, Harvard theologian Gordon Kaufman in his provocatively titled *In the beginning . . . Creativity*, argues that the notion of a Creator simply does not hold up to modern science, whereas placing *creativity* at the center of creation seems much more congruent. In both the sciences and theology there is therefore a substantial movement, infused with a systems approach, not only to address creativity, but to make it central to both the scientific and the religious underpinnings of our world and indeed the universe. It is for this reason that we will explore the relationship between cosmology and scientific worldviews, and the way human beings in the West have conceptualized creativity in their lives.

The Cosmic Context

At the beginning of the twenty-first century there is an ongoing scientific revolution. Two of the central factors in that revolution are a systems approach and the role of creativity. A systems approach to the study of nature and the universe as a whole has led to a new understanding of the universe and nature not as a clockwork, a machine, or as decaying, running down, but as fundamentally creative. This means creativity is not a remarkable and relatively exceptional phenomenon, but rather at the very heart of existence. In order to understand this shift we need to understand the history of our cosmology, or our scientific study of the Universe and our understanding of what the Universe is.

Three Paradigms

The Newtonian paradigm emerged in the seventeenth century. It portrayed the universe as a giant clockwork. In the thermodynamic paradigm of the nineteenth century, the Universe was

winding down, moving toward degradation and decay. A new paradigm has emerged in the last 50 years. This paradigm is not of a static nor of a decaying universe, but of a creative universe. The stress is on interactions, innovation, and organization. There is not just a different understanding of the universe, but a different way of thinking about, and inquiring into the universe. The interconnected, dynamic, changing phenomena science is exploring require a different way of thinking, and cannot be addressed solely by analysis. There is a new perspective on the world, one that is fundamentally systemic.

The three scientific paradigms described above reflect different views of the world. In Newtonian mechanics there is a worldview based on necessity. The clockwork by necessity requires certain specific mechanisms to be in motion. With equilibrium thermodynamics we see a worldview based on chance. Decay leads to randomness and dispersion. The study of far-from-equilibrium systems leads to a worldview of creativity.

The Newtonian Paradigm

The Newtonian revolution represented the first real coherent triumph of what we now call science. With his *Principia*, published in 1687, Newton presented in the form of mathematical equations the three laws that govern the motion of material bodies. Newton's work was particularly important because it presented Universal Laws of Nature. These laws seemed to give a window into the functioning and nature of Nature itself. Particularly powerful in Newton's work was its focus on prediction, order, and determinism. With Newton the universe became a gigantic clockwork mechanism, and each part had to play its role without fail.

The laws and principles created the foundation for general theories and predictions that could be tested through experiments. These experiments conducted following the scientific method, consisted of breaking systems down to their simplest components, a method now referred to as *reductionism*. This reflected an assumption that the world was made of basic building blocks called atoms. The underlying assumption was that these atoms exist in isolation from their environment, and that knowledge of the behavior of the atoms could be used to predict the future of the system as a whole.

Two fundamental things make up the Newtonian world: matter and energy. Matter and energy exist in the emptiness of absolute space and time. Matter is composed of atoms and even subatomic particles such as electrons and protons. Knowing the location, mass, and velocity of all the particles in the universe, the assumption of the Newtonian worldview was that it would be possible to predict the future. With progressive improvement in scientific knowledge, in other words, it was believed that eventually it would be possible to predict every event. The Newtonian world was therefore *deterministic*. Every event *had* to happen *by necessity*. Once set in motion, the universe unfolds following precise laws. The assumption was that fundamentally, the Universe is governed by simplicity and simple rules. There is an unquestionable order to the universe, and anything we consider disorder or complexity was simply a function of our limited knowledge. Simplicity, predictability, and determinism were central to the Newtonian worldview.

The Newtonian world was also 'reversible.' This means that time exists so that we may assess the interval between events. But past and future have no significance. Nothing can be said to actually *happen* in such a universe. This is a particularly interesting feature that defies common sense, but made perfect sense in the Newtonian world. Interestingly, it reflects the same static view of the world before Newton, which was considered a perfect, preordained, God-given hierarchical order: nothing actually happens, because the Laws of Nature are the Laws of God, and these laws are perfect, therefore no change occurs, is necessary, or even possible.

The Newtonian worldview had very clear implications for the nature of thinking. The power of prediction and control that the scientific method provided was staggering. The technology driving the Industrial Revolution was the result of the application of the new scientific method. Who, in the middle of this explosion of human power, could argue against it? The social sciences and the management sciences wanted to import the scientific method, in order to enjoy the same legitimacy as real sciences, and the same successes. Being a real science was defined largely by the capacity for prediction and control. The scientific method led to technology and industry, which in turn were the engine of progress.

The notion of progress became central to modernity. The belief was that the scientific method offered a way to get at truth in a way that was empirical, testable, and gave the user power. It's important to understand that before the scientific method was applied, human beings simply did not think this way. Before the scientific method, what was considered the 'highest' or most evolved form of thinking on a social level was a mixture of Aristotle, the encyclopedic Greek philosopher who had written about everything from logic to theater to biology, and the writings of St Thomas, which informed theology, drawn from the bible. In this premodern view, Aristotle and the bible were seen as unquestionable sources of wisdom. The concept of experiment that would give empirical proof as to whether a particular hypothesis was, or was not the case, was unheard of.

It is ironic that the worldview associated with the emergence of science and technology, with the Industrial Revolution, and an incredible outpouring of creativity, could not itself account for creativity. Creativity was still considered a 'gift' of genius, a moment of 'inspiration,' but not something that could be understood without stepping completely out of the discourse of science. In fact, creativity was not really addressed at all in science. Despite its title, in *The Logic of Scientific Discovery* the influential philosopher of science Karl Popper's 500 page work essentially dismissed the possibility of understanding the process of conceiving or inventing a theory, arguing that there was no logic or rationality – essentially no rhyme or reason – to the creative process. In doing so, Popper suggested that studying scientific discovery was essentially a futile process, stressing instead the context of justification, or the defensibility of theories. This reflects the scientific position that creativity was essentially a process that could not be understood and should therefore not be addressed by serious scholars. This marginalized creativity and reflected a modern opposition between rational, logical inquiry, and allegedly completely irrational or arational creativity.

Romanticism, a parallel movement in European thought that articulated a strong critique of modernity and particularly

industrialization, came out the arts and humanities. It was much more open to exploring the plight of the creative individual, but did so in a way that was much more poetic and eventually contributed to the mythologization of creativity and the creative person and process. Some of the myths that emerged with Romanticism include 'genius without learning,' which became the idea that the genius did not need to work hard or study because naturally gifted, and the notion of the misunderstood 'lone genius,' working in isolation from the rest of the world (see Alfonso Montuori and Ronald E Purser in 1995).

The Decaying Machine

The second revolution in science was ushered in by the second law of thermodynamics. It addressed the issue of irreversibility. Irreversibility is a very basic feature of the world from our everyday point of view. You cannot become young again, unbreak an egg, 'take back' an unkind comment, or 'unlose' your lost keys (you can find them in the *future*, of course). Literally we cannot go back in time to undo or reverse an action. And yet the Newtonian world was 'reversible.' Time as such played no role in it. Everything essentially stayed the same, and the movie could be played forwards or backwards with no visible difference.

With the second law, Rudolf Clausius in 1850 brought us the familiar concept of *entropy*. In a nutshell, the second law of thermodynamics states that in a closed system, entropy never decreases, where entropy is defined as energy that is unavailable for work. Entropy is the disorder or randomness in a system. So as a machine worked, some energy became unavailable for work. What this brought us is a view of the universe as a decaying machine, a closed, mechanical system struggling against the forces of corrosion and decay. A machine, yes, but a machine that is running down, and inexorably moving toward the end. Time was introduced into the picture, and its role was essentially to tear away at the primal perfection.

As a machine worked over time, it would gradually lose energy. But along with this loss of energy there also seemed to be another process at work that was not accounted for in Newton's Perfect Clockwork paradigm or in the paradigm of the Decaying Machine. Decay was not the only direction time seemed to lead to. There was a parallel time that seemed to defy the Universe's winding down. It was a time not of machines, but of Life.

The Universe and Creativity

It was Charles Darwin who added a completely new wrinkle to our understanding of the world. Before the emergence of science, it was generally thought that the world had been created in 4004 BCE, and everything on the planet was the result of God's plan. This meant that every creature on the planet had been placed there by God, in the 'Great Chain of Being,' and nothing had really 'changed,' because that would mean a deviation from God's plan. Darwin, on the other hand, suggested that life on the Earth had started quite simply, and evolved into more complex forms.

Darwin's world was not Newton's world, or Clausius's world. Newton's world was static. Clausius's was running down. Darwin's seemed to be getting more and more complex, indeed, 'evolving.' Darwin's original image of the evolutionary process was very much a product of his times.

Darwin presented a third scientific perspective – neither perfect machine, nor decaying machine, but rather an explosion of life, reproducing itself and changing and adapting as it did so. And in this process, time played an active, creative role, because things changed as they reproduced, and as they came into contact with each other. The principle of natural selection suggested that interactions between organisms and their environment played a central role in evolution.

Self-Organization and the Role of Disorder

One of the most interesting shifts in recent scientific thinking, in particular because of the sciences of cybernetics, and then chaos and complexity, has been a deeper understanding of the mutually constitutive relationship between order and disorder, information and noise. This shift also reflects a transition from a fundamentally static view of the world to one that is process oriented. Rather than seeing order as fundamental and unchanging, we are now seeing an ongoing process of order–disorder interaction organization that is the hallmark of self-organization. In the creative universe, disorder not only destroys structures, systems, and organizations but it is also central to their development and regeneration. The interaction of order and disorder can be generative of new forms of organization, and any order is the result of an ongoing process, not of preestablished forms.

Self-organization has been defined variously as making meaning out of randomness, or the spontaneous emergence of a coordinated and collective behavior in a population of elements. One of the key aspects of self-organization is the creation of order out of chaos, the integration of elements perceived as disorder into a larger, more encompassing organization. We might think of paradigms in science as an analogy. What is inside the paradigm is considered order, what is outside is disorder. Anomalies on the edge of the paradigm, what the paradigm cannot account for, may initially seem like noise, disorderly phenomena that cannot be accounted for. Indeed, the history of chaos theory itself shows how turbulent phenomena such as water flowing from a faucet were rejected out of hand as subjects of study for the longest time because they seemed simply inexplicable. Yet it is the study of these anomalies that led to the development of the new science of dynamical systems, also known as chaos theory. In this sense, chaos theory as a field of study was itself a creative self-organizing process, the spontaneous emergence of a coordinated and collective behavior in a population of elements (researchers), making meaning out of (apparent) randomness.

The term self-organization refers to a spontaneous emergence of collaborative behavior among elements in a system. The order out of disorder that emerges in an open system's interaction with its environment is subject to fluctuation. When certain levels of fluctuation are created by increasing complexity, a critical or bifurcation point is reached. At that point the system can move in any one of several directions until a new and more complex order may be established after a period of turbulence. If a higher order of organization does not emerge, the system returns to a previous, lower level of organization.

Creativity theorists have drawn parallels between the systems processes and the creative process, applying self-organization to the emergence of new ideas, to the creative

person, and the process of personal integration, and to creative groups. From a systems approach, premature articulation and selection of a solution is a way of reducing the disequilibrium created by a problem. This disequilibrium can be experienced as anxiety, fear, impatience, frustration, or irritation. Tolerance for ambiguity involves staying with the disequilibrium until a generative solution can emerge. The systems view also suggests why creative people, being more open to experience, and having a preference for complexity, might willingly disturb their own equilibrium in order to be challenged and stimulate their own creativity. The emergence of a new idea arises out of a process of self-organization. This demonstrates the applicability of a systems approach at various levels of granularity.

Conclusion

The implications of a systems approach to creativity are powerful. Not only does such an approach shift the research agenda to a more relational, open systems view, but it also situates creativity in a larger context, namely the context of cosmic creativity, which includes cosmology and evolution as well as social change. The application of the systems and complexity sciences to creativity is very promising. Because of the interconnected, paradoxical nature of creativity, these approaches may be able to address some of the vexing problems confronting researchers, and shed light on hitherto ignored dimensions of creativity.

See also: Domains of Creativity; Evolving Systems Approach; Innovation; Janusian, Homospatial and Sepconic Articulation Processes; Mental Health: Affective Disorders; Organizational Development; Social Psychology.

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Tactics and Strategies for Creativity

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Glossary

Accommodation One kind of tactic, used when the individual him- or herself changes. New information might be obtained, expanding the individual's knowledge base, or the creator's perspective on the problem or topic might change.

Assimilation A second kind of tactic, used when the individual changes the problem or representation of the problem.

Metacognition Thinking about thinking; the recognition that we can control our own thinking.

Overjustification Occurs when the person changes his or her opinion such that some activity that was initially intrinsically motivated becomes extrinsically controlled.

Procedural knowledge 'Know-how,' information about how to get something done. It is distinct from declarative, conceptual, and factual information. Tactics are the actions prescribed by procedural knowledge.

Social loafing One explanation for the superiority of working alone over brainstorming. It occurs when people assume that someone else in the group will complete the task at hand.

Introduction

Tactics are useful only if an individual is mature and interested in being creative. Maturity is necessary because tactics are metacognitive; they require the recognition that we can control our own thinking, and this is not apparent until early in adolescence. An interest in being creative is necessary because tactics are intentional, and the individual would not expend the effort unless he or she is interested in the potential result. They are also metacognitive in the sense that they are not dependent on effortless cognitive processes. Very importantly, then, they are relatively distinct from the processes that underlie traditional intelligence and general ability. This provides some optimism; it means that everyone, at all levels of ability, can enhance their creativity if they find, develop, and practice the right tactics.

Procedural knowledge is necessary for tactical behavior. Procedural knowledge is 'know-how.' It is information about how to get something done. In this light it is distinct from declarative, conceptual, and factual information. Tactics are the actions prescribed by procedural knowledge. If that knowledge depends on traditional intelligence, the distinction between tactical behavior and general ability is blurred. This is why I suggested that tactics are *relatively* distinct from traditional intelligence and general ability.

Tactics are not entirely dependent on procedural knowledge. Certainly they are influenced by attitudes. In fact, attitudes may be the easiest way to enhance creative behavior. Attitudes are relatively easy to change. Attitudes are related

to tactics in the sense that individuals must believe they are capable of creative thinking. They must be interested in creative ideas; they must be willing to take risks and try something new.

Tactics are often used in the classroom and the organizational setting. Educators, parents, and managers and supervisors often attempt to facilitate the creativity of their charges. Research has confirmed that such efforts pay off. There is, however, some question over the actual creativity of the results. Individuals can become more original in controlled settings, but skeptics question such efforts. Perhaps the originality learned from a training program does not easily or often generalize to the natural environment. A related question concerns attitudes: What is actually learned from training? Are new tactics learned, and learned in a manner that will generalize to the natural environment, or does the training simply change the attitudes of the participants such that they are more willing to try new things? Further research must address this question, but in some ways the answer does not matter. If behavior becomes more original, it does not really matter if that is a reflection of just tactics, or if it reflects tactics *and* attitude working together.

Classifying Tactics

Tactics for creativity and originality have been classified in several different ways. These classification schemes are reviewed here; they will structure the list of tactics reviewed.

One useful distinction between the different kinds of tactics was presented by Sidney Parnes. He referred to *let-it-happen* tactics and *make-it-happen* tactics. Incubation is an example of the former. Incubation cannot be forced, but it can be made more likely by taking a break from one's work, and perhaps by taking a walk or finding some optimally distracting activity. Let-it-happen tactics also include (a) being open to change and serendipity and (b) trusting your intuition and hunches. In these cases, the individual is not directing the process but instead allows it to occur and simply appreciates the results. Individuals may go as far as to put themselves in a position where incubation, serendipity, and the like are more likely to happen. Very likely, all tactics allow information processing that is below the level of consciousness and assume that at least part of the benefit is beyond control. Again, let-it-happen tactics may involve letting natural (e.g., intuitive) processing take place. Make-it-happen tactics are more numerous in the creativity literature. Unlike let-it-happen tactics, make-it-happen tactics are usually more detailed step-by-step procedures. "Be a contrarian: Think of things no one else will," is an example of a make-it-happen tactic.

A second way to distinguish among tactics involves stages of the creative thinking process. Certain tactics may be used within one particular phase or stage of the creative process. There are different stage models of the process but most follow from the theory presented by Graham Wallas in 1926, with preparation, incubation, illumination, and verification stages. Let-it-happen tactics are well suited to incubation, for example, just as tactics to 'seek out reliable information' and 'change perspectives' are well suited to the preparation stage.

Each of the four stages can be divided into two subcategories. For preparation, illumination, and verification this division reflects a separation between the subjective and the objective, or between the individual and everything else – the problem, the relevant information, the possible or tentative solutions, the setting, and so on. This subdivision follows from cognitive theories which divide information processing into assimilation (whereby information is changed to fit into an individual's existing personal cognitive structures) and accommodation (whereby the personal structures are changed to take advantage of the new information). (This subdivision for incubation may not reflect subject and object, but this is understandable because incubation is largely personal and subjective.)

Assimilatory strategies are those with which the creator changes the problem or representation of the problem. He or she might turn the problem on its head, for example, or work backward from the desired objective or solution to the initial state. This tactic works especially well for scheduling and travel arrangements. Strategies using accommodation are those with which the creator him- or herself changes. New information might be obtained, for example, expanding the individual's knowledge base, or the creator's perspective on the problem or topic might change.

Changes of perspective represent what may be the most general kind of tactic. This is because such changes underlie a variety of more specific tactics. Turning a problem on its head, taking time away from the problem, travel, seeking out

criticism or input, and many other tactics rely on some sort of change in perspective.

Problem finding is a kind of preparation and can be easily modified to identify and define problems such that creative solutions are more likely. Many problem finding tactics involve information or other resources; just above I alluded to a 'seek out reliable information' tactic, which is a good example. 'Question assumptions' is another example of a tactic that applies well to problem finding.

The tactic 'question assumptions' can also be worded, 'do not make assumptions.' This rewording is only noteworthy because it highlights the last distinction that can be used to classify tactics. On the one hand there are tactics that suggest learning new behaviors. 'Seek out challenges' is an example of this kind of tactic. 'Do not make assumptions,' on the other hand, is an example of what can be called an avoidance tactic. This kind of tactic suggests what should be avoided, like assumptions, routines, and conformity.

James Adams' excellent volume, *Conceptual Blockbusting*, reviews many different kinds of avoidance tactics. What he suggests we avoid are conceptual blocks:

- Perceptual blocks occur when we define a problem too closely or too generally, or we ignore important information or a useful perspective. We need to avoid preconceptions and stereotypes.
- Cultural blocks occur when we fail to utilize fantasy, play, daydreaming, and humor because, in our culture, they are not associated with serious work. Taboos can create blocks.
- Environmental blocks occur when we are distracted by our immediate environment, including people with whom we live or work.
- Emotional blocks occur when we are afraid of taking risks or are not comfortable tolerating the ambiguity that may be necessary while we incubate or think further about a problem. We may also be uncomfortable postponing a decision or solution or with challenges.
- Intellectual and expressive blocks occur when we are inflexible or do not consider alternative media for representing a problem. We might also fail to obtain the most useful information. We might find a solution but fail to record it.

Each of these ideas can be translated into a recommendation. The last idea, for example, concerning the recording of our ideas, implies that we keep a pencil and paper next to the bed, in case we wake up with a good idea. We might take a small piece of paper and short pencil when we jog, and a small tape recorder when we drive.

David N. Perkins and Robert J. Weber described the role of tactics in their work on invention. They listed 'search strategies,' which are used to seek out information and options. They identified the following:

- Sheer chance.
- Cultivating chance (searcher deliberately exposes self to wide semi-random input).
- Systematized chance (survey of a number of possibilities within a defined set).
- Fair bet (prototypes a possibility with expectations that it will work with modifications).

- Good bet (prototypes from principle and experience).
- Safe bet (derives by formal methods something that almost certainly will work) (1992: 321–322).

Weber individually described the invention and refinement of inventions such as the Swiss army knife and the chair. He listed the following tactics:

- Finding ideas in nature.
- Assemble (the parts or components) for complexity.
- Fine tune what you have.
- Repeat or duplicate a feature.
- Add a feature.
- Delete a feature.
- Rearrange features.
- Join independent inventions.
- Transform and change the scale.

Although Weber's work was focused on invention, several of these strategies apply to all kinds of creative work. In fact, several parallel tactics are elsewhere recommended specifically for creative activities. Finding ideas in nature, for example, has been regularly suggested in the creativity literature. It is similar to other tactics as well, including 'borrow and adapt' ideas from others, and even 'find an analogy.'

The use of analogies may be particularly powerful:

Eli Whitney developed the cotton gin after seeing a cat trying to catch a chicken through a fence; Samuel Morse apparently put stations in the telegraph after thinking about stagecoaches changing their horses periodically; Pasteur used an analogy of grapes and human skin; the benzene ring may have been suggested by a dream of a snake biting its own tail; George Bissel used an analogy of a brine pump being used as an oil pump; James Watt was inspired to design the steam engine after observing a tea kettle; and Sir Marc Brunel borrowed from a worm for his work on underwater tunnels. Velcro and hundreds of other creative insights have resulted from the creative person finding apt analogies.

Many famous insights have resulted from a more direct borrowing strategy. Freud borrowed heavily from neurology and the medical model when describing the psyche; Piaget borrowed from biology in his theory of cognitive development; Darwin drew from geology in his theory of evolution. Musicians often borrow from various styles, the result being an original integration. Elvis Presley, for instance, apparently borrowed from gospel and country music.

Interpersonal Tactics

Tactics can be interpersonal. As noted earlier, certain tactics can be used by parents, teachers, or supervisors to facilitate the creative work of their charges. Parents and teachers in particular should encourage children and students, but should be careful to avoid overjustification. This occurs when a person changes his or her opinion such that some activity that was initially intrinsically motivated becomes extrinsically controlled. Incentives and rewards are common extrinsic controls,

and when individuals see them, they often assume that they are the reason for their actions – even if those same actions were intrinsically motivated moments earlier. Parents and teachers should shape confidence and ego strength. This is especially important because original ideas are often unconventional, and children become quite sensitive to peer pressure in preadolescence. During that period they may shy away from their own original insights. If they have ego strength, they may maintain their originality and avoid common slumps that occur in childhood.

Another interpersonal tactic is part of brainstorming programs. Participants in brainstorming groups are asked to generate as many ideas as possible and to postpone criticism. The participants are required to be careful of what they say to one another in an effort to maximize ideational output and minimize constraint. The tactic here is best summarized as 'postpone evaluation.'

The empirical evidence suggests that brainstorming may not be the most effective use of time. Working alone may be better. When people are in groups there is a tendency toward social loafing, and people may assume that someone else in the group will complete the task at hand.

Furthermore, it may be very difficult to postpone criticism, as required for brainstorming. In fact, it may not be a good idea to postpone certain kinds of evaluation. More likely a balance of divergent thinking and convergent thinking will benefit the process. With this in mind James March recommended a balance of play and reason. He suggested several tactics for finding a balance, including treating (a) goals as hypotheses, (b) intuition as real, (c) hypocrisy as a transition, (d) memory as an enemy, and (e) experience as a theory. The last of these – experience as a theory – is another way of suggesting that we question assumptions.

March suggested that the five tactics be used alternatively, with a temporary suspension of 'reasoned intelligence.' In his words, play and reason are functional complements. . . . They are alternative styles and alternative orientations to the same situation. . . . Our design problem is either to specify the best mix of styles or, failing that, to assure that most people and most organizations most of the time use an alternation of strategies rather than persevere in either one. (1987: 77)

One uncommon tactic was used by the Wright brothers when they worked on the first flier: they argued. Wilbur and Orville would take opposite sides of some technical problem, debate the issue, then switch sides and debate some more. It was, then, an intentional, tactical technique that the brothers used to help solve the problems of flight. Very likely the argument tactic led to a questioning of assumptions and a consideration of alternative perspectives.

One kind of tactic is interpersonal but focused on avoiding rather than collaborating with others. I am referring to the contrarian strategy. Here the creator does what others are not. This works some of the time because creativity requires originality, and a contrarian will be original because he or she is doing what others are not. Examples include Jean Piaget, Sigmund Freud, Duke Ellington, and Pablo Picasso. This is, however, a difficult tactic because it requires discretion and careful moderation. If someone relies on contrarian tactics

they could reinvent the wheel. Sometimes there is a good reason others are not doing something. Originality is not sufficient for creativity, so contrarianism is not in and of itself adequate. It can be taken too far.

Conclusions

Tactics can be defined by (a) distinguishing them from strategies, which are general plans rather than specific techniques; (b) distinguishing procedural information from conceptual and factual information; and (c) distinguishing cognition from metacognition.

Tactics take various forms and can be of the let-it-happen or the more structured and effortful make-it-happen variety, although here there is some blur and the distinction is imperfect. Make-it-happen strategies may involve some relaxation and preconscious processing, in which case there is a let-it-happen component to them.

Tactics can be personal or interpersonal; they can focus on the problem, as a kind of assimilation (e.g., 'turn it on its head'), or on the person who is dealing with the problem, as a kind of accommodation (e.g., 'change your perspective').

Tactics involving shifting one's perspective seem to be the most general. Some perceptual shift underlies many other tactics. The contrarian tactics, on the other hand, may require the most tact. This tactic did not always work effectively and might be best when used in moderation. Otherwise the result might be extreme but inappropriate originality, which is not synonymous with creativity. Very likely all tactics are best used with moderation and discretion.

See also: Analogies; Enhancement of Creativity; Group Creativity; Incubation; Intuition; Metacognition; Perspectives; Problem Finding; Serendipity; Teaching Creativity.

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Rabindranath Tagore 1861–1941

Poet, essayist, playwright, musician, painter

Author of *Gitanjali*, *Sandhya Sangeet*, “Sheshlekha,” *Gora*, *Ghare-Baire*, *Nrityanatya Chitragada*, “*Kalantar*,” *Arogya*, *Janamadine*, “*Nationalism*,” “*Personality*,” “*Religion of Man*,” “*Sadhana*”

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Described as a “world poet,” RABINDRANATH TAGORE is considered a puzzling ecumenical figure, a paradigm of human possibility, a mystery, and a complex challenge of creativity who exemplified total creativity, unique and rare. As “Rabindranath” he was an Indian writer, as “Tagore” he was an international figure. He is known for his poetry, particularly “Gitanjali” (Song Offerings), which made him suddenly famous and brought him the Nobel Prize for literature in 1913, the second writer in English to be thus awarded after Kipling. One of the greatest literary figures in history, Tagore was a master of several literary forms. He experimented with many forms of art and sought an outlet first in music, then in drama, opera, and ballet and toward the end of his life in painting. Tagore was a consummate histrionic artist, a playwright and producer of plays. He also inspired and directed the revival and full development of the art of dance in modern India. Tagore is remarkable for his versatility, extraordinary range, and complexity of creative perspective. As a high priest of internationalism and the author of the national anthems of two countries, his spirited protests against the inequities and cruelties of British and other forms of imperialism and repression have a permanent place in history.



Rabindranath Tagore.

Background

Rabindranath Tagore, the product of history and of the social environment, was fortunate that at the time of his birth currents of three movements had met in the life of the country. He was born in Calcutta on May 6, 1861, and was the

fourteenth child (of 15 children), eighth son of his parents. The youngest child, however, died in early infancy, making Tagore both the youngest child and the youngest son of the family. Neither of the parents established any personal intimacy with him and early in life he lost his mother. There had never been that clinging affection between the mother and the son that would leave a void behind. But the thirst for mother's affection, never quenched in childhood, was to survive in the son as a constant longing for feminine affection and care. However, his father, known for contemplative inwardness, had the most abiding influence over the son. The influence had obvious manifestations later.

Tagore grew in a lonely and somewhat isolated family where literature, music, and painting were prized. The family was notable for the extraordinary concatenation of a variety of talents in its members. The house where he spent his childhood as a lonely outcast, a shy and quiet child, was to him tranquil and secluded. The family provided the right environment for Tagore to discover two of the major motives of his creative life: joy and mystery. The sense of wonder and mystery that for him pervaded the world of nature and men—the yearning for that mysterious world, the instinctive delight in the smallest and most common place things experienced in childhood—became for him a lifelong spiritual treasure.

Though he attended several schools, Tagore was allergic to formal schooling, which distressed him. His education remained desultory and ultimately he became a dropout. The education that he received at home was quite thorough. More valuable than what he was taught, was what he breathed in, as it were, from the atmosphere of the house, where Vedic chants could be heard along with readings from Shakespeare and Marlowe; where Indian classical music, vocal and instrumental, was seriously practiced while European music was also studied, where the family had its own drama group and compositions and collections of costumes; where a lively intellectual and spiritual endeavor was pursued with easy grace. Therefore, it is no surprise that this solitary and sensitive truant proved a recalcitrant boy who became a rebellious youth without the modicum of respect for tradition that normal systematic schooling imposes on an average adult.

Tagore admitted “the torn and the incomplete” in his makeup. He had a spate of bereavements and private and public disappointments, which could not stigmatize his work. Creative in crisis, the magic of his creativity hides the fact that it came out of a matrix not unaware of the tragic and the terrible.

The Complexity of Tagorean Creativity

When Tagore began his career, he was, as he put it, ridiculously young; in fact, he was the youngest of that band who had made themselves articulate. He had neither the protective armor of mature age, nor enough English to command respect. So in his seclusion of contempt and qualified encouragement he had his freedom.

As he grew in years, he steadily cut his way through derision and occasional patronage to recognize that the proportion of praise to blame was very much like that of land to water on our earth. The Nobel Prize, which he was awarded in 1913, brought to him “an immense burden of loneliness.” This was not only the recognition of his literary achievements but was also evidence of the impact of his personality on western contemporaries. During the World War I and for more than a decade thereafter, Tagore was hailed by the West and the East alike as a seer and a sage. Receiving the Nobel Prize was a turning point of his life.

His career and creative enterprises were largely conditioned by many influences and traditions, indigenous and foreign. His reason, personal will, and psyche only determined the form and character of this conditioning. Besides being influenced by *Upanishads*, Tagore was influenced by Buddhism, classical Sanskrit and English literature, Sufism, the *Vaishnava* poets, the submerged cultures of the rural agricultural folk and the *Bauls*, the itinerant singers who observed no formalities and were untouchables wandering from village to village, singing and dancing and taking delight in the ever-changing play of life. Tagore’s subconscious identification with the *Baul* credo was almost perfect.

These influences, in addition to the Indian reality, moulded his worldview. Tagore’s life pattern was essentially melodic and his creative genius had many facets, permeated with the idea of national liberation, of the struggle for the spiritual and political liberation from the yoke of colonialism and feudal survivals. Tagore’s multiple creative dimensions, issued from the same source and together formed an organic whole. While not denying the usefulness of expressions like “Tagore the poet,” “the essayist,” or “the playwright,” we must recognize that they overlap and interpenetrate and refer fundamentally to one unvariable reality. However, studying Tagore in a holistic framework involves risks and challenges not only of one man’s astonishing career but of a vast and intricate network of intercultural relationships. To compress Tagore’s versatility into a relatively brief account is to risk leading the reader with diffuse impressions that do the subject less than full justice.

Tagore’s complexity and extraordinariness was not of one kind, nor did he satisfy the demand for continuous development. It was a devious and diverse development, which defeats the too systematic critic at every turn. It has been noted that a paraphrastic, chronological account would be tedious and little more than a catalog. Tagore’s growth was not linear. Tagore was many poets in one, and not easy to track or label. His development did not have straightforward continuity and in fact overflowed the logical pattern of growth— it was instead a stage-wise progression. In short, Tagore’s development was not unilinear.

The Creative Purpose

Tagore’s purpose in undertaking creative enterprises emerged out of his concern for celebration of spirit and the infinite. He wrote that the desire we have to keep our uniqueness intact is really the desire of the universe acting in us. It is our joy of the infinite in us that gives us our joy in ourselves. Therefore, we must express ourselves strenuously in our life and work in “outward excursions.” The joy, which is without form, must create, must translate itself into forms. He, therefore, was sovereignly aware of the fact that “from joy are born all created things etc.” Though multitudinously various, Tagore gave a touch of completeness, an enormous unity, like the unity of a lyric, to his life. His life, it has been noted, was in fact, Tagore’s greatest work. When his other works are forgotten, his life will remain unforgettable because it is a true and silent answer to the most inward question of humankind: “How am I to live?” It has been noted that everything Tagore did and wrote bore the mark of his obsession with the maturing of the body and soul, toward the extension and intention, or renewal, of his own personality as a human being. He always aimed higher and higher, “The song that I came to sing remains unsung to this day.” His long life was densely packed with growth, activity, and self-renewal. He believed that in his creativity, one realized the supreme person (*Jivan-Devata*) who has made the universe so personal to humankind.

The Tagorean Peaks

“Thou who are the spirit of manifestation, manifest thyself in me.” This Upanishadic prayer was one of Tagore’s favorite quotations. This prayer, in Tagore’s case, was answered through diverse, multiple, continuous, and simultaneous literary enterprises. Poetry and the poetic consciousness was, of course, the animating principle in his extraordinary variety. In 1893, Tagore wrote:

The moment I begin to write poetry, I enter into my true self: true for all time. I distinctly feel that there lies my true home. Poetry is the sole refuge of all deepest truths of my life.

In May 1892 he wrote that the joy of writing one poem far exceeds that of writing sheaves and sheaves of prose. “If I could only write one poem a day.” He almost did that. Tagore, even before he was 20 years old, had published approximately 11,000 lines of verse which, with real good sense, he never reprinted. Before Tagore was 18 years old, he had published nearly 7000 lines of verse, and a great quantity of prose. Closely related to poetry, another creative enterprise that distinguished Tagore’s uniqueness was his incomparable songs. It was natural that he was attracted by a form of music that stressed the union of verse and melody. In the diversity of their mode and theme, these formed a class apart. The creative delight he discovered in his early musical experiments stayed with him until the very end of his life. When he was nearly 16 years old, he took liberties with the classical tradition and composed more than 2000 songs. From early boyhood

onward his music had the quality of profundity not inferior to the quality of his poetry.

In Tagore's career as a composer of music, the last 20 years of his life—from 1921, when he started composing his life series of songs on the seasons, to a few weeks before his death—were the richest, both in quantity and quality. Indeed this was the period when Tagore built the edifice that has now come to be known as *Rabindra Sangeet* or the Tagore school of Indian music. This was also the period when Tagore effected a perfect integration of music and dance, one interpreting and contributing to the other and thus expanding the horizon of both, which opened up new possibilities and generated new enterprises. During the 1925 and 1931 phases, his songs came to have a wide thematic range, variety, innovation, and the creation of new beat-rhythms or *tala*. Tagore's prose was as much a poet's work as was his verse. In him the poet and the prose writer were inseparable and mutually complementary, which means that we cannot assess the one without considering the other. The dramatic form interested Tagore very early in his career as a writer. He wrote more than 40 works of drama.

Tagore wrote several novels but this work, it is felt as a whole, may not claim to have attained the stature of his best poetry. Yet the novels are no less trendsetters in the unconventionality of themes, complexity of characterization, and poetic, often symbolic, language. The poet, the singer, and the teacher constantly meddled with the novelist and lured him away from concentration on one plot or one set of characters.

Tagore wrote an infinite variety of stories: comedies, tragedies, fantasies, and parables. Some are short novels, others long short stories. Apart from fiction and drama, Tagore's prose falls into a number of formal dimensions: belles lettres, literary criticism, essays on subjects other than literature, travel writing, autobiography, and finally letters. These divisions, however, are far from being rigid, for Tagore had a way of transcending rules and definitions. These kinds of writings are thus interrelated, and the relation between them and Tagore's poetry is regarded as quite palpable. The letters by Tagore that have so far been published in book form comprise 11 volumes. He wrote thousands of other letters, which served very well as an effective means of expressing his personal and private musings and thoughts, his dreams and visions on a variety of subjects and issues that interested him. He also wrote a large number of essays and addresses on a variety of subjects, kept a diary of his extensive travels, and even wrote several textbooks for the boys and girls of his *asrama* schools. As if all these were not enough, in 1912 he completed a series of essays that were later delivered as lectures at Harvard University and published as *Sadhana* (The Realization of Life). In 1917 *Nationalism* and *Personality* were published, which contained his lectures and addresses delivered in Japan and the United States in 1916; and in 1922 *Creative Unity* was published containing his occasional essays and other lectures delivered abroad.

During the stretch of six decades, Tagore had interludes of stagnation as well. Many times the poet's muse started to falter, but not for long. He had comparatively few sterile periods, though he had produced enough to make a writer famous. Constant travel, intense financial struggles, public addresses, and a ceaseless crusade for a new outlook were distractions

hardly conducive to meditative or creative moods. Besides these preoccupations and pressures, it has been noted that at times the poet lost to the prophet, the singer to the preacher, and thus the resultant cyclicality.

The last 10 years of Tagore's life opened a new phase of creativity: new but not inherently unconnected from his earlier phases. Tagore felt certain that for him poet-nature was not his sole function in life. It was through painting that Tagore found the release that he could not quite achieve in poetry. Tagore recalled the Indian theory of creation as play (*leela*) and claimed that he was beating the creator at his own game and creating forms that missed their chance in actual existence since God did not provide a place for them. Thus his recourse to another aesthetic medium helped the poet fill in the lacunae in his poetical work. From 1928 to 1940 he painted more than 2000 pictures apart from his other work, his travels, the ever increasing calls on his time, and the darkening crises of the 1930s.

As if Tagore could not have achieved permanence through his ceaseless creative activity in literature, music, and painting, his energy found expression in the experimental work that he undertook in the field of social reconstruction and the ideas and ideologies that inspired and motivated them. Rehabilitation of village and rural economy, the cooperative movement, working out new principles and methods, and evolving a national system of education, ideas and speculations on the contemporary political life in India and on nationalism and internationalism—these were again a part of his mind and personality. His creative vision prompted him to ask questions about God, life, and death, and to answer them by evolving a religion of man. Tagore sought to give tangible form to his ideas on education and socioeconomic reconstruction by establishing and funding institutions like *Santiniketan* (Abode of Peace) and *Sriniketan* (Institute for Rural Upliftment). For Tagore, this enterprise was not unrelated to that of the creative writer and artist. It was intimately related to his total creative personality and spiritual being. He described *Vishvabharti* (World University) as his “tangible poem.”

From 1912 to 1932 Tagore undertook 10 foreign tours and lectured in major cities of Europe, Asia, and North and South America. He lectured on the problems of power, militarism, war, and the decay of civilization through the human search for comfort and a consumer culture. A considerable part of these travels and sojourns was taken up by his attempts to collect funds for his school at *Santiniketan* (Abode of Peace), which had become a financial worry to the poet. Tagore's lecture tours abroad were an economic necessity for his school, but they were also a psychological necessity for Tagore. Like his many other creative endeavors, his travels also provided him opportunities to “know the full meaning of my birth as a human being in this world.”

Tagore had other reasons to travel, which made some observe that he was not only a constant international traveler but a traveler in internationalism, which he had adopted as his most cherished cause. It is not surprising that Tagore has been called “conspicuously bicultural.” Tagore's progression toward selfhood and an attempt at the realization of the infinite was not smooth. From 1878 to 1941, he continuously worked at full pressure, and though we may not enjoy all his works, we have to note the flagging of his inspiration on

occasions. We cannot trace the growth of his genius only up to a certain point, but have to discover the peaks scattered all over those 60 years. Tagore scholars feel that even his failures are more worthwhile than the success of many writers. The poet in Tagore grew slowly, stage by stage, and not in a flash. Years of formal discipline and layers upon layers of experience would have to follow before he could articulate himself convincingly.

Mahatma Gandhi called Tagore *Gurudev* (Revered Master) and he attained a certain classicality. His works have universal appeal and that illuminates his complexity and “myriad-mindedness.” His unique humanism is reflected in a statement Darwin’s granddaughter made to a friend after meeting Tagore: “I can now imagine a powerful and gentle Christ, which I never could before.”

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Talent and Creativity

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Glossary

Creativity ‘To make new.’ What is made does not necessarily mean to make something completely unique, but to continuously operate on the edge of current knowledge to grow and evolve to the next level. Creativity research focuses on the person – who is creative?; the process – what happens when one is being creative?; the product – what does the creative person make?; and the press – what is the environmental pressure on person, process, product? One approach judges a product ‘creative’ and then looks at the person who has produced that product, to see what forces operated in the creation of that product, what that person is like. Another approach tests a child through paper and pencil or through observation, pronouncing him or her potentially or really more creative than others, on a presumed normal curve of creativity, as a construct which supposedly exists within everyone to some degree or another.

Giftedness A confusing term that sometimes means having a high IQ and sometimes means having an inborn talent. Because of the confusion, people often conflate giftedness with talent, and the term is used coequally with the term *talent*, as in ‘talented and gifted,’ and ‘gifted and talented.’

Talent As a noun. “The natural endowments of a person; a special often athletic, creative, or artistic aptitude; general intelligence or mental power: ability; a person of talent or a group of persons of talent in a field or activity.” *Merriam Webster Dictionary Online*. <http://www.merriam-webster.com/netdict/talent>

Talent development ‘Talent’ as an adjective: the process by which a person with a certain natural endowment or propensity in a recognized or becoming domain is taught, shown, and mentored toward the skills that are required by practitioners in that domain.

Introduction

The word *talent* originated in Latin, and it was the term for a sum of money. As the term evolved, it came to mean an inclination, a leaning, a desire, a wish. Its first use in the contemporary sense of having a natural ability or a mental endowment evolved from the Gospel of Matthew, in his story of Jesus’ ‘Parable of the Talents.’ According to the *Oxford English Dictionary* (3rd Edition, 1981), by 1600, the word was used as we use it today: The writer W. Watson said “Silly bodies and sorie fellowes of no talent gift or ability.” To be talented is to possess the skills or proclivity to do something well. The question is whether talent is innate, and how innate propensities for adult achievement can be developed, or whether talent is the end product of high intelligence, or ‘g,’ known as giftedness.

The word *creativity* means to make new, and it is a relatively new term, coming into common parlance in the 1960s. When someone possesses talent, he or she uses this to create a product, whether it be concrete or ideational. A long literature exists which is too complex to be cited in this small entry. One of the seminal works in the current consideration of how talent development leads to adult creativity was the work of Bloom in 1985, who considered the developmental stream that led to adult creativity in various domains including music, sculpture, mathematics, and science.

Models of Talent Development and Creativity

Taylor’s Multiple Talent Approach

In 1968, Calvin Taylor, one of the early creativity researchers, developed a model called the Multiple Creative Talent Teaching Approach, later renamed the Talents Unlimited Model (TU).

He named nine areas, and these were developed into teaching modules that were used in the 1970s, through a series of federal grants. The nine areas were broken down into thinking skills called ‘talents’- academic talents, productive thinking talents, and talents in planning, communicating, forecasting, decision-making, implementing, human relations, and discerning.

Talent Search Model

In the 1970s, Julian Stanley began to give the Scholastic Aptitude Test to moderate and bright middle schoolers. The highest scorers were viewed as having the highest potential for mathematical achievement, and were given special coursework and accelerated through the lower schools to permit them to enter college early and to pursue a Ph.D. He founded a program called the Study of Mathematically Precocious Youth (SMPY). The model was expanded in the 1980s to include verbally talented middle schoolers as well. The high scorers have been followed since then by Stanley and Benbow, and over 40 years of data have resulted. Their findings have indicated that specific paths of education and mentoring are necessary for the development of talent. These include advanced courses and special programs. Talent Search centers exist at Northwestern University (Midwest Talent Search), Johns Hopkins University Center for Talented Youth (CTY), which recruits from the east and abroad, and the Talent Identification Program (TIP) at Duke University, among others.

Feldman’s Model

Another developmental approach has been to look at prodigies as Feldman has done, in the belief that looking at rapid talent development will provide knowledge about all talent

development. In 1997, Feldman proposed a theory of talent development leading to creativity called *Nonuniversal theory*, which concerns the development of the intellect that explains “transitions and transformations in understanding and extending bodies of knowledge, acquisition of expertise and creative advances in knowledge.” Feldman proposed a continuum of developmental domains: (1) universal; (2) pancultural; (3) discipline-based; (4) idiosyncratic; and (5) unique.

Olszewski-Kubilius Model

Olszewski-Kubilius developed a psychosocial model for the development of the creative person that takes into account *Context*: Family Characteristics, Child Characteristics, Family Status (e.g., socioeconomic status (SES), marginality), Birth Position, Family Generational Influences, Physical Disabilities (domain preference and resources), Asynchronies in Child, and Gender; *Conditions*: Stress (parental loss, harsh parenting, parental dysfunction, neglect, abuse), Threat to Security, Feeling Out-of-Control, Isolation, Rejection, Feeling Different, Reduced Affiliation and Identification with Parents, Disruptions in Socialization, Unconventional Socialization, Need for Refuge, Emotional Disequilibrium; and *Characteristics*: (which include Intellectual Activities such as a rich fantasy life, voracious reading, skill development, and coping strategies for isolation). Creative people compensate for developmental defects and lacks, ‘seeking to relieve loss, obtain love and admiration,’ and the ‘need to find controllable situations, optimal situations,’ and a ‘discovered life theme’ that could be described as ‘transformational coping’ that will ‘express childhood traumas.’ The creative work helps the person to ‘cope with tension/marginality,’ and gives the person ‘freedom from conventionality.’ The work is ‘tension reducing,’ ‘soothing,’ and gives the person the ‘opportunity to explore fields,’ the ‘ability to take risks,’ the ‘desire to stir up the status quo,’ and to ‘search for asynchronies.’

Expertise Theory

Another avenue of talent development is the research on expertise. This is domain – or discipline – based and includes research on transfer. How do children master the subject matter? It is content-specific and context-bound. Research on expert – novice comparisons has shown that experts have a large knowledge base of patterns in how the domain works. They can rapidly recognize situations where the patterns apply, and they can therefore reason forward, manipulating the patterns in order to reach solutions. Expertise researchers such as Anders Ericsson often say that talent does not mean much at all, but that deliberate practice is the key to human achievement and to the ultimate product that is judged creative by expert judges. Most of the research has been done on domains such as music and athletics. Motivation is key, not talent. The ‘ten year rule,’ from this theory is that a person reaches mastery after at least ten years of deliberate practice.

Gardner’s Multiple Intelligences Theory

Another theory of talent is the theory of multiple intelligences (MI). Project Spectrum, a joint effort of Gardner’s colleagues

Mara Krechevsky of Harvard’s Project Zero and David Feldman of Tufts University, engaged in studying children and developing assessments for these intelligences. Founded in 1984, Project Spectrum researchers set out to determine whether or not children as young as four years old had ‘distinctive profiles of intelligences.’ These eight intelligences are linguistic, spatial, mathematical, musical, naturalist, bodily kinesthetic, interpersonal, and intrapersonal. Gardner claimed that each of these types of intelligence is discrete, and is formed by its own peculiar kinds of learning, as well as its own kind of memory and perception. His decision to call these intelligences instead of talents was key to the ensuing success of the theory, he said. He proposed eight criteria for the discrete existence of an intelligence, including isolation by brain damage, an evolutionary history, psychometric support, and the existence of savants and prodigies.

Mainstream educators have demonstrated a substantial interest in Gardner’s work. Articles about his theory have appeared in most mainstream educational journals. Workshops conducted by educational consultants are available throughout the country. Colleges of education teach undergraduates about multiple intelligences. Thus, Gardner’s theory has transformed the educational landscape. Educators have always known intuitively that children are intelligent in many ways, and not just in the mathematical and verbal ways that are usually tested. The eight intelligences are assessed by looking directly at the intelligence as it is manifested, and not by abstract paper and pencil testing.

Feldhusen’s TIDE Model

Feldhusen saw talents as being genetically induced, with those who will demonstrate talent showing that talent in precocious behavior. Motivation, style, and ability are environmentally influenced. Insight, knowledge, and skills in thinking creatively are essential in the realization of specific talents. Feldhusen said there are four domains of talent with specific subcategories: (1) academic/intellectual; (2) artistic; (3) vocational-technical; and (4) interpersonal/social, and that children differ in their talents and in their levels of talents, that the heritability element is simply potential and not manifestation of talent, and that talent development is the business of the schools.

Gagné’s Model of Giftedness and Talent

Francoys Gagné calls talent an end product created by the interaction of aptitudes and certain catalysts. Many definitions in English assume talent is inherited and can be developed. Gagné, a native French speaker, calls giftedness what is inherited and talent what results. He has delineated many general fields where talent (the top 10% in terms of demonstrated skills) lies. Among these are talents in academic, technical, artistic, interpersonal, and athletic fields. Giftedness, on the other hand, is the aptitude for achievement in these fields. He sees gifts as the raw materials, the building blocks, of the systematically developed skills typical of a given talent field. The domains of giftedness are intellectual, creative, socioaffective, and psychomotor. There are three categories of catalysts: (a) intrapersonal (e.g., personality characteristics, motivation, volition); (b) environmental (e.g., family, milieu, provisions,

events); and (c) the chance factor. Gagné created qualitative subcategories that recognize other gifts, for example, socio-affective gifts (e.g., precocity and the ability to negotiate), creative talents (the ability to improvise in any of the arts), or technological and mechanical talents (e.g., the ability to fix machines). He thinks that there are fields where talent is needed other than the usual professional fields such as medicine, law, and education. Such fields would be those such as cooking, gardening, popular music, teaching, sales, social work, and electrical work. The concept of talent should embrace more domains – a talented cook is a chef, for example, just as a talented academic is a professor. Gagné's model has had significant influence on the latest thinking in the field of talent development.

Simonton's Emergent–Epigenetic Model

Dean Keith Simonton has proposed that many complex talents operate according to an emergent–epigenetic model. This model begins by defining talent in terms of a set of inheritable abilities and traits that facilitate the acquisition and manifestation of domain-specific expertise. In other words, talent is defined by a multidimensional profile. The question then arises of how these inherited traits and abilities are combined. One very interesting possibility is that the inheritance is multiplicative rather than additive. Multiplicative inheritance means that the abilities and traits are configurational or emergent. If any one component of the profile is missing, the talent does not exist. Hence, if talent is emergent, then a large proportion of the population will not display the talent. Moreover, the distribution of the talent will be highly skewed, the most talented residing on the extreme upper tail, heads and shoulders above everybody else.

Simonton then assumes that the abilities and traits do not manifest themselves all at once but rather develop over the course of childhood, adolescence, and early adulthood. It is this developmental aspect that makes complex talents not just emergent but also epigenetic. This gradual unfolding of genetic endowment also has several consequences. For example, a person's talent is not a stable attribute but rather may transform into another talent. A child prodigy at the piano might convert into a composer, and then later become a conductor. In addition, because the person's profile of abilities and traits is changing, it becomes more difficult to identify a person's gifts, especially in childhood. And, finally, this developmental instability means that education and training must be carefully moderated to keep in step with these changes. Simonton's emergent–epigenetic model is best suited for understanding complex talents such as choreography or architecture. It would be less useful for understanding intellectual talent, as defined by a high general intelligence.

Piirto Pyramid of Talent Development and Creativity

When one looks at the development of talent, one notices certain patterns that are common to those who enter the same field. I have called these *predictive behaviors*, for even early in life, practitioners of creativity in a certain domain have undertaken certain practices that are common. Talent is recognized through certain predictive behaviors. These are well known to practitioners and experts in the domain, and

they are the gatekeepers and judges of whether a talented person is talented enough to enter the domain. Coaches of athletics know this (body type, dexterity, physicality, etc.). Musicians know this (matching pitch, dexterity, tonal quality of voice, etc.). Each domain has its predictive behaviors that are, for the most part, evident in childhood. This article uses the Piirto Pyramid as a framework for discussing the creative person in the domains of visual arts, architecture, creative writing, science, mathematics, invention, entrepreneurship, music, theater, dance, and athletics.

The emotional aspect: personality attributes

Many studies have emphasized that successful creators in all domains have certain *personality attributes* in common. These make up the base of the model. These are the affective aspects of what a person needs to succeed. These rest on the foundation of *genes*. Among these are *androgyny, creativity, imagination, insight, introversion, intuition, naiveté, or openness to experience, overexcitabilities, passion for work in a domain, perceptiveness, persistence, preference for complexity, resilience, risk-taking, self-discipline, self-efficacy, tolerance for ambiguity and volition, or will*. This list is by no means discrete or complete, but shows that creative adults have achieved effectiveness partially by force of personality. Talented adults who achieve success possess many of these attributes. These aspects of personality are present in some way in highly creative people. One could call these the foundation, and one could go further and say that these may be innate but to a certain extent they can also be developed and directly taught.

Personality is sometimes equated with character, directing how one lives one's life. The personality attributes mentioned here have been determined by empirical studies of creative producers, mostly adults, but in some cases, adolescents in special schools. Empirical means that the researchers gave personality tests to the people and also observed them and interviewed them. Many of the personality attributes have focused on the Myers–Briggs Type Indicator, The Cattell 16 Personality Factors, The Eysenck Inventory, the Gough Creative Personality Inventory, the California Psychological Inventory, the Minnesota Multiphasic Psychological Inventory, and others. Recently, the Big Five Personality attributes (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness) and the ten facets within each attribute, have subsumed these other indicators, and more research is coming out with this instrument and gifted and talented populations.

The cognitive aspect

The *cognitive* dimension in the form of an IQ score has been overemphasized in accounting for the presence of creativity and talent. The IQ is a *minimum* criterion, mortar and paste, with a certain level of intellectual ability necessary for functioning in the world. Having a really high IQ is not necessary for the realization of most talents. Rather, college graduation seems to be necessary (except for professional basketball players, actors, and entertainers. Most college graduates have above average IQs but not stratospheric IQs).

Talent in domains

The *talent* itself – inborn, innate, mysterious – is specific and may include certain physical attributes as well as mental

qualities necessary to be creative in each domain, and every talented person needs education in the ways of the domain. Each school has experts in most of the talent domains that students will enter. Some of these domains are *mathematics, visual arts, music, theater, sciences, writing and literature, business, entrepreneurship, and economics, athletics, dance, the spiritual and theological, philosophy, psychology, and the interpersonal, and education*. They are all quite well-defined academically, and people can go to school to study in any of them. When a child can draw so well they are designated the class artist, when a child can throw a ball at 85 miles an hour, when a student is accused of cheating on a short story assignment because it sounds so adult, talent is present. These talents are demonstrated within domains that are socially recognized and valued within the society, and thus may differ from society to society.

Environmental 'suns'

These four levels could theoretically be called the individual person. In addition, everyone is influenced by five 'suns.' These suns may be likened to certain factors in the environment. The three major suns refer to a child's being (1) in a positive and nurturing *home* environment and (2) in a *community and culture* that conveys values compatible with the educational institution, and that provides support for the home and the school. The (3) *school* is a key factor, especially for those children whose other 'suns' may have clouds in front of them. Other, smaller suns are (4) the influence of *gender*, for there have been found few gender differences in personality attributes in adult creative producers; and (5) what *chance* can provide. The presence or absence of all or several of these makes the difference between whether a talent is developed or whether it atrophies.

However, although absolutely necessary, the presence of talent is not sufficient. The asterisk, or 'thorn' on the pyramid exemplifies that talent is not enough for the realization of a life of commitment (see [Figure 1](#)). The entire picture of talent development ensues when a person is pierced or bothered by a thorn, the *daimon*, that leads to commitment. However, the person who possesses the talent also must possess the will and fortitude to develop the talent. The talented person recognizes that the thorn is pricking and the call must be answered. Here is a brief overview of themes found in common domains.

Themes in Creative Domains

Domain: Visual Arts

- **Genetic Aspect.** The families of Calder, Renoir, Wyeth, Picasso, Georgia O'Keeffe, and Maurice Utrillo, are examples of visual arts being the family occupation. This was more common in earlier centuries than it is now.
- **The Emotional Aspect: Personalities of Visual Artists.** Personality studies by Barron in 1968 and Mackinnon in 1978 have shown that visual artists care little about social conformity, have a high need to achieve success independently, are flexible.
- **The Cognitive Aspect.** In 1983, Gardner wrote that the intelligence of visual artists is spatial intelligence, or as Vincent Van Gogh said, "It is at bottom fairly true that a

painter as man is too much absorbed by what his eyes see, and is not sufficiently master of the rest of his life."

- **The Domain 'Thorn' in Artists.** Art is a vocation, a 'sacred calling,' and one who heeds the call has a certain character, besides the interest and the talent. The decision to commit their careers to making art – to being artists – comes gradually and progressively. The young class artist begins to think of going to art school.
- **Sun of Home.** There are no outstanding demographic patterns in the families of artists. As many fathers professionals as blue collar workers. Families were both encouraging and discouraging.
- **Sun of Community and Culture.** Cross-fertilization and cross-cultural influences among artists is common (e.g., Matisse and Picasso). Artists do not create in a vacuum. For example, Picasso's repeating theme of the Minotaur had a profound influence on Jackson Pollock.
- **Sun of School.** In school, they showed intense drawing and the emphasis on products, on making the drawings realistic and recognizable representations.
- **Sun of Chance.** In order to enhance their chances of emittance, they must rent or buy a loft, move to an art center such as New York City be in a juried art show – try for a one-man/woman show, and/or get a Master of Fine Arts (MFA) and try to become an art professor.
- **Sun of Gender.** Women are and have been less likely to become well known artists. Women are more likely to go into art education than into fine arts.

Domain: Creative Writers

This domain has been explicated in 2002 in a book-length study by Piirto.

- **Genetic Aspect.** Whether or not there is a writing gene is not known. Few writers come from families of writers, but some do: Andre Dubus and his son Andre Dubus II; John Cheever and his son and daughter Ben and Susan. Screenwriters and novelists Nora and Delia Ephron are the daughters of Hollywood screenwriters.
- **The Emotional Aspect: Personalities of Creative Writers.** (1) Independence/nonconformity; (2) drive/resiliency; (3) courage/risk-taking; (4) androgyny; (5) introversion; (6) intensity or overexcitabilities (7) naivete or an attitude or openness; (8) intuition (N); (9) perceptiveness (P); (10) energy transmitted into productivity through self-discipline; (11) ambition/envy; (12) concern with philosophical matters; (13) frankness often expressed in political or social activism; (14) psychopathology; (15) depression; (16) empathy; (17) a sense of humor (most humorists are first writers).
- **The Cognitive Aspect: Intelligence of Creative Writers.** Writers usually score very high on verbal intelligence sections of the IQ tests, and not so high on spatial and mathematical.
- **The Domain 'Thorn' in Creative Writers.** Why write? Because one can't not write. The writing is not for fame, money, or notoriety, but to fulfill a more personal need, the need to find out what one is thinking, the need to put it down so that it can be dealt with, the need to codify emotion.

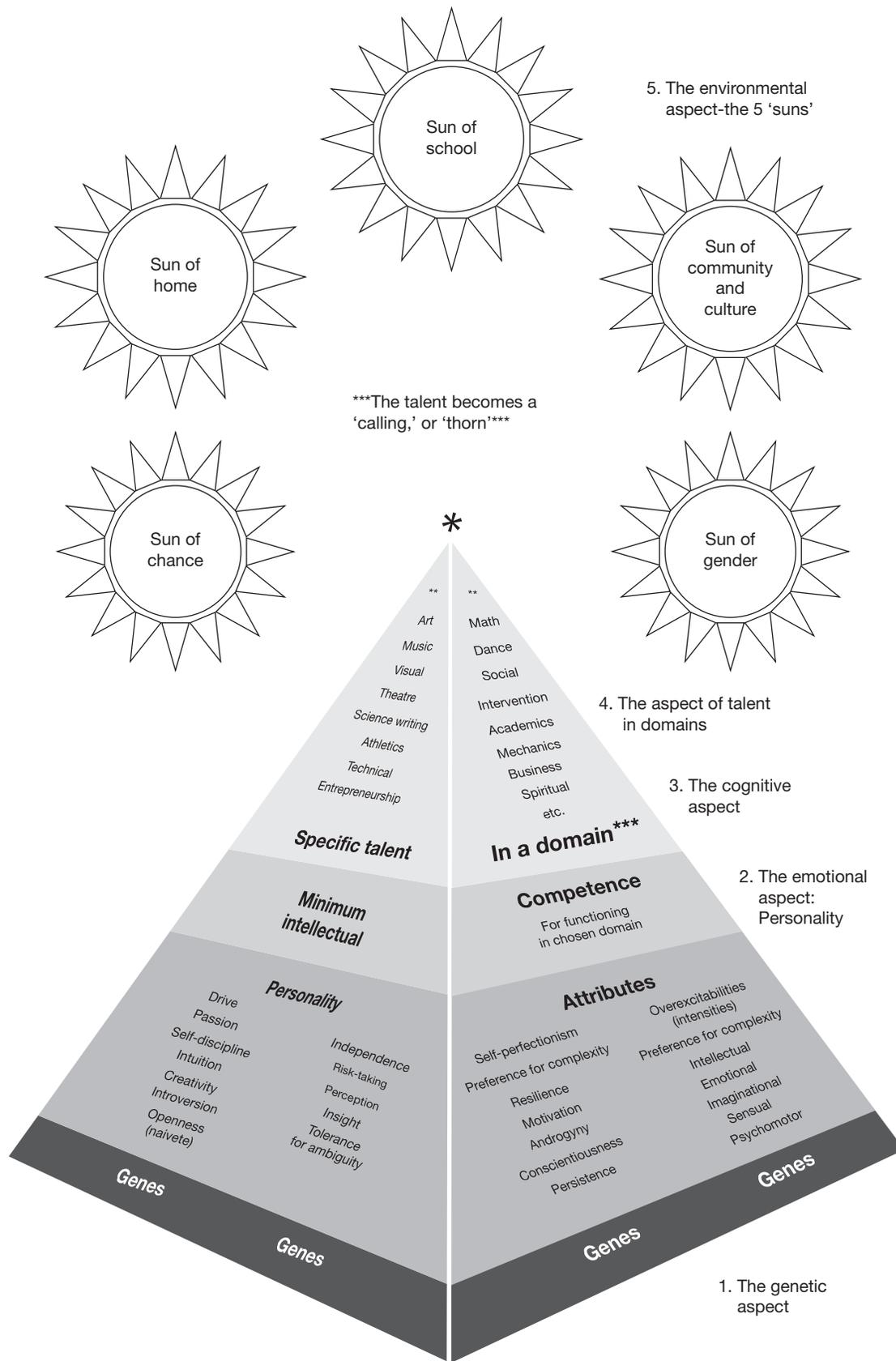


Figure 1 Piirto © 2010 Piirto's Pyramid of Talent Development first appeared in *Talented Children and Adults* (1994). It was subsequently revised in 1998, 1999, 2002 and 2004. This is Version 6.

- *The Environmental Suns* have been reduced to sixteen themes, as follows:
- *Sun of Home*
 1. Predictive behavior of extensive early reading.
 2. Predictive behavior of early publication and interest in writing.
 3. Unconventional families and family traumas (e.g., parental alcoholism, moving often, death of a parent, uncertain finances). This includes the search for the father, as in writing families, the fathers are often viewed as weak or ineffectual.
 4. Incidence of depression and/or acts such as use of alcohol, drugs, or the like.
 5. Being in an occupation different from their parents.
- *The Sun of Community and Culture*
 6. Feeling of marginalization or being an outsider, and a resulting need to have their group's story told.
 7. Late career recognition.
- *The Sun of School*
 8. High academic achievement and many writing awards.
 9. Nurturing of talents by both male and female teachers and mentors.
 10. Attendance at prestigious colleges, majoring in English literature but without attaining the Ph.D.
- *The Sun of Chance*
 11. Residence in New York City at some point, especially among the most prominent.
 12. The accident of place of birth and of ethnicity forms the subject matter.
- *The Sun of Gender*
 13. Conflict with combining parenthood and careers in writing.
 14. Societal gender expectations incongruent with their essential personalities.
 15. History of divorce more prevalent in women.
 16. Military service more prevalent in men.

Domain: Scientists and Mathematicians

- *The Genetic Aspect.* There is some evidence of heritability in families of scientists. For example, take The Darwins – Erasmus, Sir George Howard, Francis Galton, Sir Francis Darwin, Sir Horace Darwin, George Galton Darwin, Josiah Wedgewood, Thomas Wedgewood, and the Huxleys – Sir Andrew Fielding Huxley who won the Nobel Prize, Sir Julian Huxley, biologist, and Aldous Huxley, a novelist who wrote science fiction (*Brave New World*).
- *The Emotional Aspect: Personalities of Scientists and Mathematicians.* Creative scientists had personalities similar to artists and writers, except that the scientists had more emotional stability than the artists and writers.
- *The Cognitive Aspect: Intelligence of Scientists and Mathematicians.* They receive high scores in mathematics and in spatial ability on IQ tests. Scientists use mathematics as a tool. Mathematicians find joy and fulfillment in the beauty of mathematics for its own sake, or the elegance of the proof. Scientists want to unlock the secrets of nature,

and they are motivated by their beliefs in underlying universal themes or patterns in nature.

- *The Domain Thorn: Passion for Science and Mathematics.* Biographical studies by Piirto in 2004 show they have passion for doing the work and persistence in doing it. As children, they incorporate their science interest into their play with collections of rocks, insects, spiders and the like.
- *Sun of Home.* They come from more stable homes than other creators, especially writers. The father presence as an influential force. Simonton indicated that firstborns and only children make up more than half of active scientists.
- *Sun of School.* Scientists and mathematicians often skip grades in school, and take the most challenging courses. They list their favorite courses as mathematics and science.
- *Sun of Community and Culture.* Many scientists come from immigrant populations. In fact, the current shortage of US-born mathematicians and scientists has led to special modifications in immigration requirements. In the twentieth century, many scientists came from a Jewish background.
- *Sun of Chance.* The phenomenon of serendipity often applies. Serendipity can take place when a person has tried and tried to solve a problem but has failed until a universal characteristic becomes apparent; when a chance discovery truly happens; when an unanticipated find occurs; when an entirely different problem is solved; or when someone is tinkering and just seeing what happens.
- *Sun of Gender.* As Simonton said in 1999, "In the annals of science, fewer than 1% of all notables are female. Names like Hypatia, Caroline Herschel, Marie Curie, and Barbara McClintock are but drops in a sea of male scientists".

Domain: Inventors

- *Emotional Aspect: Personalities of Inventors.* They demonstrate the core attitude of Naiveté, and the ability to focus quickly. They show high self-confidence and high self-esteem. They also demonstrate risk-taking, a willingness to troubleshoot and to plunge in.
- *Cognitive Aspect: Inventors.* They demonstrate spatial (figural) intelligence.
- *Sun of Community and Culture.* Inventors Hall of Fame inductees since the 1960s have been what MacKinnon called Captive inventors in 1978, those hired by a university or a company. A Ph.D. is common (physics, biochemistry, ceramics, chemistry, engineering).
- *Sun of Gender.* Inventors inducted into the Inventors Hall of Fame were overwhelmingly male. They hold many patents, not just the ones for the invention for which they were inducted.

Domain: Entrepreneurs

Entrepreneurs such as J. Paul Getty, Bill Gates, Ted Turner, and Warren Buffett came from rich or very comfortable families; they had access to expert advice and legal protection of their ideas; they were readers and thinkers; they were smart in mathematics (e.g., Bill Gates scored 800 on his SAT); and

they liked money from an early age. In 2010, Gladwell wrote that: contrary to popular belief, they are not especially risk-takers, but conservators of their family money and 'predators.'

Domain: Musicians, Composers, Conductors

- **The Genetic Aspect.** We don't know whether there is a music gene or music genes, but music talent does seem to run in families, for example, the Mozart family, the Mendelssohn, the Bachs, the Dylans (Bob and his son Jakob) and the Simons (Paul and his son Harper).
- **The Emotional Aspect: Personality attributes.** Studies with the 16 PF have shown how various practitioners in music (performers, composers, conductors, classical musicians, popular musicians) are alike and different in personality. For example, male composers are aloof, dominant, sensitive, controlled, imaginative, and self-sufficient, while female professional composers are dominant and self-sufficient.
- **The Cognitive Aspect: Musical intelligence.** Appears early in spontaneous singing, chanting, creating sounds with instruments, imitating songs, remembering songs heard, interest in playing.
- **Talent in the Domain: The Thorn.** Music is the expression of deep emotion. Conductor Herbert Blomstedt said, "After a concert I feel exhilarated and want to do it again. I never get tired of making music." Conductor Esa-Pekka Salonen said, "Sometimes I have these funny moments of joy. I'm studying the score and I suddenly realize how great the music is, and I'm overcome by very powerful feelings of euphoria."
- **The Sun of Home.** The family of the musical talent most often has a keyboard instrument. The families are amateur musicians who perform music at home as pleasure, and who listen to music together. They also attend concerts of other musicians. The Sun of Home in rock and popular musicians is less stable, less supportive in terms of lessons, less tolerant of practice, and less full of encouragement.
- **Sun of School.** One must audition and constantly practice, and take lessons from ever more advanced teachers. The master teachers expected discipline and commitment. Being a student of a master teacher means more than just taking lessons; it means adopting a style, a sense of musical repertoire, and a raising in standards of musicianship and performance.
- **The Sun of Community and Culture.** As in other domains, the importance of hanging around with other musicians and artists cannot be underestimated. Cross-influence often takes place in artistic communities, where musicians, visual artists, writers, dancers, and actors hang out together. To illustrate, consider New York City in the 1950s and 1960s, where artists such as Andy Warhol, Bob Dylan, Robert Mapplethorpe, and others met and influenced each other.
- **The Sun of Chance.** The talented musicians, as in other domains, must be ready for chance to strike. For example, take the story of Leonard Bernstein and of Esa-Pekka Salonen. Both were assistant conductors who got their big chance when the maestros under whom they worked had to miss a concert.
- **The Sun of Gender.** 'Lookism' is alive and well in the music domain. Ella Fitzgerald was called too ugly to front a band. Janis Joplin was voted Ugliest Man on Campus. Anne Sophie Mutter is known for her sexy album covers, as is Lara St. John, so much so, that the women bemoan ever being taken seriously as classical musicians. Mama Cass almost didn't make the Mamas and Papas because she was overweight.

Domain: Physical Performers (Actors, Dancers, and Athletes)

- **Actors: The Genetic Aspect.** Families of actors exist, and have existed for ages. Take, for example, the Bernhards, Barrymores, Booths, Sheens, Fondas, Redgraves, and Houstons.
- **Actors: The Emotional Aspect: Personality Attributes.** Psychometric studies have shown the preference for ENFJ (Extraversion, Intuition, Feeling, and Judgment), for resilience, and a tolerance of ambiguity.
- **Actors, Dancers, Athletes: The Intelligences: Cognitive aspect.** These physical performers show what Gardner (1983) called bodily-kinesthetic intelligence, interpersonal intelligence, and intrapersonal intelligence.
- **Passion for the Domain: The Thorn.** As in other domains, the passion must drive the performance.
- **Sun of Home in Actors.** The biographies show family turmoil and/or Bohemian families, for example, the Phoenixes, the Downeys, the Fiennes. Poverty was also present in many theatrical families.
- **Sun of School: Actors.** Actors have a large dropout rate, mostly from university, some just short of graduating, like Brad Pitt and Steve Martin. They are practical, and want to learn the craft, not the liberal arts. Even though, in the United States, there are more than 80 master's degree programs, 300-plus bachelor's degree programs, and several hundred nondegree conservatory programs, many actors do not finish school.
- **The Sun of Chance: The look.** Unfortunately, in the theater, talent is preceded by looks, at least in the United States. "Getting a good head shot is as important as studying with the best teacher," said a theater artist I interviewed. The best singers and dancers, not the best actors get roles in musical theater.
- **The Sun of Chance.** 'Good genes,' said Jane Fonda, when she confessed she no longer exercises very much. Sophia Loren's chest got the attention of Carlo Ponti, and the rest is history. Ava Gardner's looks got her her first jobs. Family connections also matter in enhancing the chance.
- **The Sun of Gender.** The issue of women having to be thin and beautiful and young in order to be performers is present, to a greater extent than for men, though it is present there as well. "Let's hear it for the fat girls!" shouted Camryn Manheim when she won an Emmy. However, she and only a few others such as Kathy Bates are permitted to be overweight.

Domain: Dancers and Athletes

- **Personality Attributes: The Emotional Aspect in Dancers and Athletes.** Personality studies of dancers and athletes have

shown that they have the ability to cope with and control anxiety, confidence, mental toughness/resiliency, sport intelligence, ability to focus and block distractions, competitiveness, hard work ethics, coachability, and high levels of hope.

- **Domain Thorn – Athletes.** “Baseball drove me. It pushed me.” said Derek Jeter in his autobiography. “I was in love with basketball. I couldn’t wait for school to be over so I could run right over to the Stadium,” said Hakeem Olajuwon in his.
- **Sun of Home: Dancers and Athletes.** These creative performers had parents who were willing to pay for lessons and the intense training necessary. They also may have felt the necessity to move the whole family in order to find the perfect coach (as in tennis, ice skating, and gymnastics). Even choreographer Alvin Ailey’s mother, in poverty-stricken Texas, encouraged him to move to Los Angeles to pursue his interests. Male dancers often experience the disapproval of their fathers of their choice of dance.
- **Sun of School.** Sports camps, special schools for various sports, are attended by aspiring athletes. Hour after hour is spent shooting hoops, keeping a soccer ball in the air, practicing plays and moves. They practice, practice, practice to the point of automaticity.
- **Sun of Community and Culture.** The importance of the ensemble, the team, and the group is key in this domain. No one achieves on his own without help from the group. These groups have initiations, rituals, and exclusionary practices.
- **Sun of Chance.** Again, the ‘luck’ of having the right physical makeup for the dance or sport cannot be underestimated. Dance and each sport have its physical requirements.
- **Sun of Gender.** The personality attribute of androgyny in athletes at the top levels has been studied. Male and female athletes at elite levels (on national teams) are remarkably similar in personality. They have high achievement motivation, high tolerance for pain, are highly competitive, and are able to train with great intensity.

These, briefly, have been a few examples from several domains of talent, organized according to the framework of the Piirto Pyramid of Talent Development.

See also: Acting; Dance and Creativity; Domains of Creativity; Eminence; Expertise; Families and Creativity; Ella Fitzgerald 1917–1996; Genetics; Giftedness and Creativity; Intelligence (as Related to Creativity); Intuition; Motivation; Multiple Intelligences; Nature/Nurture and Creativity; Overexcitabilities; Personality; Autonomy and Independence; Risk-Taking; Sports and Creativity; Theater; Women and Creativity; Writing and Creativity.

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Relevant Website

<http://talentdevelop.com> – Talent Development Resources - Enhancing creative expression and advanced personal development.

Teaching Creativity

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Glossary

Accommodative thinking Thinking that seeks to build new ideas in response to new information (contrast with assimilative thinking, which seeks to maintain existing ideas).

Antipathy to creativity Teachers' dislike of creative students and/or of their behavior and personal characteristics.

Blocks to creativity Factors both within the individual and also in the external environment that block the expression of creativity (contrast with facilitators of creativity, which encourage its expression).

Creativity-facilitating general teaching and learning methods Special approaches to teaching that are particularly likely to promote students' creativity.

Creativity fanaticism Excessive enthusiasm for creativity on the part of parents, resulting in driving or forcing children to be 'creative.'

Differential diagnosis of creativity Procedures for identifying special strengths and weaknesses of particular children so that they can be given appropriately focused

creativity training (see, for instance, 'stifled' creativity, 'abandoned' creativity, or 'frustrated' creativity).

Half-life The period of time it takes for a piece of knowledge or a special skill to become only half as useful or effective as it used to be.

Metacognition Thinking processes that permit control, selection and evaluation of one's own thinking.

Omnivalence The capability of seeing links among large numbers of apparently different ideas.

Pseudocreativity Blind departure from the customary; simply being different.

Quasicreativity Generation of novelty without regard to practicability.

Sputnik shock The surprise and dismay experienced in western countries in 1957 when the Soviet Union successfully launched the first artificial earth satellite.

Technology of creativity training An organized series of activities combined to form a creativity-facilitating package or program to be used regularly for training creativity according to a schedule.

Introduction

The idea of deliberately attempting to foster creativity in the classroom initially aroused controversy and opposition in the 1950s and 1960s. It was argued, for instance, that creativity is by its very nature mysterious and unknowable, and thus incapable of being systematically promoted or fostered, and that attempts to do this were almost sacrilegious. A second argument rested on the assumption that creativity is a special property found in only a few individuals. Some people who regarded themselves as belonging to this chosen group – members of the creativity establishment such as acclaimed writers or critics – argued in a self-important way that ordinary people could never understand their special gifts, and should not try to do so. Some parents and teachers feared that promoting such a rare and highly-prized phenomenon would encourage elitism. There was fear that some children would become the victims of creativity fanaticism among teachers and parents, in much the same way as seems to have happened to some contemporary female tennis stars.

Finally, the association of creativity with highly-acclaimed, sublime products was daunting for teachers, because it seemed to impose on them an even greater responsibility than they already bear. On the other hand, stress on creativity in day-to-day classroom functioning made many teachers and parents uneasy because it seemed to mean encouraging unruly, disobedient, careless, imprecise, or just plain naughty behavior. Some people saw the call for creativity in the classroom as meaning that basic skills, standards, and principles such as correct – incorrect would be abandoned.

However, elitism, fanaticism, sublime products or neglect of basic skills are not the purpose of fostering creativity in the classroom. The desire to foster it derives from a liberal tradition in educational thinking that goes back at least to the Ancient Greeks. This tradition emphasizes that all children should be given the opportunity to develop their potentials to the full, and that education should help prepare young people for the richest and most productive life possible. Modern educational researchers and theorists thus concentrate on aspects of creativity that they believe are present, at least as potentials, in everybody. In other words, appropriate learning conditions can promote some elements of creativity in all children. The purpose of this is not self-aggrandizement or domination of other people, however, but making contributions to the common good.

Why Foster Creativity in the Classroom?

Benefits for the Individual

It is evident that in modern society knowledge and skills have ever-diminishing half lives (the period of time within which 50% of what a person knows or can do will become incorrect or irrelevant). The knowledge and skills needed in the future may not even be known at the time a person attends school. As a result, the school cannot limit itself to the transmission of set contents and techniques, but must promote skills like the ability to adapt the already-known to new situations or to see new ways of dealing with old situations, as well as personal properties such as flexibility, openness, interest in the new, and

courage in the face of the unexpected. These are central elements of a psychological definition of creativity. Such properties help the individual maintain job and life skills in the face of rapid change, and also help cope with the personal challenges of life, especially in the areas of change, uncertainty, or adaptation, and are thus closely connected with mental health. Thus, the fostering of creativity in the classroom is part of efforts leading to the development of successful and mentally healthy individuals.

There is also substantial evidence that a creative approach to teaching has beneficial effects on acquisition of traditional knowledge and skills: A practical demonstration of this is to be seen in the differences in mathematics achievement between Japanese and German and American children in the Third International Mathematics and Science Study (TIMSS): The Japanese were the third best mathematics achievers out of pupils from 41 countries, whereas the Germans were placed 23rd and the Americans placed 28th. Striking for present purposes is that analyses of videotapes showed that whereas the Americans and Germans spent their time acquiring routine mathematical procedures, Japanese students spent theirs learning to invent, analyze and solve problems. In addition to promoting acquisition of basic knowledge and skills, there is also evidence that creativity-oriented teaching (see later) has beneficial effects on pupils' motivation, as well as on their attitudes to school and their self-image. Put briefly, creativity in the classroom helps students learn better and enjoy school more.

Benefits for the Society

The upsurge of interest in fostering creativity that started in the United States after the 1957 Sputnik shock was, however, not set in motion by concerns about individual wellbeing, but by a perceived need of the society for engineers capable of inventiveness and originality, because of fear that the then Soviet Union was gaining the upper hand in the arms and space races. It was thought that most students were being trained simply to apply the already known in conventional, logical ways (as in the TIMSS example of the teaching of mathematics in Germany and the United States just given). The view that societies need to foster creativity in schools for the good of the whole society quickly spread to other countries, and is now widely accepted.

Although the term 'creativity' is strongly associated in everyday English with fine arts, literature, music and the like, the benefits for society are now seen as going far beyond the esthetic/artistic domain: indeed, the original thrust of post-Sputnik calls for fostering creativity in the classroom focused on science and engineering. Ironically, the initial legislation emphasizing creativity in schools in the United States was the National *Defense* Education Act. More recent thinking also emphasizes the necessity of creativity in commerce, business, manufacturing and marketing, government, health, transport, and communications, as well as defense, law-enforcement, and counter-terrorism. In a 2009 speech, José Manuel Barroso, President of the European Commission, identified creativity as essential for collective and individual well-being, long and sustainable economic growth, and answers to the current

financial, economic and social crisis. Business-oriented writers see creativity as the key to meeting the challenges of the early twenty-first century arising from technological advances, social change, globalization, and now the global financial crisis. Creativity is thus seen as capable of contributing to raising the quality of life, easing the burden of manual labor, improving health care, and promoting peace and security. In other words, in addition to its benefits for the individual, creativity is also seen as having an important role in the favorable evolution of society.

What Should Be Fostered?

Creativity as a Psychological Constellation Within the Person

Children only display creativity when, in addition to being able to, they also *want* to and *feel that it is safe to do so*. Thus, creativity arises from a constellation of psychological characteristics including (a) cognitive aspects (knowledge, creativity related skills and abilities; (b) motivation; and (c) personal properties such as self-confidence. **Figure 1** summarizes the psychological dimensions of creativity and represents their interaction with each other and with the environment. Thinking, remembering, knowing, reasoning (cognitive factors) only lead to creativity when the person is motivated to seek the new and is prepared to take the risk of being laughed at and go without the security offered by sticking to the safe and well known. This requires appropriate personal properties such as courage, openness or self-confidence. **Figure 1** presents an oversimplified view in order to demonstrate the main psychological dimensions. In fact, there are interactions within the elements of a psychological domain (e.g., divergent thinking increases the amount of information available, to take a single simple example), and also between domains (e.g., personal properties such as risk taking and openness facilitate the cognitive process of acquiring information and encourage divergent thinking).

These interactions occur within a social context, of which the classroom is most important for the present article. Properties of the classroom context, often referred to as the 'classroom climate,' affect all three intrapersonal areas (information and thinking, motivation, personal properties), as is shown in the figure. Thus, classroom climate involves a fourth dimension, often referred to as 'Press' – the environment outside the individual. The relationship between creativity and the classroom environment is similar to that between creativity and any social environment such as family or place of work. The classroom can foster or inhibit the emergence of the personal prerequisites for creativity such as interest in the new, daring thinking, or openness, but is also itself affected by the personal properties, thinking skills and motivation of the students – openness, adventurousness, and similar characteristics are encouraged by an appropriate classroom climate but also contribute to the emergence of such a climate.

Cognitive Factors in Creativity

Perhaps the best known approach to creativity emphasizes thinking. It arises out of the distinction between convergent and divergent thinking. Effective application of divergent

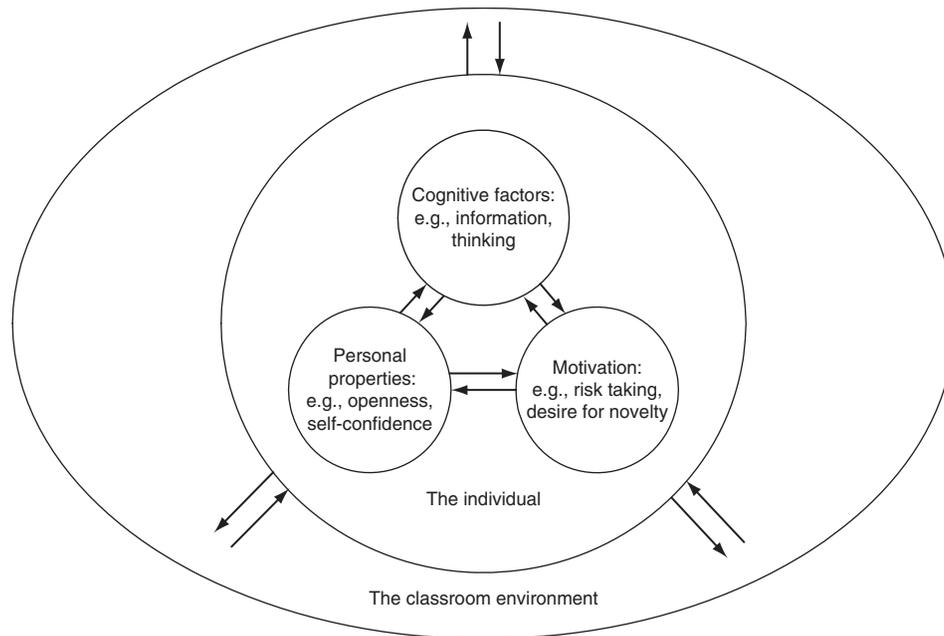


Figure 1 The interaction among personal prerequisites for creativity and classroom environment.

thinking requires information, that is, knowledge of a field. Otherwise creativity has no contents to which it can be applied. Convergent thinking involves applying conventional logic to such information in order to home in on the one and one only best answer it implies – the answer that would in theory be arrived at by anybody who possessed the necessary information and applied the rules of conventional logic. Since the answer is unique and arises more or less inevitably from the available information, in a certain sense it already exists and must only be discovered. In practice, this usually means that the teacher already knows the answer and that students must find out what this answer is.

By contrast, divergent thinking involves branching out from the available information, for instance by seeing unexpected aspects or making unusual associations which others might not notice, or might notice but suppress, for instance because of the risk of attending to them. There are as many answers to be produced from a given set of information as human ingenuity can invent, once attention is directed away from the single, best, correct answer implied by convergent thinking. Although – especially in practical settings where a genuine problem must be solved – some ideas may be more practicable than others, different students may nonetheless come up with drastically different solutions that are theoretically of equal value.

Dean Simonton argued that the making of creative associations is a random process. A person with broad knowledge of a field possesses a large array of ‘cognitive elements’ that can be combined with each other to form ‘configurations’ until a novel and effective configuration (a combination of ideas that meets the requirements of the particular situation) occurs. However, blind associating, in the sense that all possible combinations of all possible kinds are carried out until one of them delivers the hoped for solution, would involve vast

numbers of empty trials unless the person in question employed mechanisms that permitted short cuts, for instance by ruling out whole groups of associations that can be recognized as in principle blind allies, or by indicating that certain lines of attack are very promising. Such mechanisms involve *metacognition*. They permit control, selection, and evaluation of one’s own cognitions.

One approach, based on Jean Piaget’s research on cognitive development, differentiates between ‘figural,’ ‘operational’ and ‘executive’ *schemata*. Figural schemata permit an accurate internal representation of information, operational schemata yield an abstraction and generalization of the information, and executive schemata consist of general principles for transforming information. Creativity is permitted by accurate figural schemata, abstract operational schemata, and flexible, complex, and differentiated executive schemata. A further approach to describing the thinking processes involved in creativity based on Piagetian principles involves a distinction between ‘accommodative’ and ‘assimilative’ thinking. This distinction is important for educators, as it emphasizes that fostering creativity involves both broadening and deepening the existing organization of knowledge in a process of enrichment (assimilative creativity), as well as fostering the building of novel ways of seeing the world (accommodative creativity).

However, teachers should not focus exclusively on creativity. On certain tasks, such as acquisition of facts, students who display high levels of divergent thinking but without accuracy, speed, conventional logic and similar properties may experience particular difficulty. They are sometimes surpassed even by students who are poor at both convergent and also divergent thinking. On the other hand, those students who do best of all in the widest variety of situations are the ones who display both ‘creative’ factors and also speed, accuracy, logic,

and the like. What is needed is rounded ability: originality and similar characteristics accompanied by accuracy, and conventional thinking at appropriate times.

What these findings on the cognitive aspects of creativity mean for teachers can be summarized in the following way. They should strive to promote in their students:

1. possession of a fund of general knowledge;
2. knowledge of one or more special fields;
3. an active imagination;
4. ability to recognize, discover or invent problems;
5. skill at seeing logical connections, overlaps, and similarities, drawing logical conclusions, etc. (convergent thinking);
6. skill at making remote associations, branching out, seeing the unexpected, etc. (divergent thinking);
7. ability to think up many ways to solve problems;
8. a preference for accommodating rather than assimilating;
9. ability and willingness to evaluate their own work; and
10. ability to communicate their results to other people.

Personal Properties

Some theorists have gone so far as to argue that creativity is, in the first instance, *a particular pattern of personality* rather than a set of cognitive factors. Many studies have investigated this view by studying people already acknowledged as creative and have concluded that personal properties such as flexibility, sensitivity, tolerance, responsibility, autonomy and positive self-image are related to creativity. Openness to the new has also been regarded as crucial. Openness involves an interest in novelty for its own sake; the open person simply likes to go beyond the conventional, is spurred on by the unexpected, and seeks alternative explanations for everything.

Descriptions of the creative personality cross the boundaries of gender stereotypes: inspiration is thought of as stereotypically female, for instance, elaboration stereotypically male. In a similar way, sensitivity and responsibility are regarded as female, autonomy and positive self-image as male. Thus, the creative personality is said to involve a mixture of stereotypically male and stereotypically female characteristics. These findings underline the need to break away from gender stereotyping in school programs. For instance, whereas most girls acquire empathy, altruism, and consideration (properties that are favorable to creativity) more or less effortlessly, for instance by learning from models, many boys do not simply 'pick up' such properties and need help to acquire them.

Motivation

Research has shown that creative individuals differ from the less creative in *motivational patterns* too. Among other things, they seek to create new order out of chaos (to accommodate), whereas less creative people seek to return things to the way they were before (to assimilate). A further motivational characteristic of highly creative individuals is their near obsession, with some tasks. They are willing to strive to their mental and physical limits. This requires a fascination with the field and a sense of invincibility, which is greatly strengthened when the drive comes from

within; that is, when motivation is intrinsic. The motivational prerequisites for creativity include (a) curiosity; (b) willingness to take risks; (c) tolerance for ambiguity; (d) dedication; (e) stamina; (f) fascination for the task. Of these, dedication and tolerance for ambiguity are crucial. Tolerance for ambiguity is so highly developed that it does not involve simply tolerance for two alternatives (ambivalence), but willingness to see that anything could be combined with anything else (omnivalence).

A major question in connection with classroom instruction is that of the effect of rewards such as praise, grades or prizes on motivation for creativity. The dominant view until recently was that such extrinsic rewards cause children to concentrate on behaviors that lead to the rewards, and to cease behaving in the desired way when the rewards stop. Such children are experiencing *extrinsic motivation*, a state of affairs that was thought to be the antithesis of creativity, since it involves reproducing the already known under the direction of others. What writers like Teresa Amabile initially regarded as necessary was *intrinsic motivation*, where children are motivated by their own curiosity and their fascination for an issue, events, a problem or an activity, and are thus encouraged to invent, innovate, and branch out on the basis of their own imagination, fantasy, and the like.

Such findings appear to have profound implications for fostering creativity in the classroom. If external feedback such as grades inhibits creativity, the teacher's role in fostering creativity seems to be limited to encouraging free expression of ideas regardless of quality. Recent findings indicate, however, that the effects of external rewards are not as simple to define as had been thought. Their effects are dependent upon the exact situation and may differ between males and females. Researchers such as Robert Eisenberger have shown that extrinsic motivation can be applied in such a way as to encourage creativity. Highly differentiated external rewards given only for high quality performances have been shown to increase creative activity rather than reduce it. 'High quality' can be defined in terms of the child's own talents, abilities, and skills, and need not involve sublime performances at the level of acknowledged creators. However, the child must know exactly what it is that is being rewarded: If creativity is to be facilitated by giving rewards, the children must have a concept of creativity (even if it is not given this label), for instance, novel ideas, brave speculations, or promising fantasies, and must be rewarded for displaying such behaviors, not simply for being active or unrestrictedly productive, that is, uninhibited.

Creativity research has scarcely concerned itself with the role of *feelings and emotions* in the process of finding effective novel solutions. However, Melvin Shaw showed that a number of feelings such as fascination for the task, self-confidence, frustration when progress is blocked, excitement at the moment of illumination, and satisfaction upon successful verification play a major role. These are all aspects of what might be called 'the joy of creating.' Interestingly, the participants in the study just mentioned made little mention of competitiveness or aggressiveness, perhaps because these feelings are socially undesirable. Creativity seems to be positively affected by feelings such as fascination or excitement, negatively by the feeling of stress.

The findings just presented suggest that teachers should value and promote in their students properties such as:

1. task commitment, persistence, and determination;
2. curiosity and adventurousness;
3. drive to experiment and willingness to try difficult tasks;
4. tolerance for ambiguity;
5. independence and nonconformity;
6. self-confidence and willingness to risk being wrong.

Social Factors

It is important to bear in mind that creativity is influenced by the social setting, in this case the classroom. Various authors have pointed out that being creative means living your life your own way or displaying 'resistance to socialization.' Studies in several different countries such as Israel, the former Soviet Union, and the United States have shown, for instance, that a low level of control can facilitate creativity, although this must be accompanied by warmth and support, as it may otherwise be interpreted as aloofness and lack of concern. Authors such as Robert Sternberg and Todd Lubart have emphasized the role of social factors like norms and conformity pressure in inhibiting creativity. Children learn that certain things are simply not done, and thus acquire general rules forbidding certain lines of action (e.g., "You shouldn't question what the teacher tells you"). As a result, whole classes of theoretically possible solutions are banned *en masse*. Society has 'filters' through which certain behaviors, even certain thoughts, are blocked.

Social factors can, however, also have a positive effect on creative achievement. A study of creative individuals by Benjamin Bloom showed that in many cases a single significant person played a crucial role in their childhood, for instance by making the young person aware of his or her own potential. This was often done by a person such as a grade school teacher who demonstrated passionate interest in a topic and awakened fascination for it in the child, showed a creative youngster that he or she was not alone, or helped the student make contact with peers, experts, or other supportive adults. Despite this, a major aspect of social factors seems to be their powerful role as inhibitors. Thus, in fostering creativity teachers must seek not only to provide releasers, but also to eliminate blockers.

An interesting finding in this regard is that some teachers tend to be more supportive of creative students, so that it is possible to speak of 'creativity fostering' teachers. These teachers often get along well with all students, but are particularly effective with creative students. Darnell Cole, Heather Sugioka, and Lisa Yamagata-Lynch summarized the ways such teachers foster creativity: They provide a model of creative behavior, reinforce such behavior when students display it, protect creative students from conformity pressure from their peers, provide a safe refuge for the students when they are subjected to ridicule or criticism from peers, parents or other teachers, and establish a classroom atmosphere which is supportive of creativity. They are those who:

1. encourage students to learn independently;
2. have a cooperative, socially integrative style of teaching;

3. motivate their students to master factual knowledge, so that they have a solid base for divergent thinking;
4. delay judging students' ideas until they have been thoroughly worked out and clearly formulated;
5. encourage flexible thinking in students;
6. promote self-evaluation in students;
7. take students' suggestions and questions seriously;
8. offer students opportunities to work with a wide variety of materials and under many different conditions;
9. help students to learn to cope with frustration and failure, so that they have the courage to try the new and unusual; and
10. develop a classroom atmosphere that is tolerant of unexpected answers, questions, suggestions, etc.

Promoting Creative Products

Discussions of fostering creativity in the classroom initially saw its products as a matter of uninhibited production of artistic works such as fanciful drawings of a creature from space, or stories of imaginary events such as a journey to the moon. However, writers have paid greater attention in recent years to the idea that creativity should go beyond mere deviation from the usual, and have emphasized that it should lead to appropriate products. An increase in interest in fostering creativity in areas of curriculum such as technological design education or entrepreneurship education – where useful practical products and not just uninhibited flights of fancy are at the core – has also greatly strengthened the modern idea that creativity in the classroom should lead to something concrete and meaningful, not just to flights of fancy. It also encourages the idea that the teaching of creativity is not a 'frill' activity, almost recreational in nature and engaged in perhaps once a week in a special classroom, but a core element of curriculum.

This has increased interest in evaluating creativity, not just as an indicator of a free spirit and the ability to make unexpected suggestions, but in its own right. Related to this is the growing demand for transparency and accountability in evaluation of students' work. The result is that it is becoming necessary to be able to say what makes students' work creative and to help them improve. This requires developing ways of assessing the creativity of products, identifying their strengths and weaknesses in an understandable and stable way, and communicating to students what they are doing right and how to improve what they are doing wrong.

It is obvious that a creative product involves bringing something new into existence, that is, novelty. However, although absolutely essential, novelty is not sufficient on its own. Not every departure from what already exists is creative. Writers have emphasized the need for qualities such as 'correctness,' or 'usefulness.' Such terms clearly involve value judgments, but it does not seem unreasonable for teachers to expect that students' products should be relevant to the task at hand.

A creative product can go further than simply being novel and effective in a specified situation (relevant). It can also be 'elegant.' At its simplest this means that good design solutions look good. Elegance adds value to a relevant and effective solution, and this increases its creativity. In the real world, elegance may mean that a solution is readily identifiable as a

solution, and is accepted, applauded and adopted, while it may also mean that a particular solution defeats a rival solution, for instance in the market-place. Finally, comes 'genesis': the property of a relevant and effective, novel and elegant solution that makes it transferable to different (quite possibly unanticipated) situations. Genesis opens up new ways of looking at known problems, or draws attention to the existence of previously unnoticed problems. In this way, a generic solution goes beyond a 'merely' elegant one and yields the highest level of creativity.

Students' products can be assessed according to the criteria of relevance and effectiveness, novelty, elegance, and genesis. What is needed for doing this, however, are guidelines for teachers that enable them to recognize these criteria when they see them. Hints about what to look for are provided by a number of writers. David Cropley and I have developed a list of criteria (Relevance and Effectiveness, Novelty, Elegance, Genesis) and indicators of the presence of these criteria such as 'correctness,' 'diagnosis,' 'redefinition,' 'reinitiation,' 'convincingness,' 'harmoniousness,' and 'transferability.' Such indicators may be highly subjective, but Susan Besemer and colleagues have shown that people can rate products in terms of subjective criteria with acceptable reliability and a high level of interrater agreement.

Teachers' Attitudes to Creative Students

Antipathy to Creativity

Surveys have shown that teachers appear to overwhelmingly agree in theory that creativity should be fostered in the classroom – a study by John Feldhusen reported that 96% of them expressed this view. However, *in practice* the situation is different. In classrooms many teachers often

- dislike student characteristics associated with creativity, and
- frequently express disapproval or even dislike of the students in their classes who are most creative or score highest on creativity tests.

They often frown upon traits associated with creativity, or even actively dislike characteristics such as boldness, desire for novelty, or originality. Preferred are courteousness, punctuality, obedience, and receptiveness to other people's (the teacher's) ideas. In the area of thinking, high skill in memorization and accurate recall are often preferred to critical thinking or independent decision making. This finding emerged early in the modern creativity era (i.e., in the 1950s and early 1960s), when for instance Jacob Getzels and Philip Jackson reported that teachers expressed a strong preference for teaching 'merely' intelligent children rather than highly creative students. It has been strongly supported by research ever since, right up to the present day, as a recent summary by Elizabeth Mowrer-Reynolds showed.

Paul Torrance concluded that the problem arose from the tendency of creative children to do things like asking unexpected questions or giving unusual answers to teachers' questions. He pointed out that some teachers even went so far as to describe creative children as mentally defective, and concluded that what teachers liked was students who conformed and reproduced material supplied by the teacher or the textbook.

This preference cuts across disciplines, and has been repeated consistently over the years in many different countries including Africa, Asia, Australia, Eastern and Western Europe, the Middle East, and North America. There is a high level of disapproval of schoolchildren asking questions, having the courage of their convictions, guessing, being intuitive in making associations, or taking risks. By contrast, there is near unanimity that school children should be obedient, work industriously, accept the judgment of authorities, and be considerate of others.

It seems that teachers may not understand what creativity really involves. In one study they linked several words associated with mental illness (emotional, impulsive) with creativity. Teachers who were given adjectives describing traits typical of what creative children are actually like (e.g., inclined to take risks, curious, inclined to offer unexpected answers), said they *disliked* such youngsters. In fact, research shows that the students most likely to be rated creative by their teachers are simply the ones the teachers and classmates like best. As Gudmund Smith and Ingegerd Carlsson put it, "... teachers seem to have a confused picture of what is a favorite pupil and what is a creative pupil."

Why Do Teachers Display Antipathy to Creativity?

A major problem for educators is that many of the personal properties discussed above are not conducive to order and discipline in the classroom. Independence, autonomy, and nonconformity associated with quick shifts of attention, fascination for the unexpected and constant search for alternative explanations may not only be disconcerting for the teacher, but may be misunderstood by peers. As a result, children who display such properties may either act as a catalyst for disorderliness or be regarded by other youngsters as beneficiaries of playing favorites by the teacher, who may seem to peers to be tolerating behavior from one student which is not tolerated when classmates behave in (as they see it) a similar way. At this point it is helpful for teachers to remember the distinction between genuine creativity, pseudocreativity (mere blind deviation from the customary) and quasicreativity (generation of novelty without concern about the link to reality), as this makes it possible to recognize and describe the difference between creativity and similar looking misbehavior.

Characteristics associated with creativity include lack of concern for social norms. Studies have also shown that creative children are significantly more introverted, more self-willed, less satisfied and less controlled than children who display lower levels of creativity. In social situations they are less willing to conform and less interested in making a good impression. To put it plainly and briefly, creative students can sometimes seem to teachers to be 'weird,' defiant, aggressive, self-centered, or antisocial, characteristics which make them disturbing, even threatening. Furthermore, for most teachers, transmitting standard knowledge in an easily understood manner is the essence of their job. Their knowledge is their stock in trade, and any student behavior that seems to offer a challenge to it is a serious matter: behavior such as penetrating, unexpected, even challenging questions – no matter how innocently meant – may even threaten teachers' self-esteem. Little wonder that this aspect of creativity arouses teachers' unease or dislike.

Summing up, creativity may sometimes:

- shake the foundations of the received classroom order,
- bring uncertainty for pupils (and parents),
- question the value of laboriously acquired knowledge and skills,
- threaten loss of status and authority for teachers, and
- weaken teachers' self-image.

Can Creativity Be Taught?

But does creativity training work? It is frequently argued that the effects of creativity-facilitating programs scarcely generalize to behavior in settings other than those closely resembling the training procedure itself. However, more recently Ginamarie Scott, Lyle Leritz, and Michael Mumford carried out a more encouraging meta-analysis of 70 studies. Tse-Yang Huang also conducted a methodologically rigorous meta-analysis of 62 empirical studies of the way creativity training influenced the behavior of schoolchildren, university students, and adults. Both analyses concluded that training did foster creativity. The effects were strong in both children and adults and in both educational and noneducational settings (e.g., at work), and in both gifted and nongifted people. This was true for both males and females, although more marked in males. Positive effects were most pronounced when the criterion of creativity involved cognitive processes (i.e., divergent thinking and problem solving). Within the cognitive domain, the single largest benefit of creativity training was greater originality of thinking, although training also enhanced fluency, flexibility, and elaboration of thought.

Of great interest for this section, Scott, Leritz, and Mumford found differences between training procedures in their effectiveness. When cognitive, social, personality, motivational, and combined training procedures were compared, it was found that the cognitive approach produced the largest changes. Most effective in promoting creativity was practice in analytic thinking, that is, processes such as problem identification, idea generation, conceptual combination (linking ideas often kept separate), and constraint identification. The second strongest effect of training was on creative performance (i.e., the products produced after training were more creative). There were also noteworthy changes in attitudes such as dissatisfaction with the *status quo* or willingness to take risks.

Scott, Leritz, and Mumford showed, in a nutshell, that the best way to foster creativity was to give participants opportunities to analyze novel, ill-defined but realistic problems, whereas mere deviation from the usual (pseudocreativity), or unfettered expression of unexplored fantasies (quasicreativity) was actually negatively related to the effectiveness of training. They also found that highly organized and systematic training based on realistic examples and involving substantial periods of structured, focused practice (i.e., relevant to a real field or domain) was most effective. Training should start by introducing relevant general concepts and basic principles, then move to specific skills.

These findings suggest that reality-oriented creativity can be trained. The failure of early efforts to teach creativity may

possibly be attributed to the fact that the training consisted of isolated short bursts of unstructured work on activities that had no connection with real-life settings. The findings of Scott, Leritz, and Mumford suggest five principles for successful creativity teaching. These are:

- Give students targeted practice in solving problems (not for instance simply in generating 'blind' novelty).
- Give students highly organized and systematic training based on realistic examples from the field they are learning about.
- Base the creativity training just mentioned on extended periods of structured, focused practice (not an occasional 'creativity' session).
- Base training on broad knowledge and skills (relevant general concepts and basic principles).
- Move from broad knowledge and skills to targeted practice aimed at acquiring specific knowledge and skills.

Methods for Fostering Creativity

Eliminating Blocks Versus Actively Promoting Creativity

Many theorists believe that creativity is present in all people, especially children, at least as a potential, and that it emerges spontaneously if it is not inhibited or 'blocked.' The basic idea is that children do not need to be taught to think divergently, phantasize, or make remote associations, or to be open, flexible, and courageous enough to take risks and break away from the well known, or to show fascination for the new. They already know how to do this, but are inhibited by learned 'blocks' that make them hide these properties. Fostering creativity is then seen as eliminating such blocks. Typical blocks in the child's own mind include (a) inability to break an existing set, (b) inability or unwillingness to relax control and let ideas flow, (c) inability to handle the flow of ideas, (d) excessive preference for analytical thinking, (e) excessive preference for verbal expression, (f) fear of letting the imagination loose, (g) fear of giving the wrong answer, and (h) desire to answer as quickly as possible. Other blocks are part of the social climate of the classroom. These include (a) exaggerated success orientation, (b) intolerance of questioning, (c) reliance on external evaluation, (d) exaggerated conformity pressure, (e) rigid maintenance of strict sex roles, (f) strict distinction between work and play, and (g) intolerance of differentness. For this group of theorists, fostering creativity is thus principally a matter of breaking down blocks.

The opposing point of view is that people are not naturally divergent and full of fantasy, but need to be shown how to be creative. However, the necessary 'instruction' can be quite simple. For instance merely giving students examples of unusual responses, or simply allowing them to play with test materials or to watch a video of a comedian or of a person solving a creativity test seemed to increase their scores. However, some authors have emphasized the need to learn special thinking techniques such as (a) reversing the problem, (b) considering the end result, (c) focusing on the dominant idea, and (d) discarding irrelevant constraints. Game-like procedures

exist for training such thinking skills, including (a) producing, (b) analyzing, (c) elaborating, (d) focusing, (e) associating, (f) combining, (g) translating, (h) breaking out, and (i) recognizing the new.

Well-Known Techniques and Packages

Among the specific techniques which have become well known and are often available on a commercial basis are Synectics, Bionics, Brainstorming, Morphological Methods, Imagery Training, the KJ Method, the NM Method, and Mind Maps. Of these, Brainstorming has assumed particular importance in business, where it has become probably the most widely practiced set technique. Reduced to the absolute minimum, Brainstorming is a procedure in which participants initially produce answers without particular attention to whether they are practicable or not and all ideas are accepted without criticism. Synectics has similar properties, although it involves special techniques for finding ideas, especially 'making the familiar strange' and 'making the strange familiar'; basically this is a procedure for encouraging the making of unexpected associations.

Many other procedures for training creativity have also been marketed. These may consist of specific, discrete activities such as 'attribute listing,' 'idea matrix,' and 'creativity toolbox,' that sometimes take the form of games such as 'bridge building,' 'idea production,' or 'creative productions.' Sometimes a series of activities are combined to form creativity facilitating packages or programs which are meant to be used regularly for creativity training, according to a schedule. It has become common to refer to such materials (both the discrete activities and the packages) as involving the *technology* of creativity training, in much the same way as the machines in a gymnasium constitute the technology of bodybuilding. The idea is that it is possible, with the help of this technology, to do mental workouts, just as athletes do physical workouts.

The US Patent and Trademark Office compiled an extensive overview of relevant techniques and materials, listing about 25 packages aimed at promoting creative thinking – these packages involved several hundred separate activities in all. About a dozen sets of materials they listed were concerned with fostering critical thinking, once again encompassing hundreds of individual activities. Also listed were materials on fostering decision making, higher order thinking skills, and problem solving. This publication is a valuable source of information on creativity technology. A number of better known packages or programs for fostering creativity are listed in [Table 1](#). This table is an expanded version of a table in Runco, M. (ed.) *Handbook of Creativity* (p. 87) (Hampton Press, 1997).

Particularly interesting for the present discussion are the psychological characteristics the programs in [Table 1](#) aim at promoting. Most give greatest weight to the cognitive aspects of creativity (getting ideas, combining elements of information, etc.), even those which do not specifically see themselves as focusing on creative thinking. Only one program focuses on aspirations and feelings, while another gives some weight to attitudes toward problem solving. This cognitive focus makes good sense in view of the findings of Scott, Leritz, and Mumford mentioned above that the strongest effects of creativity training are to be seen in the cognitive domain.

However, the importance of personality, attitudes, values, self-image or motivation should not be overlooked. There is even a danger that creativity training may simply make children aware that certain kinds of behavior are preferred by the teacher, and lead to them copying this behavior. As a result, they would learn to conform to teachers' wishes rather than to be original. Although children may be encouraged by cognitive training to work hard on a variety of tasks, they may also learn that it is easy to give 'original' answers by engaging in hairsplitting, giving rambling answers without regard to accuracy or relevance, or offering unexpected banalities. Instead of becoming more creative as a result of offering ideas freely and without evaluation, students may simply become less self-critical.

A number of organizational forms have been adopted for incorporating various forms of creativity training into school curriculum. The traditional approaches involve various forms of enrichment. This frequently occurs outside the regular classroom, often involving special 'creativity' sessions conducted by a specialist resource teacher and frequently in a special resource room, the 'creativity center.' In some countries programs for fostering creativity outside the regular classroom involve visits, for instance to art galleries, while special activities such as creativity weekends, creativity workshops or creative vacation camps are now offered, not only in North America but also in Germany and France, among others. Some schools incorporate creativity training into the regular classroom, for instance by having creativity lessons or sessions once or twice a week in the home room. In these sessions, students are usually encouraged to work with unusual materials and to create nontraditional products, quite often in a problem-solving context: For instance to make a model of a rocket ship for mice out of cardboard, string, paper clips, and glue. The product may also be artistic in nature, for instance to draw a picture of the child's nicest experience using paints, crayons, chalk, pencils, colored paper, etc. With older children the emphasis may be on creative thinking, and problem solving is very popular. Such activities are often criticized as being no more than fun and games that have little to do with the goal directed, self-critical work of acknowledged creative people. This attitude has become prevalent in the United States where teachers have been encouraged to focus on basic skills, and teaching to the test has become a common practice.

Differential Diagnosis of Creativity

The creativity enhancing enrichment in a resource room or in weekend seminars or vacation camps often involves only a small group of children who have been selected as showing particular promise. This raises the whole issue of selection: what instruments are to be used, how valid are they, do they discriminate against specific groups on the basis of sex, race, socioeconomic status, physical disadvantage, or other factors? Even where selection procedures are technically sound, the whole idea of selection contradicts the ideal of full development of all children and the view that creativity can be fostered in all children, as well as raising fears of developing a small elite group. Some authors have developed procedures for admitting children to creativity programs that deal with some of these issues, such as the revolving door approach (children pass into and out of the program

Table 1 Main characteristics of well known creativity programs

<i>Program</i>	<i>Level</i>	<i>Materials</i>	<i>Aimed at promoting</i>
Imagi/Craft	Elementary school	Dramatized recordings of great moments in the lives of famous inventors and discoverers	<ul style="list-style-type: none"> ● The feeling that their own ideas are important ● Widened horizons ● Career aspirations of a creative kind
Purdue creative thinking program	Fourth grade	Audiotapes and accompanying printed exercises	<ul style="list-style-type: none"> ● Verbal and figural fluency, flexibility, originality, and elaboration
Productive thinking program	Fifth and sixth grades	Booklets containing cartoons – uses principles of programmed instruction	<ul style="list-style-type: none"> ● Problem-solving abilities ● Attitudes to problem solving
Myers–Torrance workbooks	Elementary school	Workbooks containing exercises	<ul style="list-style-type: none"> ● Perceptual and cognitive abilities needed for creativity
Creative problem solving	All levels	No special materials – makes great use of brainstorming	<ul style="list-style-type: none"> ● Finding problems ● Collecting data ● Finding ideas ● Finding solutions ● Implementing solutions
Talents unlimited	All levels	Workbooks based on idea of ‘inventive thinking,’ aimed at problem solving Emphasis on brainstorming	<ul style="list-style-type: none"> ● Thinking productively ● Communicating ● Planning ● Making decisions ● Forecasting
Khatena training method	Adults and children	No special materials Simple teacher made aids	<ul style="list-style-type: none"> ● Breaking away from the obvious ● Transposing ideas ● Seeing analogies ● Restructuring information ● Synthesizing ideas
Osborne–Parnes program	High school and college level	No special materials Primary emphasis on brainstorming	<ul style="list-style-type: none"> ● Getting many ideas ● Separating idea generation and idea evaluation
Clapham–Schuster program	College level	No special materials Relaxation exercises Definition of creativity as involving combining ideas brainstorming, synectics, etc	<ul style="list-style-type: none"> ● Getting ideas ● Understanding creativity ● Using metacognitive techniques (setting goals, expecting success, coping with failure)
Creative dramatics	All school levels	Exercises involving touching, listening to and smelling common items Pantomime activities such as removing things from an imaginary box Playmaking – acting out stories	<ul style="list-style-type: none"> ● Imagination ● Discovery ● Sensory awareness ● Control of emotions ● Self-confidence ● Humor

according to interest, need, and success) or selection via performance (those who display creativity go into the program) or selection via motivation (all those children who wish to enter the program are admitted).

The psychological model of creativity presented above offers prospects of what can be called a ‘differential diagnosis’ of creativity. It is seen as arising out of the interaction between a number of elements each of which is necessary but not sufficient: knowledge, thinking skills, motivation, personal properties. The classroom is seen as a social setting in which these properties can be fostered or inhibited. **Table 2** shows the various combinations of properties that are theoretically possible. A plus sign indicates that the characteristic in question is strongly developed, a minus sign that it is weak. In order to focus the discussion, only situations where the personal

prerequisites are particularly strongly or particularly weakly developed are presented in the table. As a result, the 16 ‘types’ shown are more or less stereotypes, but they serve here to demonstrate the point clearly.

Column 1 refers to a child possessing all four elements and represents ‘fully realized’ creativity, Column 2 a child in whom the personal properties are absent – ‘stifled’ creativity, Column 3 a child in whom only the motivation is missing – ‘abandoned’ creativity, Column 4 a child without the necessary thinking skills – ‘frustrated’ creativity, and Column 5 a child who lacks knowledge – ‘naïve’ creativity. The patterns shown in Columns 5–8 have in common that the child does not possess the necessary knowledge, that is, they involve various forms of pseudo-creativity. To take a single example of differential diagnosis, it can be seen that a child resembling the profile in Column 3

Table 2 Theoretically possible combinations of the factors involved in creativity

	Possible combinations															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Knowledge	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-
Thinking skills	+	+	+	-	+	+	-	-	-	-	-	+	+	+	-	-
Motivation	+	+	-	+	+	-	+	-	-	+	-	-	+	-	+	-
Personal properties	+	-	+	+	+	+	+	+	-	-	+	-	-	-	-	-

(no motivation to be creative) needs a different kind of help from a child resembling Column 2 where motivation and knowledge are present but openness, flexibility, and self-confidence are missing.

Differential diagnosis of the kind just suggested can only occur if appropriate diagnostic instruments exist. This indicates the need for procedures, for instance tests, capable of yielding a profile, rather than a global creativity quotient that attempts to sum up a child's creativity in much the same way as a global IQ summarizes intelligence but loses sight of special strengths and weaknesses. Such diagnosis has no point, of course, unless it leads to differentiated treatment. Thus, a challenge for the theory and practice of creativity in the context of education is the development of instruments capable of delivering profiles and of training procedures capable of fostering development in specific areas. This, in turn, opens up issues in the developmental psychology of creativity, and requires answers to questions such as the timing of the necessary cognitive, personal and social development, the reversibility of developmental defects, and the possibility of critical phases in both development and 'remediation.'

Creativity-Facilitating General Teaching and Learning Methods

Various researchers have developed and tried out special approaches to teaching and learning that can be applied in the classroom in all disciplines and at all age levels, and focus not only on thinking skills but also on motivation, attitudes and personal characteristics. These include:

1. *Discovery learning*: Working alone or in small groups students examine contents to discover hidden or unexpected connections or structures, either physically or, more usually in the form of recurring regularities, categories, rules, or irregularities, incongruencies and problems. For instance, a physics class could tackle the task: In what way are an electric motor and a prism similar?
2. *Play learning*: Play is free of the constraints of the strictly logical. Risks can be taken without fear of real life consequences, rules can be broken, the impossible can be tried out, fantasy can be given free rein. An example could be: Act out a scene showing what would have happened to the Plymouth Brethren when they reached America if the Viking settlement hundreds of years earlier had been successful.
3. *Learning via problem solving*: A gap, difficulty or open question is the starting point for the learning. The problem has to be defined, relevant information collected, and solutions

suggested. The suggestions can be developed in a play-like atmosphere with the advantages listed above, or they may be required to be strictly reality-oriented. In the latter case, the relationship to reality must be managed in such a way that risk taking is not inhibited by the stringent requirements. An example might be: How could you build a perpetual motion machine?

4. *Learning via structural analysis*: A given situation has to be broken down into its constituent elements (in some ways the opposite of discovery learning) and the rules or principles of its structure identified. Suggestions, including fanciful ones, can then be made for ways of changing elements or their connections with each other. English students could be asked: How could you turn *Macbeth* into a comedy?

In all these suggestions, surprising, unorthodox, even apparently absurd suggestions are tolerable and can be pursued. However, the point is not to encourage blind guessing, random answers or ridiculous responses. A child who gave the answer, 'Eat more bananas,' to the question, 'How could you build a perpetual motion machine?' would be asked to explain further.

Closing Remarks

If all children's creativity is to be fostered effectively in the classroom, it seems unlikely that narrow, limited exposure to cookbook creativity-facilitating exercises will achieve the desired effects. Although limitations of space preclude a detailed discussion here, this is especially the case with children from disadvantaged groups and children of low intellectual ability. What is needed is an approach in which all aspects of teaching and learning adhere to basic principles for fostering creativity. Children need contact with complexity, with ambiguity, with puzzling experiences, with uncertainty, and with imperfection. The task for teachers is to challenge children to be open for the novel; to give them courage to think for themselves and to seek the new; to show respect for children and their achievements in order to foster in them self-confidence and high expectations. These tasks involve not only intellectual, but also personal, motivational, emotional, and social aspects of creativity. What is needed was put with great clarity about 100 years ago by the German educationist Wilhelm Rein (I have translated his words with a certain artistic license):

You cannot become creative merely by reading books on creativity. However, simply daubing paint on canvas, making up doggerel or stringing notes together does not make you creative either. Above all, two things are necessary: creative potential on the one hand, and schooling that takes creativity seriously on the other [emphasis added].

See also: Definitions of Creativity; Divergent Thinking; Everyday Creativity; Mental Health: Affective Disorders; Moral Issues in Creativity; Play; Problem Finding.

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- <http://www.brainstorming.co.uk> and <http://www.synecticsworld.com> – Information on brainstorming and synectics.
- <http://www.mycoted.com/creativity/techniques/> – Lists more than 200 procedures for fostering creativity, including some of those mentioned in this chapter.
- <http://handle.tamu.edu/1969.1/2338> – Scholarly, research-based review of the effectiveness of creativity training.
- <http://www.cpsb.com> – The Creative Problem Solving Group.
- Mindmapping software is available from a number of sources (e.g., www.visual-mind.com).
- Training in TRIZ is commercially available (e.g., <http://www.Altshuller.ru>).

Teams

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Glossary

Diversity The variation among team members in personal characteristics such as expertise and demographic characteristics.

Electronic brainstorming Generating ideas by means of computer systems.

Innovation The development and implementation of new products or ideas.

Interdisciplinary Team collaboration that involves the integration of knowledge or expertise to develop new concepts or approaches.

Multidisciplinary Teams that represent different disciplines working on a common goal.

Production blocking The inability of individuals in groups to express ideas as they occur since only one idea can be effectively expressed at one time.

Psychological safety The feeling that one is free to express one's ideas or develop innovations without fear of negative reactions from one's fellow team members or the organization.

Self-managing teams Work teams that have a large degree of autonomy in how they perform their tasks as a team.

Transformational leader A leader who has a strong vision and inspires followers to take a creative or problem solving perspective to their tasks.

Virtual teams Teams that are typically geographically dispersed but interact through various media to accomplish their tasks.

Teams

Teams are groups of individuals who work together to accomplish a task or series of tasks. Many tasks are accomplished by ad hoc teams brought together temporarily to accomplish a task in a specified period of time such as committees or task forces. Other teams are part of organizations and work together over an extended period of time on a variety of related tasks. One of the key characteristics is that teams are interdependent – that is team members depend on one another for the successful completion of their goals. This often presumes that team members vary in their expertise and have to effectively coordinate their activities to optimize their performance. There is an extensive literature on teamwork that suggests that working as a team can indeed enhance overall performance of tasks including creativity tasks. Although teams are often embedded in organizations and have an extensive history with their fellow team members, much research on creative teams and groups involves interactions on specific tasks during limited periods of time in laboratory settings. This research is similar in scope to that done under the label of group creativity. Studies of longer term creative teams are often in the form of case studies. Much of the research on team creativity involves the use of self-report measures of the processes and the outcomes. This is potentially problematic in that the use of such a methodology may not reflect what is actually occurring in teams. Studies of work teams in organizations that use objective measures are relatively rare. Most studies using objective measures of creativity involve laboratory studies of group creativity. Of course, these laboratory studies may have limited applicability to the understanding of creativity in long-term and specialized teams. However, there is considerable overlap in the findings on innovation in work teams and creativity in laboratory groups. Thus, the results from both areas of study appear relevant to understanding the creativity of teams.

Creativity Versus Innovation

The literature on creativity in teams tends to use the term innovation rather than creativity. This may in part reflect a bias in terminology by researchers in organizational behavior who are trying to appeal to the business world. The world of business and industry is interested in innovation or the development of new products or services that are useful and have a positive economic impact. Just because a product or idea is creative does not mean it is going to be useful. So the criterion of usefulness or feasibility is an important one. However, innovation is also often reserved for implementation of ideas generated during a prior creative phase. Creativity is seen as an exploration phase of generating novel alternatives or solutions, and innovation as a phase of exploiting the ideas toward some useful end. Although it is presumed that different principles govern the different phases, our assessment of the literature suggests that many of the same factors that influence creativity also influence innovation. Successful exploitation or implementation of ideas also requires creative thinking. This thinking may not be as radical or divergent as that in a prior exploration phase but is creative nonetheless. Moreover, in many studies of team innovation, there is not a clear distinction between the exploration and exploitation process. So in our summary of the team creativity literature we will ignore the innovation/creativity distinction, except in our discussion of the phases of the creative process.

Basic Processes

Team creativity involves social interaction and collaboration. That is, team members engage in a variety of social activities in order to complete their tasks. In the early stages they may have

discussions about goals, task distribution, coordination, feedback systems, and compensation. If they are involved in a creative task there is at some point a process of sharing ideas about a particular issue or problem. This may be followed by some evaluation of the different ideas and possible implementation of the most promising ideas. These processes may be repeated in different sequences during the life of the team. The focus of this entry is on the creative or ideational phases of the team process since there is a significant literature on this issue. The initial planning and later innovation stages may involve somewhat different processes.

Theories of collaborative creativity have recognized both the social and cognitive forces that play a role. Some theories have emphasized the cognitive aspects of collective ideation. As individuals share ideas they need to search their memory or knowledge base for relevant information or ideas. When these ideas are shared in a team, they may stimulate others to think about related issues. So collective sharing of ideas should increase the range of topics or issues that are discussed and lead to mutual stimulation of ideas. Of course this requires careful attention to the shared ideas and thoughtful relating of these ideas to the knowledge or memory base of each team member. This may be facilitated by some intermittent opportunities to reflect on the shared information. At the same time, the idea sharing process may provide a social stimulus for increased effort as team members compete in trying to come up with more and better ideas. This would be particularly true if there is some degree to which individual group member contributions can be identified and recognized. It also appears important that team members function effectively to seek help and give help at critical times in the creative process. This process needs to be reinforced by positive experiences in the group and a supportive organizational culture. However, the social context can also hinder the creative process because of concern about deviating from normative group expectations and there may be a tendency for group members to focus on areas of agreement rather than their potentially unique perspectives. A fundamental process in team creativity is the communication among team members and with other teams. This process appears to be strongly related to team creativity, although there is some evidence that too much communication can be detrimental. A high level of communication may distract one's focus on the task or may involve task irrelevant as well as task relevant information. Irrelevant information may make it more difficult to focus on the essential aspects of the task.

Factors Influencing Team Creativity

Much of the research on team creativity has examined the factors that influence the degree to which teams, especially work teams, develop creative ideas, or innovations. The basic presumption is that the composition of the team, the characteristics of the team members, and the task and social context of the team will influence these outcomes. This presumption is consistent with an input-process-output perspective of teamwork. This perspective focuses on the person, team, and context characteristics that influence the team processes that in turn affect the various outcomes such as performance, satisfaction, and team viability. This framework provides a useful

means for organizing the presentation of the major findings. We will summarize the major factors that influence the team processes and the resultant degree of creativity.

Team Member Characteristics

To a large extent the innovativeness of a team depends on the personal characteristics of the team members. The higher the creative ability of the individual members, the higher will be the creativity of the team. Teams whose members who are open to new experiences, extroverted, and have a divergent thinking style are more likely to be creative. It also is beneficial if team members have a positive attitude toward the team. The teamwork literature suggests that it is important for team members to have a range of team relevant skills such as shared leadership, coordination, performance monitoring, and adaptability.

Team Size

Teams can vary greatly in their size, depending in part on their scope and the complexity of their task. Complex and multifaceted problems may require a wide variety of expertise on the team. Since larger teams are more likely to consist of members with diverse perspectives and skills, it is not surprising that larger teams are associated with more innovation. However, large teams may also have drawbacks since they may reduce the extent to which individual members feel accountable or important to the rest of the team. Thus there may be some loss of individual motivation. Moreover, in large team meetings it may be difficult for all team members to effectively contribute because they have to share the available discussion time. It appears that the ability to express one's ideas as they occur is important in one's ability to generate a flow of ideas. This interference effect due to having to coordinate the expression of one's ideas in the group is known as production blocking. Therefore, it may be best to keep the team as small as possible while still providing the range of expertise needed.

Diversity

One of the benefits of bringing team members together on a creative task is to take advantage of their diversity. Diversity represents the variation in personal characteristics of team members. Team members can vary in their demographic characteristics such as race, gender, age, tenure in the organization, personality, status, values or beliefs, knowledge, experience, and expertise. Each of these characteristics may make interacting with other team members interesting, but research has found that most people prefer to interact with people who are similar to themselves. So there may be a social bias to homogeneous groups or teams. In diverse groups, group members may be somewhat uncomfortable in sharing their ideas or perspectives since they may conflict with those of other group members. Groups often like to gain a consensus based on common perspectives, as seen in cases of groupthink in decision-making groups. So individuals in groups may be more responsive to an idea or information which is familiar rather than one that is different or unique. As a result most reviews of the literature have found that overall diversity is not related to enhanced performance in groups or teams. There is

some evidence that demographic diversity can enhance creativity. However, it appears effective tapping of diversity requires that group members have a positive disposition or attitude to interacting in diverse groups and that they are either intrinsically or extrinsically motivated to take advantage of the diverse ideas or information shared by the team. Intrinsic motivation requires a strong personal interest in the creative activity and learning from others. Extrinsic motivation involves social or organizational incentives (such as financial incentives or prizes) that motivate team members to work hard. Under such conditions team members may carefully process or elaborate the shared ideas and information and come up with potentially innovative ideas based on the diversity of perspectives present in the group. However, the type of diversity is also important. It is often assumed that intellectual or cognitive diversity is more likely to lead to team creativity than social or demographic diversity. Diversity that is mostly social such as demographic or value diversity may not have much influence on creativity unless it is relevant to the team task. Thus the development of an advertising campaign for diverse populations may benefit from demographic diversity, but this type of diversity might not have a positive influence on the development of some innovation in healthcare. This type of innovation will probably require people with diverse expertise or experience relevant to that issue. Research suggests that job relevant diversity in work teams is related to creativity while diversity in background or demographic characteristics is not.

Interdisciplinary Teams

The diversity in interdisciplinary teams should be helpful to creativity. Interdisciplinary teams consist of individuals who are experts in different areas relevant to some task or goal. In science this may involve scholars from different disciplines, in technical fields they may consist of people with different expertise, and in work settings they may involve employees from different departments or divisions. The presumption is that for broad problems or initiatives, a broad range of expertise or knowledge will be required. Teams that include individuals that represent these divergent perspectives or areas of expertise will be better able to solve complex problems or come up with creative solutions or ideas. One can make a distinction between multidisciplinary and interdisciplinary teams. Multidisciplinary teams involve team members from different disciplines coordinating their efforts to achieve a common goal. This type of collaboration primarily involves the use of complementary areas of expertise required to accomplish a goal. Interdisciplinary teams require a higher level of collaborative interaction that involves the actual integration of knowledge or expertise to create new concepts, theories, techniques, or approaches that go beyond what was possible in any one of these disciplines. Members of multidisciplinary teams have to effectively coordinate their various contributions to achieve the group goal. They also need to understand each others' areas, and this level of enhanced mutual understanding may allow the team to reach new levels of technical development.

Achieving mutual understanding in interdisciplinary groups may be difficult. Groups tend to focus on areas that they have in common, in part because such common understandings have obvious validity to the team members and provide a sense of

cohesion. It may be difficult for team members to understand each other's unique areas of expertise unless they have broad training or expertise. With the increasing specialization in all areas of science and technology, few have the time or inclination to develop the broad expertise to effectively understand and build on diverse areas. However, it may be sufficient if team members have the basic knowledge to understand the exchanged communications. An important issue for future research is to determine the role of depth and breadth of expertise in the creative potential of interdisciplinary teams.

Interdisciplinary teams appear to function best when the context or relationships among team members enhance the communication processes. So teams whose members are located close to each other physically or who are in the same organization tend to be more effective than those who are at different locations. Also, it appears to be beneficial if the team members have some degree of collaborative 'closeness' in that they communicate frequently and have strong interpersonal bonds. This is most likely to occur if team members have considerable experience in working together effectively. In fact, the team members who are at the center of the information flow and are aware of the distribution of expertise in the team tend to perform best. A major benefit of interdisciplinary teams is that they provide the type of conflicting and diverse perspectives that should increase the chances of creative ideas. These potential benefits are discussed in the sections on diversity and conflict.

Turnover

In most teams members change periodically. Loss of members that have key skills or knowledge can be very detrimental to the functioning of the team. The team can also lose some of its cohesion and may have to redevelop its transactive memory systems (knowing who knows what in the group). Although research on the issue of turnover in teams is limited, there is some research indicating that periodic changes in group members can enhance creativity. The new perspectives provided by a new member could stimulate other team members to think more deeply about issues or reevaluate their ideas. However, in reality this effect will also depend on whether this team member is a creative person who asserts him or herself effectively as a new member of the group. Newcomers in groups may have to first establish social ties with other group members and adopt the group norms before they can begin to have an innovative impact on the other group members. The impact of contributions by newcomers to the team is also enhanced if they share a common identity with the group (i.e., they share a common goal, values or personal characteristics). However, this positive effect may only occur if the newcomer makes high quality contributions.

Conflict

When team members share diverse perspectives, there may be conflicts. Conflicts in teams are generally associated with negative feelings, especially if the conflicts are social in nature. However, it appears that cognitive conflicts that involve differences in perspectives can stimulate creativity. Such conflicts can lead participants to reevaluate their own perspectives,

especially if those presenting the conflicting perspectives are persistent and do so in a way that is not offensive to the team. In fact, exposure to conflicting perspectives may increase the tendency to divergent thinking and affect creativity on tasks totally unrelated to the setting in which the conflict was experienced. Apparently, the experience of divergent perspectives increases the extent to which a person is willing to consider alternative perspectives in general. Even though cognitive conflicts can increase creativity among group members, overall performance of the group may not increase. Cognitive conflicts may have negative emotional effects which can inhibit the types of interactions required for the overall effective performance of the team.

Safety

One of the key factors in fostering a creative atmosphere in a team is psychological safety. This is the extent to which group members feel that they can express their thoughts and ideas without fear of negative reactions from their fellow team members or the organizational leadership. When participants have this kind of feeling, they are more likely to share their unique and possibly controversial ideas. In a similar vein, research has found when there is an element of trust among the participants involved in a creative enterprise, creativity is more likely to flourish. Trust represents the feelings that others care about one's well-being and one can count on their support even for the 'risky' activities that may be involved in creative work. In fact, the emotional support for one's creative activities from both fellow workers and from family and friends are important for enhancing creative performance. So team members need to trust one another and to support one another in their creative activities. This does not mean that all the innovative ideas expressed have to be accepted or carried out. However, team members should feel that their creative ideas will get a fair hearing from the team.

Another important source of support is the organization within which the team is embedded. Unless the organization and its leaders support creative activities by the team, the team will not have an incentive to be creative and will not feel comfortable in sharing novel ideas for improving the organization and its various projects. Although psychological safety appears to be necessary for creative teamwork, it needs to be balanced with appropriate levels of accountability. In an 'anything goes' environment team members may be tempted to loaf and may drift in their task focus. Some degree of task structure and specific goals may be needed to keep team members on track.

Cohesion

A psychologically safe environment is likely to be one where team members have positive feelings about one another. Such positive feelings are an important component of group cohesion. Group cohesion is the extent to which group members are attracted to the group and its goals. Cohesion can consist of feelings of interpersonal liking, task commitment, and group pride. Not surprisingly these factors have been associated with enhanced performance in groups and teams. Cohesion should enhance creativity since team members feel comfortable with

one another and are motivated to achieve the team goals. They should not be inhibited in sharing their unique perspectives and should work hard to integrate these perspectives to come up with a novel solution. Cohesion may take some time to develop, so positive effects may not be evident until the team has been together for a period of time. However, long-term teams that are cohesive may not necessarily be optimal for creativity. There may be pressure to maintain the positive team feelings and to act in accord with the group norms or expectations. This may inhibit the sharing of novel perspectives that are contrary to the dominant views of the team. Thus it may be important to balance team cohesion with some degree of membership turnover and active contacts with experts outside the team.

Task Structure

Creativity is generally seen as an unstructured activity in that the participant should be as unconstrained as possible by reality, task structure, and time. There is in fact considerable evidence that periods of time without distractions or other demands can facilitate creative achievements. This is particularly true for individuals who have a strong intrinsic motivation for their creative pursuits. Research has shown that it is important for such individuals to have a high degree of autonomy or freedom in their task activities. Increasing task constraints and applying external pressure for task achievement may in fact reduce such intrinsic motivation and creativity. Autonomy also tends to be important for teamwork. Much research has shown that teams that are self-managing, in that they have a choice in their tasks, task processes, and team procedures, tend to function better than those that do not have such autonomy. Similarly, team autonomy appears to be related to enhanced creativity.

Although autonomy and freedom appear to be important for creativity, some degree of structure may also be helpful. It helps to have clear goals and objectives. The team can collaborate in setting such goals, but there may be some tendency to set 'attainable' goals rather than challenging goals to avoid the experience of failure. It should also be clear the goals are for creative production. If the organizational context provides psychological safety, group members may feel it is 'safe' to select ambitious goals. These goals can vary in the extent to which they emphasize originality and feasibility or applicability. Although mutual goals of innovation and feasibility can be seen as conflicting, some research indicates that such dual goals can in fact be quite effective in promoting both originality and the generation of feasible products or ideas.

Although external pressures or incentives can reduce creative motivation, this is not inevitably the case. When these external forces are seen as external control, it may lead to reduced intrinsic motivation. However, when the external forces are perceived as confirming one's competence or enabling one to do an intrinsically interesting task, they may actually increase overall motivation. Competition within the team or with other teams may be one such external motivator. Performance feedback or the provision of challenging goals may have similar positive effects on the creative production of teams. In addition to having some 'directive' social contexts, the task context is also important. In particular it appears that it

is useful to have some degree of task structure. Breaking a task into its subcomponents, providing brief breaks during long idea generation sessions, and providing clear instructions about how to efficiently share are important in increasing the number of ideas generated.

Therefore, in order to increase team creativity, intrinsically motivated group members should be given a high degree of autonomy and time to perform the task without distraction. The development or provision of clear, challenging but attainable goals, performance feedback, and intra- and intergroup competition can increase motivation without decreasing intrinsic motivation. Although many see creativity as an unstructured activity, certain procedural guidelines (e.g., breaks) can improve team creativity.

Training

Although there has been considerable research on training creativity, there has been very little systematic research on the training of group or team creativity. While experience in creative groups may be beneficial, it may also lead to the development of task procedures which are not beneficial to enhancing team creativity (such as the amount of time spent in group interaction). Although the creative process in a particular team may appear to be quite successful, team members typically do not have a clear basis for assessing how effective they have been. Research that has used control groups as a reference point has found that providing groups training that includes practice and the reinforcement of efficient sharing strategies can increase the quality of ideas generated.

Leadership

It is typically presumed that groups need leaders for effective performance. There is a massive literature on leadership in general and considerable data on leadership for groups. Group leaders may be external such as bosses who assign tasks to teams. Teams may also have internal leaders who are actually members of the group. These leaders may be assigned, elected, or may simply self-select to this position in the absence of any clear structure. In general, it appears that team creativity can be enhanced by leaders that provide a clear vision or goals, provide support for innovative activities, and develop a climate in which team members feel it is safe to explore creative directions. It appears that both task oriented leadership (structuring the task, setting goals, directing interaction) and relationship or participative oriented leadership (concerned with good relations and encouraging personal initiative) can enhance team innovation. Participative leadership may be most helpful in the early idea generation stages of the innovation process while the task oriented leadership may be more helpful in the implementation phase. Many studies find that the most effective leader for creative teams would be a transformational leader. These leaders provide individual mentoring, encourage challenging old assumptions, and inspire by sharing their vision and setting high expectations. Teams may also exercise 'self-leadership' if they have considerable autonomy. Such leadership may take the form of shared leadership with different members leading different aspects or phases of the task. Such shared leadership requires effective skills in knowing how to

allocate task components and when to switch leaders. Teams will need some extensive experience or training to develop such adaptive routines. This may involve 'coaching' group members to optimize motivation, task allocation, and appropriate alignment of task routines with task requirements.

Summary

Team creativity appears to be influenced by a broad range of factors. Teams composed of members with certain personal characteristics and task and creativity relevant skills may be most creative. It can also be beneficial if teams have sufficient members, diversity of task relevant expertise, and some degree of turnover in membership. Team cohesion and a degree of psychological safety can also enhance creativity. To attain an optimal level of creativity, teams will need some degree of task structure, training, and effective leadership.

Implementation of Ideas

The process of generating ideas in teams is often followed by an implementation or innovation phase. Creative thinking involves coming up with a number of novel perspectives, but innovation involves selecting one of these perspectives for actual implementation. Innovation requires a process of selecting the best or most feasible ideas for implementation. This may involve a different skill set than that involved in divergent thinking. In fact, ideas that are rated as novel also tend to be rated as less feasible. So it might be best if the innovation process was not conducted by those who actually came up with the idea but by those who have a good sense of what it takes to successfully implement and/or market a particular idea. So an organization might have a team of creative types for generating novel ideas and a team of more technically oriented implementers. This makes sense from the perspective that one can select members for teams depending on their strengths and skills. Team members who score high on creativity do indeed function more effectively in creative teams. In contrast, individuals who are good at evaluating the feasibility and applicability of alternatives may be best suited for development teams. However, in reality the creativity and innovation phases may be difficult to separate. Implementation also requires a good degree of creativity to come up with an effective product or process. In addition, if there are some problems in the implementation stage, it may be necessary to take a fresh creative look at alternatives. Some of the research we have cited indicates that groups can be quite effective with the joint goals of originality and feasibility. Future research will need to determine more precisely the conditions under which separation of creativity and implementation is more effective than a mixing of these phases.

Electronic Brainstorming

With the increased availability of digital means of communication such as email, cell phones, and computer networks, there is much potential for creative collaboration by electronic means. If group creativity is construed primarily as a process of mutual cognitive stimulation, electronic communication

should be as effective as face-to-face communication. In fact, research on electronic brainstorming in which participants share ideas by means of various group information sharing systems has found that electronic exchange of ideas can be more effective than face-to-face exchanges, particularly for large groups. This may reflect the fact that electronic exchanges avoid the production blocking inherent in face-to-face settings. One potential disadvantage of electronic exchanges is that it may be more difficult to build cohesion when the interacting members are working from distant locations. Interpersonal ties may be important in motivating interactions among group members and may facilitate understanding of each other's ideas. Electronic interactions also vary in the richness of interaction modalities. Some may be limited to written exchanges of information while others may involve visual and auditory interactions through the use of video technology. Richer technologies may allow for more effective communication of meanings since they provide for the exchange of various linguistic and paralinguistic cues.

Virtual Teams

There has been an explosion of the use of virtual teams (VTs) in organizations. Like other teams, VTs are comprised of multiple individuals who have some degree of task interdependence, shared goals, and work within an organizational setting. Unlike other teams, VT members are geographically dispersed and rely on technology to communicate. VTs are often distinct in their ability to develop some way to archive the shared ideas and information for later review and the ability to expand the team as needed through electronic means. However, in most ways the creative process in VTs seems to follow similar patterns and processes as co-located teams. There also is often a mix of face-to-face and virtual interaction in such teams. Initial ideation sessions tend to be face-to-face, maybe in part to develop some level of bonding or cohesion. During the development stage, teams tend to work electronically. Evaluation activities are typically done face-to-face. There is not much research to establish whether these are optimal practices. Research with electronic brainstorming suggests that in contrast to VT practice, ideation may be best done electronically. However, this literature supports doing evaluation or decision-making face-to-face.

VT members need the same general skills, knowledge, and attitudes as their co-located counterparts, but also need to have the ability to use technology. Training in such skills has been found to be beneficial. One potential advantage of the VT may be that it can minimize some of the negative emotional reactions observed in face-to-face groups for teams high in demographic diversity. Demographic differences should be less salient in virtual interactions. Thus the information may be processed without regard to interpersonal differences. However, there may also be conflicts about preferred modes of communication among individuals from different cultures. For those from high-context cultures the meaning of messages is determined through an understanding of the context in which it is presented. People from low context cultures primarily focus on objective or factual information in the exchange. Thus communication rich

technologies may be required for effective interactions with individuals from multiple cultures.

Although VTs may not have much in-person interaction, feelings of connection or cohesion still appear to be important. Highly creative VTs tend to have a high level of involvement with and commitment to the group task. It is also important for a VT member to have some sense of psychological safety and trust in their colleagues in order to enhance creativity. Conflicts in VTs may have negative effects that may be hard to resolve without a chance for personal interaction. Thus it is possible that it may be more difficult to observe beneficial effects of cognitive conflict on creativity in VTs.

Summary

Team creativity is influenced by a range of cognitive and social factors. Team members need to be highly motivated and to carefully process the shared information or ideas in order to develop creative products. Teams need both autonomy and some degree of structure and goals to function at a high level. A psychological safe environment, participative or transformational leadership, and training appear to facilitate creative team performance. Implementation of creative ideas also seems to benefit from some of the same factors, but groups may not be particularly effective in selecting the best ideas for implementation. Diversity, conflict, and turnover of membership can both facilitate and hinder creativity. Electronic exchanges of ideas among team members can be quite effective. Studies of virtual teams suggest that they may have some unique features but that their performance is governed by the same factors as conventional teams.

Our review suggests that there is no simple recipe for creative teamwork. Many of the factors we have discussed can have both positive and negative effects depending on their level or other factors. In general there seems to be support for a sort of 'balance' perspective. Teams should be large enough to do the job, but as small as possible. Some degree of diversity, conflict, and turnover can increase creativity, but too much will backfire. Psychological safety and cohesion are important, but too much may make the team members too comfortable with the *status quo*. A high degree of autonomy may motivate creativity in teams, but without some degree of structure, external goals and effective leadership, the team may not accomplish much. Some degree of virtual interaction among team members may facilitate the exchange of information and ideas, but face-to-face sessions may be needed to deal with more complex problem solving and decision aspects of the creative process. So organizations that foster teams will need to be sensitive to balancing these various dimensions to optimize the creative performance of their teams.

See also: Creativity Training; Divergent Thinking; Group Creativity; Innovation; Leadership; Rewards and Creativity.

Further Reading

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Sara Teasdale 1884–1933

D Lester, The Richard Stockton College of New Jersey, Pomona, NJ, USA

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Glossary

Affective disorder Depression severe enough to warrant a psychiatric diagnosis.

Depression A mild emotional state, formerly known as melancholia, which does not warrant a psychiatric diagnosis.

Personality disorder A psychiatric diagnosis involving a chronic maladaptive lifestyle which impedes the individual's success or happiness.

In a study of creative women by David Lester in 1993, he noted that suicide seemed to be especially common in female writers and artists. Did these women commit suicide because they were *women*, because they were *creative*, or because they were *creative women*? It is not because they were women since men engage in fatal suicidal behavior at a much higher rate than do women, although women do engage in nonfatal suicidal behavior at a much higher rate than do men, as discussed by Lester in 1984.

Suicide may be more common in creative women because they are *both* creative and women. It may be that the path of the woman who chooses to be creative is far less easy than that of a man making the same choice. The opportunities may be fewer for creative women, the prejudice against their work greater, and their rewards fewer. In his study of 1993, Lester compared six creative women who completed suicide with six creative women who died from natural deaths. He found that the suicidal women were affected by the reception their work received. Dora Carrington appears to have lost confidence in her ability as a painter, Sylvia Plath had just published her first novel to luke-warm reviews, Sara Teasdale was experiencing severe writer's block, and Virginia Woolf was acutely anxious in the time leading up to publication of her novels and often received negative reviews.

It was also clear that depression, both of psychiatric proportions and of moderate intensity, played a role in almost all of the suicides. Diana Arbus, Sylvia Plath, Anne Sexton, and Virginia Woolf had affective disorders, while Sara Teasdale was depressed, and four of them had made previous suicide attempts (Dora Carrington, Sylvia Plath, Anne Sexton, and Virginia Woolf).

The life of Sara Teasdale (based on a biography by William Drake in 1979) illustrates some of these issues.

Sara Teasdale

Sara Teasdale was born on 8, August 1884 in St. Louis, Missouri. She was the fourth born, with a brother George aged 20, a sister Mary (Mamie) aged 17, and a brother John aged 14. She was christened Sarah Trevor Teasdale, but later dropped the final "h". At home she was known as Sadie.

Sara's father had intended to study law but went into business at the age of 17 after his father died suddenly. He had been

successful, ending up as a wholesaler in dried fruits, beans, and nuts. He met his wife at the Third Baptist Church, where they were married in 1863, and they remained devoutly religious. At Sara's birth, her mother was 40 and her father was 45. Sara was almost like a grandchild in the family, only five years older than the first grandchild.

The dominant parent was her mother. Like her daughter Sara, she had a sickly childhood but became transformed upon marriage. Now she was an energetic and domineering mother. Sara's biographer speculated that to have had a daughter at the age of 40 was unseemly in Victorian times. It advertised the fact that she and her husband still engaged in sexual intercourse. Her determination to bring her daughter up as the model of gentility was possibly an attempt to compensate for this shadow on her virtue.

Sara was watched over anxiously from birth and had an early tendency to frailness. She was never strong, got colds easily, and was easily exhausted. When she caught a cold, she was treated as if she had pneumonia and put to bed. For much of her life, her family hired a nurse to be with her to ease the burden of daily tasks and see that Sara did not overtax her strength. Drake suggested that this concern for her led to Sara's life-long anxiety about her health. Her mother crippled Sara by her kindness and lavish concern. Sara's sickness was not a *cause* of her lack of energy but rather it was a *result* of Sara trying to suppress her energy.

Sara was not exceptionally beautiful, and she always regretted this. She was indulged, surrounded by luxuries, given whatever she needed, and excused from household responsibilities. Sara never cooked, mended, or cleaned house. Sara was a placid, sweet-tempered, and obedient child who learned to inhibit her hostile impulses. Drake reprints a photograph of Sara at age five, looking cute for the photographer, but clenching her right fist by her side, perhaps to help her suppress her inner feelings.

Sara was taught at home until she was nine. Thereafter, she attended private schools. Her parents discouraged her from playing with other children because of her frailty, and she became rather shy. At school, Sara did not go to parties, engage in athletics, or have typical teenage fun. She was asked to be on the commencement program, but she declined the honor.

Although her parents were not especially interested in literature, Sara soon developed a passion for it, and her older brothers and sisters encouraged her poetic gift. The schools she attended gave her an excellent education in literature and

the arts so that, even without a college education, Sara was well-read and informed.

The Young Adult

At school, Sara made several close friends and, after graduation, this group formed the nucleus of a group of women interested in the arts. They called themselves the Potters, and they decided to produce an artistic monthly magazine containing their literary and artistic efforts. Each month they produced just a single copy of *The Potter's Wheel*, from November 1904 until October 1907, a total of 36 issues in all. The group also wanted to improve their skills, and so criticism was encouraged. Sara's poems first appeared in print in this magazine, and her first published book of poems contained many of these poems. From the beginning, Sara was very conscientious about her writing and distressed by flaws in her poems. She worked hard to improve them and relied on her associates for constructive criticism.

Friendship with women continued to play a major role for the rest of Sara's life. In the Potters, Williamina Parrish played a prominent role, helping her organize the poems for her first collection. The women in these years played a nurturing and guiding role, taking the place of her mother in supporting her, and Sara always seemed to need one of them to help her complete a book of poems (after Williamina Parrish, there was Marion Stanley, Jessie Rittenhouse, Marguerite Wilkinson, and finally Margaret Conklin). Later, however, she became less dependent upon them, and her final friend (Margaret Conklin) was more like a servant/daughter to Sara. In Sara's early years her heroes were women – Sappho, Guenevere, and the modern Eleonora Duse. Nonetheless, she also needed fantasy male figures for her love poems. Until she was age 28, though, the lovers about whom she wrote poems were almost entirely imaginary.

In 1905, Sara and her mother took a trip abroad for three months. By the time the boat reached Greece, which for a long time had fascinated Sara, she was ill with a fever. But she managed a little sight-seeing and recovered enough to visit the Holy Lands, Egypt, Italy, Paris, and London. Sara enjoyed the trip immensely and took many trips abroad during the rest of her life.

The fame of *The Potter's Wheel* spread through the literary circles of St Louis, eventually reaching the attention of William Reedy who ran the *St Louis Mirror*. He included a piece by Sara for the first time in May 1906, and her pieces in the *Mirror* soon began to establish her reputation as a lyric poet.

In 1907, *Poet Lore* accepted one of her sonnets and later that year produced a book of poems for her which her family had to subsidize. Reviews of the book, in *The Saturday Review* of London for example, were favorable. In 1908, she had a poem accepted in *Atlantic Monthly*, and Putnams brought out a book of her poems in 1911. Reviews in *The New York Times* and *Current Literature* praised it, and she became a member of the recently founded Poetry Society of America. From the first, Sara had the tenacity to submit her work again and again to periodicals until it was accepted. She shrewdly sent copies of her books to supportive reviewers, and she cultivated friends in the literary field.

Sara continued to live at home, in a suite of rooms on the second floor, with a door isolating her from the rest of the

house. Friends did not drop in on her casually. Rather, close friends had fixed, scheduled meetings, and their visits were kept brief so as not to overtax Sara's health. There were two main sides to Sara: this distraught, sickly person who withdrew into isolation versus a witty, intelligent, and candid companion. However, this latter social side appeared only with those whom she knew well, and Sara preferred to develop new relationships through exchanges of letters.

There is no evidence that Sara was especially sickly. She had illnesses and fevers to be sure, but perhaps no more than the average person. When she involved herself in social activities, she experienced desires in her that she could not cope with. At this point, she would retreat into exhaustion and sickness and withdraw to a clinic or a hotel away from everyone to reorganize herself. Sara herself once wondered whether, had she been born into a poor family, she would have had better health! More likely, if she had not been so suppressed as a child and so repressed as an adult, she would have had no need for retreating into sickness.

In both 1908 and 1909, Sara's health continued to be poor, and so she spent some time in San Antonio and at a hospital in Connecticut hoping to recover. Thereafter, when life became too much for her to handle, she escaped to this hospital under the guise of being sick. In San Antonio, she made the acquaintance of another poet, Marion Stanley, with whom she developed a close friendship. Marion tried to get Sara to see herself honestly and to get out of the path of sickliness she had entered. However, even though every visit back home to her parents and St Louis brought on depression (and a desire for death) and a retreat into the patient role, Sara did not appear to have the strength to leave home and try to build a healthy life for herself. Sara was overwhelmed by the aggressive vitality of her mother, and the patient role was how she and her mother had learned to relate to each other in a semblance of a loving relationship.

In 1909, though, Sara decided that she did not want to live at home with her parents forever, especially with her domineering and suffocating mother, but neither did she want to be independent and support herself. (If she ever had to do that, she said, she would kill herself.) She decided that she needed a husband to support her, and she began to look around.

In 1908, Sara had begun a correspondence with a poet in New York City, John O'Hara, which developed into a life-long friendship. However, Sara developed an infatuation with O'Hara that was fueled by her fantasies about him made possible by the fact that she had never met him face-to-face. Indeed, she was scared by the prospect of real love and avoided meeting O'Hara on several occasions. She eventually met him in the January of 1911 and realized that he was not suitable as a partner for her.

In 1911, Sara persuaded her parents to let her go to New York (at age 27, she still needed their permission), and she began visiting New York for meetings of the Poetry Society, building up close relationships with writers there. When away from New York, she kept in touch with friends there by letter. Interestingly, when she was in New York, Sara showed little of the exhaustion and illness that plagued her in St Louis.

In the summer of 1912, Sara and Jessie Rittenhouse took a trip to Europe, and on the boat back Sara met Stafford Hatfield, an Englishman, with whom she became infatuated. It is not

clear whether he wanted Sara to become his lover or return to England with him. But Sara could not cope with her anxiety, and she fled back to St. Louis. From afar, Hatfield no longer was as interested in Sara as he had once seemed, and eventually he ended the relationship. This episode persuaded Sara that she had to plan more purposefully to get married or else she would remain a spinster. Since erotic emotions frightened her, perhaps rationality could find her a husband?

The next romantic figure was John Wheelock, also a poet. But though Sara fell in love with him and gave him every opportunity to declare his love for her, he never did. In 1913, Sara began a correspondence with Vachel Lindsay, also a poet, and they finally met in 1914 in St. Louis. After this meeting, they wrote to each other more often, and eventually Vachel fell in love with her. However, in 1914 Sara was introduced to Ernst Filsinger, who was running a shoe business in St. Louis. He too was attracted to Sara, and soon Sara had to choose which one to marry. John Wheeler was still the man she loved, she thought, but he did not want her. So she had to choose from two men, neither of whom she loved, but both whom seemed to love her.

In 1914, Sara's father had suffered a stroke and her mother's health was also poor. These events happened at a critical point for Sara. The poor health of her parents made the question of what would happen to her once they died more urgent. Vachel was poor, too full of energy and too egocentric to be a caring husband for Sara. Ernst appeared to fit the role much better. Their interests and natures seemed harmonious, and he appeared to worship her. He would make a good husband and father for her children. Despite Sara's misgivings, which she did not tell anyone till many years later, they married in December 1914 in St. Louis.

The marriage was a disaster from the beginning. Sara could not abide sleeping in the same bed with a man, and so they always had separate bedrooms, at home, in hotels, and even on board boats. Sex too, apparently, was a disaster. Sara developed a bladder problem that caused excruciating pain soon after the wedding which lasted for two years and probably limited their sexual relationship. More importantly, Sara never felt passion for Ernst.

Life must have been difficult for Sara at this point. She had chosen the conventional life of marriage partly to get away from her parents, partly for security, and partly because she was a conventional person who expected to live conventionally. But since love was missing, and passion too, she had failed. She was faced with a difficult interpersonal relationship, an absence of love, and probable future unhappiness. Sara had one solution open to her. She retreated into illness again.

Sara and Ernst made their home first in St. Louis and then in New York City, and they chose to live in hotel apartments to spare Sara the strain of running a house and staff. Ernst was proud of Sara's poetic talent and encouraged her in every way he could. Her third book of poems appeared in 1915 from Macmillan, again receiving excellent reviews. And her next book of poems in 1918 received a prize that was the forerunner of the Pulitzer Prize.

Married life soon developed a clear pattern. Sara continued to write poems and edit collections. Ernst became involved in international trade and was called upon to travel the world widely, but at a pace that would strain Sara too much. So she stayed in New York and took trips to secluded spots around

America. Sara continued to feel frail, so that even socializing was restricted. She would send Ernst in her place occasionally to read her poems and to important meetings, and even to social events with her friends for company. Ernst screened her mail when she was away and occasionally handled her business affairs. Sara even turned down honors because they would involve evening dinners or travel.

Very soon a conflict developed in their relationship. Ernst's new job, after his shoe business went bankrupt, was in international trade. He became an expert on the topic. He gave talks all over America and traveled all over the world. Sara encouraged him in this, since she wanted him to be successful and she also wanted financial security. But she also resented the fact that he threw himself so energetically into his work (which he may have done in order to cope with the frustrations arising from his marriage). She was continually telling him to take it easy.

Then again, she missed him a lot at first when he began to travel although, after he came back, she seemed unable to cope with him in their apartment. She would become depressed, fall ill and go to her hospital in Connecticut or to a favorite vacation spot. In fact she seemed most content by herself in hospital or resort hotel as long as Ernst stayed in New York City.

However, much as she found life with Ernst difficult, at least his presence kept her depression at bay and took her mind off self-destructive thoughts. Ernst's absences brought Sara closest to feelings of love for him.

Surprisingly, in 1917 Sara became pregnant. Although she had thought she wanted to be a mother, the reality of it now threatened to interfere with her career. More importantly, it threatened her role as a patient. How could Sara cope with taking care of someone else? So she had an abortion. Of course, she could justify an abortion on the grounds of her frail health, but she possibly felt some guilt over her decision. (It is not clear whether Ernst knew of this.)

For much of their life, their financial position was not secure. Though they could afford a comfortable life style, especially supplemented by Sara's earnings from her writings, in early years they had to borrow from Ernst's family to get by. Sara considered ways of increasing her contribution to their income, but she never did much about it.

The absences caused by Ernst's traveling grew. In 1920 and 1921, they were together just six weeks in a period of a year and a half. Sarcasm grew more common between them, they brought up old annoyances, and they readily got hurt over new trifles. Ernst grew more defensive, moody and irritable, and his explosive temper showed itself more.

The Divorce and Final Years

Sara's decision to divorce Ernst in 1929 came as a surprise to her friends. Sara feared abandonment, and this fear had been made worse by his frequent absences. Eventually she began to fear that he would be attracted to another woman. This was possible, of course, since she would not be his lover and since he was away a lot. However, there is no evidence that Ernst ever behaved in any way as to reinforce these fears.

She had discussed divorce with Ernst before, but he had protested. So she planned the divorce in Nevada while he was away. She divorced him for mental cruelty and begged him not to contest it. Although she expressed euphoria at being free,

when she was back in New York, she soon sank into a depression. After the divorce, Sara lived in hotel apartments by herself, just as her marriage had consisted of living in hotel apartments mainly by herself while Ernst was away. Her life changed little, except that Ernst no longer made occasional visits!

Sara met a young student, Margaret Conklin, who became her close friend in her final years. Margaret would visit daily, and they went to Europe together. However, interestingly, Sara showed little concern for Margaret. She ate meals sent up to her from the hotel in front of Margaret without ever worrying whether Margaret had eaten. Sara had been in the patient role all of her life, with others taking care of her, so that she had never learned that sometimes one has to take care of others. If Margaret upset Sara in some trivial way, she would even be banished for days at a time.

Sara grew more inflexible. She still gave friends specific appointment times for their visits, and now she kept them waiting if they arrived a few minutes early. These latter years illustrated quite clearly her egocentricity, her lack of caring for others, and her selfishness.

In the final years of her marriage, Sara had experienced periods during which she could not write. She went from the summer of 1920 till November without writing one poem. These long barren spells became quite common – five months in 1925 and more during the period leading up to her divorce. But even after the divorce, writing was not easy.

Sara had experienced depressions throughout her life. In later years she lost weight. She suffered from insomnia, although during her creative periods she would work on her poems during the night, and she also had trouble getting up in the mornings, typical symptoms of depression. She took Veronal as a sleeping tablet. Her moods varied with the seasons. Her depressions were worse in winter, and she hated the cold weather since it brought on her respiratory illnesses. As she grew older, external events led to an intensification of her depression (such as the marital problems of her friends, the Untermyers, and the suicide of their son).

Sara's father died in 1921 at the age of 82, and this was a severe loss for Sara. Her mother died in 1924, as did her older brother George. In 1928, a friend, Marguerite Wilkinson, drowned after recovering from a nervous breakdown. Later that year, Sara was injured in a taxicab accident. In September of the year, Ernst's father died.

Sara's concerns over her finances grew. After her parents' death, the inheritance was not as great as had been expected. The stock market crash in 1929 also increased her anxiety. After the divorce, although she had asked for no alimony, Sara tried to get Ernst to set up a trust fund for her. She worried whether she could afford to renew the lease in her hotel and decided to move to a cheaper apartment. Her concerns became almost a nightmarish obsession. However, she left almost 84 000 dollars, and so it appears that her financial concerns were irrational.

After her divorce in 1929, many of Sara's friends moved away from New York City, and she was often lonely. Despite craving company, she often rejected offers from friends to visit her, pleading illness. In 1931 Vachel Lindsay killed himself by drinking Lysol, and Sara was distraught over this. For many months after Lindsay's suicide, Sara feared that she was about to have a complete physical breakdown or die in an accident.

Sara was no longer able to write productively, but John Wheelock suggested she write a biography of Christina Rossetti. Macmillan gave her an advance on the project, and she had written about a hundred pages at the time of her death.

In August 1932, Sara went to England to gather material for the biography but got pneumonia. She came back to America in September 1932, still sick, and recovery was slow. She was very weak and deeply depressed. She had failed to build a fruitful life after the divorce, and now only ill health seem to lay ahead for her. She worried that her heart had weakened and that her blood pressure was fluctuating too much. Her friends were very concerned over her despondency. She was taking sleeping pills regularly and seemed severely depressed.

During the Fall, the deaths of some friends deepened her despondency, and in December she began to accumulate a supply of sleeping pills. She began to fear having a stroke, like her father and her brother John (who had lived for 20 years after a paralytic stroke, dying in 1917 at the age of 47).

In December, she went to Florida to stay with Jessie Rittenhouse but lay in bed all day with the drapes closed. Jessie discussed the situation with Sara's doctor and nurse, and they all felt she should return to New York and seek psychiatric help. She developed an obsessive but unfounded fear that her blood vessels were beginning to rupture, increasing her fear of a stroke. On 27 January 1933, a blood vessel did break in her hand, making her frantic with the idea that her long-awaited stroke was imminent.

On the evening of 29 January 1933, Margaret Conklin visited her. They read and listened to Beethoven's *Fifth Symphony*. Sara was found the next morning at 9 a.m. by her nurse, dead in her bath after taking an overdose of sedatives. The water was still warm, and perhaps the nurse could have saved her had she checked earlier.

Sara Teasdale's Poetry

Sara was a lyrical poet and, at the time (the early part of the twentieth century), her poetry was popular. Sara was awarded the Columbia Poetry Society Prize in 1918, the forerunner of the Pulitzer Prize. Her poetry has been praised for its verbal precision and its exploration of human emotions (www.enotes.com), but it later fell into obscurity and was criticized for being sentimental and anachronistic and for being pure lyricism (www.enotes.com).

Discussion

In 1979, Drake pointed out that four major women poets of the nineteenth century (Emily Bronte, Christina Rossetti, Emily Dickinson, and Elizabeth Barrett Browning until she was 40) were all recluses like Sara. All four belonged to very close family units which fulfilled their desires for affection and intellectual stimulation. Sara ventured out more than some of her predecessors but continually retreated into seclusion because of her 'illnesses,' becoming almost a total recluse by the end of her life.

The Victorian era encouraged women in the creative arts but undermined their self-confidence. They were allowed to

dabble, but they were not supposed to achieve. When they did write poetry, they wrote mostly about love, protective love, and the desire to submit to the ideal lover. However, it was not always easy to find this in their own lives. They often ended up renouncing love for men and substituting an attraction to death, and these themes are frequent in Sara's poems. They frequently had mysterious physical weaknesses and chronic ill health, a neurotic way of resolving the conflict between their personal desires and the conventions imposed upon them by the society.

Sara was a chronically depressed woman whose depression worsened as she grew older. In her middle age, concerns that were mild as a young adult grew to be irrational obsessions. She feared poverty and an imminent death, though neither was very likely. It is unfortunate that Sara would contract a real illness (pneumonia) at this time and that a blood vessel did break in her hand. Her irrational concerns no longer seemed so irrational to her.

She had struggled to lead a conventional life but failed. Sara never learned to form and maintain healthy interpersonal relationships. The patient role she learned as a child was of no use to her in marriage. Simply put, she failed to mature. She remained a child, as evidenced by her failed marriage and the self-centeredness she displayed in her friendships.

Her childhood experiences led her to repress her basic emotions. Anger, curiosity of the world, and sexuality were all suppressed by her aged parents, and in particular by her mother. She married at 30 with no realistic idea of the responsibilities of a person involved in adult relationships.

The prospect of having a child frightened her so much that she had an abortion. In looking for an event that could have turned her life around, this might have been it. The easiest change for a person to make in life is to switch to a role that is complementary to one that she has already had. Perhaps Sara could have become the nurse (mother) taking care of the patient (her baby) after her years of experience as the patient? But maybe not. Anyway, Sara panicked and avoided the experience.

By the end of her life, she was finding it hard to write creatively, she was lonely and isolated, and her irrational fears and depressions were getting worse. Sara had often contemplated death, and now she planned it. She had long used sleeping pills and knew the peace they brought her. And so she

sought the ultimate peace, not in bed, but in a warm bath, as if seeking the womb from which she may have wished that she had never emerged.

Sara does not seem to have suffered from a bipolar affective disorder (manic-depression) or a major depressive disorder, nor did she abuse alcohol, the two classic accompaniments of creativity. Rather Sara seems to have developed a chronic maladaptive life style, technically known as a personality disorder, perhaps as a result of the way her aged parents raised her. Certainly she was depressed from time to time, but melancholia is a frequent human experience and does not always indicate a psychiatric syndrome.

Did Sara write better when she was depressed? She herself felt that her poetry was stimulated by her 'emotional irritation' and that this irritation was present long before she was conscious of what was tormenting her. In an interview in 1919, she said that her poetry sprang from a 'fog of emotional restlessness.' It is not clear exactly what emotions she was referring to, and it is not possible to match the poems to her psychological state at the time to see whether her poems were better when she was 'irritated' or 'restless.'

See also: Poetry; Suicide; Women and Creativity.

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Relevant Websites

There are no websites devoted to Sara Teasdale, but information about her and copies of her poems can be found on:
www.poets.org – From the academy of American poets.
www.poemhunter.com – Poem searchable database.
www.americanpoems.com – Showcasing the greatest American poets.

Testing/Measurement/Assessment

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Glossary

Conceptual definition The definition of an abstract construct using other abstract constructs.

Convergent thinking Cognitive processes that result in one or a few responses to a question or stimulus.

Divergent thinking Cognitive processes that result in numerous ideas in response to a question or stimulus.

Histriometrics The application of quantitative analysis to data concerning historical figures.

Operational definition The definition of an abstract construct in observable, measureable terms.

Psychometrics The quantitative analysis of psychological measurement characteristics.

Reliability The extent to which test scores show consistency.

Validity The extent to which inferences drawn from test scores are appropriate for their use.

Why Assess Creativity?

Creativity is a fundamental human characteristic. We recognize evidence of creativity across time and across cultures, from ancient civilizations to twenty-first century endeavors. We see it displayed at the individual level as well as in collaborative enterprises, and we see its effects in small ideas as well as in revolutionary advances. Creativity's contributions to all areas of human activity, including science and technology, medicine, government, agriculture, literature, the arts, and entertainment are undeniable. There is no doubt that creativity enriches and enhances our lives.

Because of the breadth and depth of its impact, understanding and capturing creativity is of great interest. In order to systematically study creativity, however, one must have a means of assessing it. Assessment simply refers to the evaluation of the quality or quantity of a construct. Assessment may be based on one or more measures, or methods of measuring, or quantifying, the construct. Testing, a special case of measurement, refers to the use of standardized procedures for quantification of a construct.

Numerous techniques of varied types have been developed to assess creativity in individuals, groups, and organizations. Creativity measures are generally used to identify creative potential, to examine and understand factors that relate to creative performance, or to determine the impact of creativity interventions. The popularity and diversity of creativity assessment techniques illustrates our desire to grasp the valuable resource that is creativity.

Is Creativity Assessment Possible?

Creativity is a broadly used term. Sometimes, it is used to specify a personal characteristic, such as when we describe an individual as having high levels of creativity. On other occasions, we use it as a descriptor of objects or ideas, as is the case when we offer opinions about the level of creativity displayed in artwork. Yet in other applications it refers to a cognitive process, such as when a person is encouraged to use creativity in developing a solution to a problem. Although the term has

varied applications, there is a shared sense of its general meaning: creativity involves producing something new and different, something that did not exist previously.

The meaning of creativity evokes skepticism about the possibility of assessing it. How can we measure something that is unknown? Is it possible to understand an outcome that is unforeseeable? Can we capture the seemingly elusive construct that is creativity? Although the assessment of creativity may seem paradoxical, it is not. In assessing creativity, the goal is not to predict specific creative outcomes, but rather to measure characteristics related to creative production irrespective of specific outcomes.

Considered in this light, assessment of creativity is feasible and, given the importance of creativity for individuals, society, and culture, it is critical to understanding human nature.

Defining the Construct

As with any abstract construct, a definition must first be established in order for assessment to take place. Most researchers in the field identify creativity as an ability to produce objects or ideas that are novel and purposeful.

According to this perspective, creativity involves two components: novelty and appropriateness or usefulness. The first component is widely accepted. Most people identify creativity with originality. The second component, however, is more controversial. Why must something be appropriate or useful in order to be considered creative? Is it not the case that many creative works were deemed highly inappropriate by society at the time of inception? Creativity scholars interpret 'appropriateness' and 'usefulness' in the broadest sense. The original idea should have intent, purpose, meaning, in order to be creative. A unique random thought produced by an individual is generally not considered creative unless it is developed or applied with some intent or purpose. The nature of this intent may vary widely. It may consist of solving a practical problem or developing a coherent theoretical model. But it may also consist of expressing an emotional state for oneself or for others, in provoking an emotional reaction, or in presenting an alternative perspective or method. A dream you have may

be very unique, so much so that you share it with friends and family who proceed to describe it as 'really weird' or 'bizarre,' yet we do not generally describe that dream as demonstrating creativity. Implementing ideas that are gathered from your dreams, however, may be associated with creativity.

This definition of creativity remains conceptual and vague. It lacks precision that allows one to pinpoint exactly what or who demonstrates creativity. According to the definition, creativity is context dependent. To identify something as original, one must establish a point of comparison. Is it original in relation to the entire history of humanity? Is it original in comparison to the typical work produced by members of a certain age group within a specific culture? Or is it original within one person, a new idea for a particular individual? To determine appropriateness, one must also consider context. Is the idea or artifact appropriate given the situation in which it was produced? Would creative works from past centuries be considered equally provocative or ingenious if they had been produced for the first time today? A creative response is a response within a socio-cultural context.

The conceptual definition of creativity must be operationalized, or expressed in observable terms, in order to develop creativity assessment techniques. Both the purpose of assessment and the theoretical perspective of the researcher affect how a construct is operationalized. Assessing creative potential in children, for example, requires a different measurement approach than evaluating the creative contributions of eminent historical figures. Because of the multitude of purposes for which creativity assessment might be used, a wide array of measurement techniques have been developed.

Historical Foundations

Until relatively recently, creativity was not scientifically studied. Explanations of creative outcomes, if given at all, frequently referred to supernatural influences such as muses, divine intervention and demonic powers, or to vaguely identified personal characteristics such as 'giftedness' and 'madness.' Many believed these external or internal forces in turn produced an 'a-ha' experience in individuals that in turn propelled them to act on their ideas.

As the study of individual differences in psychological characteristics gained importance in the late 1800s and early 1900s, greater attention was directed toward the construct of creativity. Initial steps toward assessing creativity began with experimental attempts to measure fluency and imagination. Stimuli such as inkblots or word association tasks were used to assess these constructs. At this time, investigators considered creativity to be either a component of general intellectual functioning or a characteristic of personality.

J. P. Guilford is credited with directing greater attention to the scientific study of creativity and providing a framework in which to do it. In 1950, his presidential address to the American Psychological Association emphasized the need for psychologists to dedicate more time and effort to understanding creativity. He developed a multidimensional model of intellect, called the structure of the intellect (SOI), that classified mental abilities by operation performed, content used to perform the operation, and the type of product produced.

The broadest impact of this model was the distinction between two types of operations, convergent thinking, associated with traditional forms of intelligence, and divergent thinking, associated with creativity. Convergent thinking refers to a mental process that focuses an individual on one correct response. Divergent thinking, in contrast, is a mental process that results in a wide range of potential responses. Guilford and his colleagues identified several primary components of divergent thinking. These included fluency, flexibility, elaboration, and originality. Fluency is the number of interpretable ideas produced in response to a stimulus. Flexibility refers to the number of different categories of ideas produced. Elaboration is the embellishment of ideas. Originality is the uniqueness of the ideas. Guilford and his associates also designed measures to assess the components of divergent thinking.

Although the concept of divergent thinking did not originate from Guilford, he was instrumental in popularizing both the construct and means of measuring it. Guilford believed divergent thinking was a distinguishing feature of creativity, and most current theories of creativity consider divergent thinking to be a necessary, although not sufficient, requirement for creativity. Furthermore, Guilford's conceptualization of divergent thinking influenced the development of a popular method of assessing creativity, divergent thinking tests. The divergent thinking tests developed by Paul Torrance shortly after Guilford's presidential address continue to be some of the most widely used creativity tests worldwide.

Guilford's call for more research on creativity not only impacted the study of creativity as a mental ability. His work also stimulated researchers to study creativity as it relates to personality. Of particular importance was the work conducted by researchers at the Institute of Personality Assessment and Research at the University of California in Berkeley. Both Frank Barron and Donald MacKinnon are noted for providing important insights into the characteristics of creative achievers. Their research influenced the use of personality measures as well as ratings of creative achievements for the assessment of creativity.

Since the mid twentieth century, researchers have made significant strides in the study of creativity. Numerous useful measures of creativity have been developed as a result of this research that serve, in turn, as tools for furthering our understanding of creativity. More research in this area, however, is warranted. Although great progress has been made, the scientific study of creativity remains limited relative to the importance of this construct.

Focus of Creativity Assessment

Because creativity is a broadly applied construct consisting of complex processes, development of creativity assessment approaches requires that a point of focus be identified. This point of focus involves both facets of creativity and types of creativity.

Facets of creativity have been grouped into four broad categories: products, people, processes, and environmental press. These categories are commonly referred to as the 4Ps of creativity. Most studies oriented toward understanding creativity examine how people, processes or environmental

conditions contribute to creative outcomes. Each of these categories necessitates that assessment efforts have a different focus. In measuring products, the emphasis is on specifying the level of creativity displayed in objects or ideas. In order to do so, type of product should be considered. Inventions, for example, may best be assessed using different methods than those applied to the evaluation of artwork. In assessing creative people, the interest is in identifying attributes associated with creative individuals. In this case, consideration must be given to the population of interest. Methods for evaluating creativity in children may differ from those for adults. In assessing processes, the researcher focuses on the cognitive functions involved during the varied stages of creativity. With environmental press, the interest is in determining the environmental conditions that, when pressed upon a person, enhance or inhibit creativity. Measures of creativity may be described in terms of the 4Ps that they emphasize.

Creativity assessment procedures must also adapt to the different types of creativity that exist. A distinction is made between eminent creativity and everyday creativity. Eminent creativity, referred to as 'big-C,' is that displayed by individuals of renowned fame who are recognized as creative geniuses. Figures such as Einstein, Beethoven, Cezanne, and Galileo, represent eminent creativity. In contrast, everyday creativity, referred to as 'little-c,' is displayed in creative endeavors that have less breadth or depth of impact on society. Everyday creativity may present itself at a personal level, in original and useful responses within the range of responses typical for a particular individual, or at a social level, in original and useful responses relative to those produced within a socio-cultural group. It may consist of the development of completely new ideas or the adaptation of existing objects to meet new demands. Examples of everyday creativity include original artwork produced by children, unique dance moves that become the popular trend, or small adaptations of objects to meet current demands.

These two types of creativity, big-C and little-c, are studied using different methods. Eminent creativity is most commonly examined through case studies or historiometrics. Case studies generally produce qualitative descriptions of individuals, while historiometrics involves the quantification of information related to historical figures. Eminent creativity is interpreted as representing the highest level of achievable creative performance. It can serve as a standard to which all other creativity is compared. Its study, however, is limited by what information is available in historical records and how this information is used. The study of everyday creativity generally examines creativity of the present, which allows for the use of a broader array of assessment methods. It also relies on assessment of creativity in a relative rather than absolute fashion. In so doing, the creativity of a participant may be compared to that of others, or to one's own under different conditions, instead of to an absolute level of creativity. This relative approach to assessment acknowledges the importance of context for creativity.

The varied points of focus in creativity assessment give the sense that creativity researchers are very scattered in their study of creativity. At the same time, the availability of creativity assessment techniques that have varied points of focus provides an opportunity to examine creativity from different perspectives.

Types of Creativity Measures

Creativity measures can be classified into several types depending upon their aim and content. According to a popular taxonomy presented by Dennis Hocoavar and Patricia Bachelor, the primary types of creativity measures are: divergent thinking tests; attitude and interest inventories; biographical inventories; personality inventories; ratings by peers, teachers, or supervisors; ratings of eminence; judgments of products; and self-reported creative activities. A variation of this taxonomy with an added category, environmental climate inventories, is used below as a framework for discussing types of creativity tests.

Divergent Thinking Tests

Divergent thinking tests are arguably the most frequently used approach for assessing everyday creativity. These tests ask participants to produce multiple ideas in response to specific stimuli. Stimuli and responses are typically either pictorial or verbal in nature. Examples of item response formats include drawing pictures using an incomplete figure, writing questions evoked by hypothetical situations, or listing possible uses for an object. The intent is to measure divergent thinking skills displayed in test-taker responses. Divergent thinking tests usually assess multiple skills, and those most frequently assessed are fluency, flexibility, originality, and elaboration.

Many divergent thinking measures are available. Some of them are considered general tests that can be administered to a broad segment of the population. These include the *Torrance Tests of Creative Thinking (TTCT)*, the *Alternative Uses or Consequences* tests, and international instruments such as the Spanish *CREA* test. Other divergent thinking tests have been designed with stimuli that apply to specialized fields of expertise, as is the case with the *Purdue Creativity Test* for engineers and the *Creative Engineering Design Assessment (CEDA)*. Some measures assess both divergent and convergent thinking. The *Structure of the Intellect Learning Abilities Test (SOI-LA)* is an example of such an instrument designed for the general population.

Of the numerous divergent thinking tests available, the *Torrance Tests of Creative Thinking* are currently the most popular both in the United States and abroad. They are considered the gold standard of divergent thinking tests. Various Torrance Tests are available, including verbal (*Thinking Creatively with Words*), figural (*Thinking Creatively with Pictures*) and abbreviated measures (*Abbreviated Torrance Test for Adults, ATTA*). Each consists of several tasks that are scored on multiple dimensions. Subscores and overall scores are then computed.

Research on the Torrance tests and on divergent thinking tests in general indicates that they typically demonstrate positive psychometric characteristics. Overall scores have strong reliability although subscores frequently do not have sufficient reliability to warrant individual interpretation. Evidence supports the contention that divergent thinking tests measure a construct that is distinct from that measured by traditional academic aptitude tests. Validity studies show that overall scores are related to creativity as measured by expert evaluations of performance as well as by creative achievements. Studies examining the ability of divergent thinking tests to predict

creative performance in the long term demonstrate weaker associations than those examining associations between divergent thinking and creative performance in the present. Critics of the tests argue that their ability to predict future creative performance is limited.

A number of studies have found that scores on different types of divergent thinking tasks, such as verbal, figural, or mathematical, do not show strong associations with each other, suggesting that domain specific skills influence test performance. The basis for this finding may lie in the fact that divergent thinking tasks require additional skills beyond divergent thinking that are linked to domain expertise, rather than in the notion that the process of divergent thinking itself is domain specific. Regardless of the reason, it appears that divergent thinking tests containing different types of stimuli and response formats are not completely interchangeable.

Overall, despite some limitations, research on divergent thinking tests indicates that they can be useful in measuring an important component of creativity, divergent thinking.

Self-Assessment Inventories

Creativity self-assessment inventories focus on characteristics of the person rather than on an evaluation of thinking skills demonstrated in the production of a response. Their purpose is to tap into one's personal orientation toward creativity. There are several types of self-assessment inventories, including attitude and interest questionnaires, biographical inventories, and personality measures.

Attitude and interest inventories are based on the belief that creative individuals tend to have attitudes and interests that distinguish them from less creative individuals, such as positive inclinations toward taking risks, trying new activities, engaging in hobbies that allow exploration or self-expression, or being playful. Questions in these inventories may consist of rating scales, forced-choice options, or checklists. Examples of such inventories abound. The *Creative Attitude Survey* assesses characteristics such as imagination, creative interests, humor, and risk-taking in children. The *Group Inventory for Finding Interests (GIFFI)* examines interests associated with creativity in children. Appropriate questionnaires for adults are also available, such as the *How Do You Think?* And the *How Creative Are You?* The *Khatena-Torrance Creative Perception Inventory* has two subtests: *Something About Myself* focuses on interests and *What Kind of Person Are You?* assesses personality characteristics. The *Creative Styles Questionnaire-Revised* integrates elements of interest and personality into one measure in an effort to assess thinking style that relates to creativity.

Biographical inventories for creativity collect information on individuals' activities and experiences that are believed to be associated with creative performance. These inventories include questions on topics such as current and past hobbies, leisure activities, family history, childhood environment, and educational experiences. In addition to questions that are biographical in nature, these inventories sometimes include items related to interests and attitudes. The item format is usually a frequency rating scale or a checklist. Biographical inventories may be general or domain specific. *Biographical Inventory: Creativity* is a broadly focused inventory that incorporates dimensions specific to varied fields. Other inventories, based

on evidence of differences in the backgrounds of creative individuals from diverse fields, are designed to apply to specific areas of expertise. The *ALPHA Biographical Inventory* from the Institute for Behavioral Research in Creativity, for example, was designed for scientists.

Interest/attitude inventories and biographical questionnaires have strengths and weaknesses. They are relatively easy to administer, and research shows that they generally have adequate reliability. Studies comparing the two types of tests indicate that interest/attitude inventories and biographical inventories are highly interrelated. This is not surprising for several reasons. First, to the extent that individuals have choices about activities, interests can affect activities. Second, as stated earlier, biographical inventories may contain interest items, and interest inventories may contain biographical items, thus blurring the distinction between the measures. These inventories, however, provide distinct information from that obtained by divergent thinking tests as indicated by relatively low associations between scores on the two types of measures. Validity studies generally provide some support for the use of interests, attitudes, and biographical information in evaluating creative potential. Some specific inventories, however, provide limited evidence of validity. Further examination of the validity of these inventories is warranted.

Personality inventories assess an individual's typical pattern of responding to situations. The characteristics assessed may be defined as personality traits or types. Most personality inventories studied in relation to creativity are questionnaires that assess an array of personality dimensions, some of which are believed to related to creative performance. Examples of these inventories include Cattell's *16 Personality Factor Questionnaire (16PF)* and the *NEO Personality Inventory (NEO P-RI)*. The *Creative Personality Scale* from the *Adjective Check List* is an example of a creativity scale that was developed from a personality inventory. Other inventories are specifically designed to assess the creative personality, as is the case with the *Cree Questionnaire*.

Currently, the most commonly studied personality characteristics in relation to creative performance are the five *NEO PI-R* characteristics of extraversion, emotional stability, openness to experience, conscientiousness, and agreeableness, commonly referred to as the Big 5. Much research has been conducted on the relation between these characteristics and creativity.

Evidence is somewhat inconsistent, but patterns of relationships have emerged that suggest differences in personality characteristics associated with creativity in various domains. Openness to experience is the characteristic that is most consistently associated with creative performance. Extraversion has been found to relate positively to performance on divergent thinking tasks and in creative occupations that require social interaction. Conscientiousness appears to show a positive association with scientific creativity but not artistic creativity. Emotional instability, in contrast, has been found to be positively associated with artistic creativity. The Big 5 dimensions are very broadly defined, which limits the ability to specify aspects of personality that relate to creativity with precision. Subcomponents of the *NEO PI-R* measures as well as alternative measures, such as the dimensions of the *16PF*, have been used to examine the relationship of more narrowly defined personality

characteristics to creativity. The *16PF* characteristics of persistent, adventurous, imaginative, shrewd, and self-sufficient have been related to creativity. Continued research should clarify how personality characteristics interact with domains of creative pursuit.

Self-Reported Creative Activities

Self-reported assessments of creative activities are similar to biographical inventories in that they focus on past activities and accomplishments. They are distinct in that they aim to specify the quantity and/or quality of creative activities, rather than personal experiences that are associated with creative performance. In other words, the focus is on the product rather than the person.

These assessments usually produce counts of real-life accomplishments believed to show evidence of creativity, or ratings of frequency of involvement in creative behaviors. In some applications, the accomplishments may be ranked or rated by quality. Writing plays, stories or musical pieces; publishing research articles; being selected for art show participation, receiving special awards and recognitions for original contributions; and obtaining patents for inventions are all examples of creative accomplishments. Some inventories for assessing creative activities are the *Creative Activities Checklist*, the *Creative Behavior Inventory*, and the *Creative Achievement Questionnaire (CAQ)*. Another inventory, the *Runco Ideational Behavior Scale (RIBS)*, assesses self-rated level of engagement in ideational activity rather than actual creative accomplishments. As such, it shares similarities with questionnaires intended to assess thinking style. Further research on this inventory to examine its relation to other types of measures is warranted.

Self-reported creative activity measures are valuable as criteria, or standards, to which other creativity assessment instruments are compared. For example, research showing that divergent thinking tests are able to predict significant creative accomplishments provides validity for the use of divergent thinking tests as indicators of creative potential. Creative activity measures show strong reliability in overall scores. Difficulties in their use derive from the fact that substantial creative accomplishments are limited in number for most people, making it difficult to determine distinctions in creativity, while involvement in activities may relate more strongly to interests than accomplishments.

Ratings/Rankings/Nominations of People

In this form of assessment, a knowledgeable individual reports on other people's creativity. In the case of eminent creativity, the evaluator is usually considered an expert in a specialized field and is asked to either nominate individuals within that field whom they consider to have made important creative contributions, or alternatively to rate or rank the creative contributions of individuals in a provided list. In the case of everyday creativity, the evaluator is most typically a peer, teacher, or supervisor who knows the person well. This evaluator may be asked to provide a global rating of an individual's creativity or to rate the person on several dimensions related to creativity. The *Meecker Creativity Rating Scale* and the *Teachers' Evaluation of Students' Creativity (TESC)* were developed to rate

students on creativity-related characteristics, while the *Parental Evaluation of Children's Creativity (PECC)* asks parents to assess their children's idea generation. Teacher, peer and supervisor ratings, rankings and nominations have been used as criteria for evaluating the validity of creativity tests and the effectiveness of creativity interventions. Research shows that multiple evaluators with knowledge of an individual and information on the rating criteria provide similar creativity ratings. Some critics, however, question the level of validity of these assessments.

Judgments of Products

An alternative approach to rating people is to rate creative products. In this assessment approach, knowledgeable individuals rate ideas or artifacts on their level of creativity. One or several questions may be used in the rating scale. The most popular and sound method for rating creative outcomes is the *Consensual Assessment Technique*. In this method, multiple expert judges rate the creativity of an observable response within a particular domain. Artists rate paintings or collages, writers rate stories, mathematicians rate math problems, and so on. The average rating across experts is then used as the measure of creativity. Experts are also asked to rate other dimensions of the product such as technical quality or attractiveness to ensure discrimination between dimensions. Research shows that this method generally results in high agreement among raters on creativity and clear distinction of creativity ratings from ratings on alternate dimensions. The consensual technique, with its use of multiple raters, reduces error due to idiosyncrasies of raters. Judgments of products using the consensual assessment method have been used effectively as criteria in many creativity studies.

Creative Climate Inventories

A relatively recent approach in creativity assessment is to examine the extent to which the environmental climate supports creativity. Several measures have emerged which assess factors in the environment that may promote or inhibit creative performance. The purpose of the *KEYS: Assessing Climate for Creativity* instrument is to assess stimulants and obstacles to creativity in work environments. Questions in the instrument ask employees to rate their work environment on a number of dimensions believed to relate to creative production. The instrument can be used by employees at various levels in the organization, and scores show strong evidence of association with ratings of organizational creativity. The *Team Climate Inventory (TCI)* is intended to assess climate for innovation in work teams. The instrument measures four dimensions of team performance: vision, participative safety, task orientation, and support for innovation. Research to date indicates that these dimensions are related to perceived team performance on creative projects. These measures are an important contribution to the assessment of creativity (see [Table 1](#)).

Challenges and Opportunities

The various approaches to creativity assessment are quite distinct. Associations between scores on the diverse types of

Table 1 Partial list of creativity measures

<i>Name of test</i>	<i>Authors/date</i>	<i>Type of test</i>
16 Personality Factor Questionnaire (16PF)	Cattell, R. B. (1993)	Personality
Abbreviated Torrance Test for Adults (ATTA)	Goff, K. and Torrance, E. P. (2002)	Divergent Thinking
Adjective Checklist: Creative Personality Scale	Gough, H. and Heilbrun, A. (1965)	Personality
ALPHA Biographical Inventory	Institute for Behavioral Research in Creativity (1972)	Biographical
Alternative Uses	Christensen, P. R., Guilford, J. P., Merrifield, P. R., and Wilson, R. C. (1960)	Divergent Thinking
Biographical Inventory: Creativity	Schaefer, C. E. (1970)	Biographical
Consensual Assessment Technique	Amabile, T. (1982)	Judgment of Products
Consequences	Christensen, R. R., Merrifield, P. R., and Guilford, J. P. (1958)	Divergent Thinking
CREA	Corbalán, F. J., Martínez, F., Donolo, D., Alonso, C., Tejerina, M., and Limiñana, R. M. (2003)	Divergent Thinking
Creative Achievement Questionnaire (CAQ)	Carson, S., Peterson, J. B., and Higgins, D. M. (2005)	Activities/Accomplishments
Creative Activities Checklist	Runco, M. A. (1983)	Activities/Accomplishments
Creative Attitude Survey	Schaefer, C. E. and Bridges, C. I. (1970)	Interest/Attitude
Creative Behavior Inventory	Hocevar, D. (1979)	Activities/Accomplishments
Creative Engineering Design Assessment (CEDA)	Charyton, C., Jagacinski, R. J., and Merrill, J. A. (2008)	Divergent Thinking
Creative Styles Questionnaire-Revised	Kumar, V. K., Kemmler, D., and Holman, E. R. (1997)	Interest/Attitude/Personality
Cree Questionnaire	Thurstone, T. G. and Mellinger, J. (1986)	Personality
Group Inventory for Finding Interests (GIFFI)	Davis, G. A. and Rimm, S. B. (1980)	Interest/Attitude
How Creative Are You?	Raudsepp, E. (1979)	Interest/Attitude
How Do You Think?	Davis, G. (1975)	Interest/Attitude
KEYS: Assessing Climate for Creativity	Amabile, T. M., Conti, R., Coon, H., Lazenby, J., and Herron, M. (1996)	Creative Climate
Khatena–Torrance Creative Perception Inventory	Khatena, J. and Torrence, E. P. (1998)	Interest/Attitude/Personality
Meeker Creativity Rating Scale	Meeker, M. (1987)	Ratings/Rankings/Nominations
NEO Personality Inventory (NEO PI-R)	Costa, P. T. and McCrae, R. R. (1992)	Personality
Parental Evaluation of Children's Creativity (PECC)	Runco, M. A. (1989)	Ratings/Rankings/Nominations
Purdue Creativity Test	Lawshe, C. H. and Harris, D. H. (1957)	Divergent Thinking
Runco Ideational Behavior Scale (RIBS)	Runco, M. A., Plucker, J. A., and Lim, W. (2001)	Activities/Accomplishments
Structure of the Intellect Learning Abilities Test (SOI-LA)	Meeker, M. and Meeker, R. (1975)	Divergent Thinking
Teachers' Evaluation of Students' Creativity (TESC)	Runco, M. A. (1987)	Ratings/Rankings/Nominations
Team Climate Inventory (TCI)	Anderson, N. and West, M. A. (1996)	Creative Climate
Torrance Test of Creative Thinking: Figural (TTCT-Figural)	Torrance, E. P. (1966)	Divergent Thinking
Torrance Test of Creative Thinking: Verbal (TTCT-Verbal)	Torrance, E. P. (1966)	Divergent Thinking

measures indicate that they are not assessing identical constructs. This poses challenges in the study of creativity.

First, choices need to be made in terms of appropriateness of measures for the intended purposes of assessment. Using an instrument for predicting creative potential is quite different from using a measure to evaluate current levels of creative performance. A set of guidelines to assist creativity measurement users in the selection of instruments appropriate for their purposes would be quite practical.

Second, confusion can arise regarding what different assessment techniques actually measure. There is a tendency for the

interpretation of the meaning of test scores to extend beyond their actual meaning. Divergent thinking, for example, is frequently equated with creativity when it more accurately represents just one component of creativity, ideation. Creativity interest inventories may be interpreted as instruments for identifying creative people when they assess relatively limited aspects of individuals that may relate to increased likelihood of creative performance. In either of these examples, additional conditions must exist for creativity to be displayed. The confusion about the meaning of scores can lead to erroneous inferences being drawn from research results.

Third, the identification of appropriate criteria for the study of creativity is difficult. Frequently used criteria include performance on divergent thinking tests, ratings of creative products, or scores on creative achievement and activity measures. Divergent thinking test scores are a popular choice as criteria in research studies because of their availability, applicability to diverse populations, and strong psychometric characteristics. However, because the ideation displayed in these tests is produced within a testing condition that generally does not incorporate situational or motivational variables that affect creativity, performance on these tests does not mimic creative performance in real life. Their usefulness as criteria in certain studies, therefore, is limited. Other potential criteria, such as ratings of creative products or counts of creative achievements pose their own problems. Obtaining meaningful ratings of creative products with high psychometric quality can be difficult and time consuming. Furthermore, the products that are rated may not be representative of one's creative capabilities across time and across domains. Similarly, measures of creative achievements may not be representative in that achievements might not be fully realized at the time of assessment. Using multiple criteria can compensate for limitations in any one assessment approach, and is therefore highly valued in research studies.

While challenges exist, the various approaches for assessing creativity also provide opportunities for integration of the creativity literature. Research studies in creativity tend to examine one or a few factors at a time using one or a few methods of assessment. Current models of creativity, in contrast, theorize that multiple components must be present for creativity to emerge. Several confluence models exist, such as those developed by Teresa Amabile and by Robert Sternberg and Todd Lubart. Although there is some variability in the components specified by each of the models, they share basic elements. These include creative thinking skills, personal characteristics, and environmental factors that promote creativity. The tendency to study factors that influence these components individually prohibits a full understanding of the creative process. There may be very complex interrelationships between the various factors involved in creativity and the diverse types of creativity. For this reason, studying one factor at a time using one measure of creativity may be misleading. Research using different types of creativity measures to assess the multiple aspects of creativity can illuminate the interrelationships between components of creativity. The variety of creativity measures that exists, therefore, is an important toolbox that can be used for integrating research findings into a coherent theoretical framework.

See also: Climate for Creativity; Componential Models of Creativity; Consensual Assessment; Divergent Thinking; Domains of Creativity; Interest Inventories.

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- <http://www.creativelearning.com/Assess/index.htm> – Creativity Assessment Index.
- <http://www.buffalostate.edu/creativity/> – International Center for Studies of Creativity.
- <http://www.gifted.uconn.edu/nrcgt.html> – National Research Center on the Gifted and Talented.
- <http://www.coe.uga.edu/torrance/index.html> – The Torrance Center for Creativity and Talent Development.

Theater

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Glossary

Brahma In Hinduism, the creator, the first member of the Trimurti, with Vishnu, the preserver and Shiva, the destroyer.

Commedia Dell'arte Italian, meaning literally comedy of the artists (or guilds) is a form of improvised theater encompassing a set group of characters played in masks that began in Italy in the sixteenth century and is still performed today.

Culture The behaviors and beliefs characteristic of a particular social, ethnic, or age group. According to anthropological theory, culture is the sum total of ways of living built up by a group and transmitted from one generation to another.

Hellenistic theater A name given to ancient Greek theater. It refers to the age of the Persian Empire, ruled by Alexander the Great, and commonly known as the Hellenistic Period.

Kabuki Popular drama of Japan developed in the seventeenth century and characterized by elaborate costuming with a stylized acting style comprised of rhythmic dialogue, music and dance; men playing both male and female roles.

Noh theater Traditional Japanese theater and one of the oldest theatrical forms in the world. Name derived from Japanese meaning talent or skill. Performers are storytellers and rely less on plot than visual imagery.

Passion plays A religious drama concerning the crucifixion of Christ widely performed on Good Friday in the Middle Ages and still performed today by the villagers of Oberammergau, Bavaria.

Sanskrit An indo-European, Indic language in use since c. 1200 BCE as the religious and literary language of India.

Stage The area where the storytelling/performance takes place. In Greek and Roman theaters it was a platform across the diameter of the semicircular arena, in Medieval drama the stage was generally a temporary wooden platform with a trap door representing hell and a raised structure representing heaven. The thrust or apron stage appeared in the Elizabethan era with a permanent architectural background located in the back of the performing platform. In the mid-seventeenth century the proscenium stage was introduced with two areas, the fore stage or downstage area where most of the action took place and the area framed by an arched opening that contained scenic backgrounds with entrance areas located on either side at the back (upstage). By the mid-nineteenth century the picture-frame stage had virtually no forestage area; the entire playing area was located beyond the arched area. Site specific stages include exhibition halls, theater-in-the-round where the audience sat all around the performing area (a format frequently used by circuses). Today stages are as varied as the imagination of the directors, designers, and producers. Any area can become a performance venue, where performers and audience share theatrical events.

Yoruba Opera A Nigerian African entertainment patterned after English Musical Hall containing topical and satirical stories with dialogue, songs and dances. It began and ended with a rousing musical number called a Glee.

Introduction

Theater is a place designed and designated as a forum for the witnessing and sharing of stories of the culture for which the theater is built. It is a place where stories are given dimension and voice. The word theater comes from the Greek word *theatron* (the seeing place), and unlike *auditorium* (to hear), theater is the ultimate location to witness (see) that which the culture's performing artists regard as relevant, important or amusing. It has been, and continues to be, the place where we see archetypal themes embodied, where we see characters in full dimension struggling with the issues that are at the very heart of what is the human experience. Theater is always place, performer, and story.

The seminal director, Peter Brook, claimed that from the time when one Neanderthal acted out his prowess of a particularly good hunting expedition to others in the tribe, there was theater. He argued that theater must be clear and demystified; however, any live performance qualifies as dramatic by creating a representational illusion involving speech, gesture,

music, dance, spectacle, and/or combining other performing arts such as visual arts (i.e., installation art pieces, shadow theater). A myriad of venues house theatrical works including amphitheaters, Roman-style forums, Eastern Tea Houses, open-air sites, theater-in-the-round, black-box theaters, and theaters with thrust or proscenium stages. With technological advances in set design and lighting there is often a greater demarcation between audience and performer, yet both are inexorably linked through the experience of theater.

As a cultural institution, it is difficult to define theater through a single lens, as is evidenced by ongoing disagreements between artists and scholars regarding theater's ultimate form. Major journals and newspapers throughout the centuries have engaged in this debate on definition. Further, although distinctions are apparent in different geographical regions, theater practitioners tend to borrow ideas from other cultures, integrating and changing indigenous traditions and creating patterns of change that incorporate or reject traditional styles. Theater ultimately reflects and reveals its culture and the social/political policies of the times. Theater remains a dynamic

practice, whether it is used to promote aesthetic values, communal healing, or political propaganda.

Place, Performer, Story

Inevitably, the interaction of place, performer and story shapes the theatrical performance. It may be pleasing or disturbing, realistic or abstract, accurate or altered. Physical space affects individuals, especially when creativity takes place in a physical context such as within a theater. According to Tore Kristensen, in general, creativity takes place in confined spaces that restrict yet enable a free flow of sensory experiences and proximity to other people. The confinement may actually make certain sensory experiences more vibrant such as sight and sound, and frames cognitive processes while restricting others to induce emotional and creative responses. Such experiences, at their best, support coherence and continuity, optimal elements within creative works. This is what takes place within strong theatrical productions. Both performers and audience share in the constraints of the theater, even when performances are outdoors; it is the attention that is shared between performer and audience that contains the creative space.

Jerzy Limon argues that the space of the stage and the ways it is constructed are important meaning-generating elements within every theatrical production. The performance space, both real-world and artistic-construct, conveys metaphorical meaning. In the theater, the audience perceives space differently than in everyday life experiences (point of view can be altered and distorted) and they actively participate in conjuring things real and imagined. This is how Eastern theater most often functions. The audience can see the stage manager and stagehands, who appear on stage with the performers, yet the audience continues to attend to the story that is being portrayed. Further, designers are able to create sets that distort and enhance visual principles of perspective-taking, and different stages (thrust, in-the round, black-box, proscenium, site-specific) present unique limitations and opportunities for theatrical productions.

Although place, often the *mise-en-scene*, can set the location for theatrical productions, the relationship between the performer and the story remains tightly entwined and is, in many theatrical forms, the only tool to conjure place. This performer-story relationship often sparks much controversy since critics and audience alike may dispute the interpretation given by the performers on stage. Many argue that the text of a play can be analyzed as a literary work, independent of performance. In fact, there is substantial evidence that psychoanalytic theorists, most notably Sigmund Freud, furthered their psychological theories through the analysis of characters within dramatic texts. They claimed that the playwright's construction of plot and characters offered entry into the playwright's unconscious mind. According to Eric Neutzel, through careful analysis of plays such as Sophocles' *Oedipus Rex*, Shakespeare's *Hamlet*, or O'Neil's *Long Day's Journey into Night*, we can gain insight into the aesthetic values and responses of audiences and critics, the dark (shadow) side of human nature, the psychological struggles and defenses of writers and their characters, and the transferences, counter-transferences, and enactments manifested in the theatrical

processes that take place between actors and directors, actors and audiences, and actors and the characters they embody. Psychoanalytic textual and creative process analyses are compelling; however, according to Patrice Pavis, the text-performance 'couple' must be constantly reconsidered, especially since this relationship evokes questions about fidelity (whether the performance is true to the text). This is further complicated by the communal practice of theater-making. According to Nathan Kogan and Barbara Kangas, many directors and playwrights have previous acting experience, which adds more complexity to the text-performance relationship. In the end, what remains true in theater is the wedding of place, story, and performer.

Theater as Culture – Geographical Distinctions

As an artistic expression of the human condition, theater is influenced by and influences sociopolitical culture. Although it is impossible to give a full account of any one culture's theater history in this entry, the hope is to illustrate how major religious and political movements directly shaped the course of theater history. Like any dynamic social structure, theater reflects and responds to the forces of its time. Further, theater practitioners tend to adopt esthetic values from other cultures and integrate them into their own indigenous works, thus theater not only reflects local sociopolitical climates but also reveals the influences of remote cultures and times.

Western Theater

Western theater began in Ancient Greece (~500 BCE). Dance, music and drama (comedies, tragedies, and satyrs) were performed at major festivals. The ultimate goal of these ancient theatrical works was to promote harmony through the resolution of conflicting forces within the individual, society, and the gods. Following the guidelines later delineated by Aristotle, early Western theater portrayed stories that adhered to unity of place and time, in short, all Ancient Greek plays occurred in one setting during one 24-h period. According to Oscar Brockett, Greek theatrical practices incorporated the use of masks, singing, and dancing; they portrayed psychological realism while questioning social norms. One of the most significant theatrical developments during the Ancient Greek era was a shift in focus from choral performances to single actors who portrayed specific characters or gods. This practice began with Thespis, whose name is now applied to Western actors (Thespians). What is remarkable about Ancient Greek theater is that most of the conventions of Western theater started here. The power of Greek theater was in large part linked to the uncompromising integration of the poet and the performer; the storytelling was a perfect union of text and performer.

During the long reign of the Roman Empire, Greek theatrical principles were incorporated; however, more attention was given to elaborate spectacles. Bigger amphitheaters were built to house larger casts of performers and showcase spectacles that imitated real-life events. One of the major opponents to such theatrical presentations was the early Christian followers who banned all theater practices. This persisted well into the Middle Ages in Europe. Actors were denigrated by the church; however, they were granted permission to perform

elaborate Passion or Mystery plays during religious festivals. Small troupes of performers, traveling from village-to-village in wagons that served as both home and stage, provided theatrical morality plays that depicted either biblical stories or the plight of everyday man. *Every Man*, one of the most popular plays of this time, presented themes of human suffering and the triumph of good over evil.

During the Renaissance, church and state became more distinct and separate. As a result, theater was no longer restricted by the dictates of the Church as the performers and writers were given financial support from the courts. With this shift, a renewal of earlier Classical Roman aesthetics shaped Renaissance theater, including the focus on spectacle. Intermezzi were provided between the acts of the drama to feature dance and song, practices that later fostered ballet and opera as distinct art forms. Renaissance theater buildings were ornate indoor venues, and proscenium stages were invented to showcase elaborate stage scenery (sets). In Italy the *Commedia dell'arte* grew outside the influences of court spectacles. Like the earlier Greek theatrical tradition and influenced by Eastern theater practices, this form of theater focused on the skills of the performer. *Commedia dell'arte* proved to be a major historical influence on the development of future Western theater. Training performers in skills of improvisation, vocal range, and physical movement set the stage for playwrights such as Molière and the titan of all Western theater, William Shakespeare.

Shakespeare (1564–1616) was directly involved in Elizabethan theater, as actor, playwright, and part owner of the Globe and Blackfriars playhouses. He drew stories from history, mythology, fiction, and current events, reworking them into plays that were so distinct that they are now regarded as a form unto themselves. The universality of his work remains palpable today – his plays continue to be performed in every country of the world. Following the zenith of Shakespeare's Elizabethan theater, European theater fell under more government sanctions with fees and fines increasing the burden on burgeoning companies. Audiences, from royalty to peasants, demanded productions that appealed to all intellectual levels of understanding, thus more interludes and masques were produced within the dramatic productions. Scenic architecture evolved to meet audience demands and once again spectacles, much like those performed in Roman forums, became popular.

As the seventeenth century dawned, Europe was besieged by political and military conflicts. Theater responded to these changes with performances that were either more violent in presentation and content or diversionary and spectacular. With political instability, theaters promoted regional theatrical styles and views that reflected the rapid changes in the sociopolitical culture of Europe. Western theater in the eighteenth century gradually shifted from control by royalty, church, and government to individual businessmen. Restoration drama grew more sentimental, pantomime theater gained increased popularity, and opera and ballet companies completely separated from traditional theater productions. Nineteenth-century European theater shifted to more Romantic and melodramatic storytelling, and with this change came a new focus on the actor as the star attraction. This trend spread to the United States and Canada as well as many regions inhabited by Europeans such as Africa, China, South America, Australia, and New Zealand.

Theater was now powerfully influenced by the Industrial revolution, the emerging middle-class, and the increasing ability to travel. No longer were local theater companies the only option for theatergoers.

Today it is common to see theatrical productions from around the world and for world theater to be directly influenced by global events. Western theater continues to adapt to the sociopolitical climate. Whether occurring in large or small theaters, market squares, shopping malls, amusement parks, or site-specific spaces, Western theater remains dynamic and vibrant. Performers, story, and place remain essential elements shared with audiences who bear witness to the living culture of theater.

Asian Theater in General

Asian theater developed at a different pace and remained distinct from Western theater well into the twentieth century. It was known that storytelling, songs, and dance, were performed during early Asian times (c. 2500–1750 BCE) and documented evidence existed of cultural cross-pollination. Each Eastern culture developed and adapted its theatrical practices to reflect its own society, including the changes brought on by foreign or domestic upheaval. What remained consistent in Asian theater, perhaps in response to increased travel between India, China, and later, Japan, was the integration of dance and music.

India

Theater in India was originally influenced by Hinduism, the caste system, and Sanskrit literary traditions. Even today, the values of Hinduism pervade most Indian theatrical practices, especially the inclusion of themes that promote the ultimate goal of achieving union with the supreme world soul (also known as Brahman), which is infinite, indescribable, and perfect. In contrast, early Western theater in Greece portrayed the gods as finite, easily describable, and less than perfect. Indian Hindu theater is principally founded on two epics, the *Ramayana*, which is a story of 14 years of wandering by Prince Rama and his wife Sita (c. 500–200 BCE), and the *Mahabharata*, which is the history of various members of two ruling families. These early dramas were all defined by *Rasa*, which is a fundamental mood, rather than categories such as comedy or tragedy. All plays ended happily and death and violence did not occur on stage.

Similar to Western theater, Hindu theater used verse to express heightened emotion and prose for ordinary events. Sanskrit theater, known as *Natyasastra*, focused on performers and their talent for: (a) movement and gesture, (b) speech and song, (c) costume and makeup, and (d) psychological insight. Each of these categories was strictly codified according to character and caste; a codification that was also shared by much of the Chinese and Japanese theatrical traditions. Between the second and seventh century CE lower dramas (farces), shadow plays, folk plays, and more informal entertainment emerged. After the Muslim takeover in the twelfth century, drama became less widespread and formal theater was restricted to temples and festivals; however, a local form of theater, *Kutizatum* (a combination of secularism and eastern mysticism), did survive.

By the twentieth century, there were over 50 different forms of folk drama in India. Theater culture was influenced by Islam (c. thirteenth to nineteenth centuries), Portugal (from fifteenth to mid-nineteenth centuries), and France and England (eighteenth century). Theater was used as a tool to spread culture and solidify religious beliefs, especially as a means to inform a largely illiterate population. Although theater was influenced by religious teachings, it continued to follow earlier performance traditions: (a) stylized acting, (b) musical accompaniment for the full performance, (c) no scenery, (d) stage hands and stage managers appearing on stage but not acknowledged by the performers or the audience, and (e) performances starting late and continuing throughout the night. Small local theater companies developed more narrative dance and puppet theaters to facilitate easier access to remote communities. As Indian nationalism grew from the mid-nineteenth century, indigenous drama, opera, and dance regained popularity, as evidenced by a pattern of updating older stories into modern dramas (i.e., Bollywood theater). Today in India, theater is diverse, popular, and regarded as an emblem of national identity.

China

After the erection of the Great Wall of China, around 214 BCE, China became insulated from outside forces. A cultural schism developed between the North and the South which further diminished theatrical advancement. This pattern of unrest followed by stability was reflected in the theatrical practices. During periods of unrest only local variety-type entertainment was performed whereas in times of stability more complex cultural and scientific advancements took place. One such stable period (around CE 714), saw the establishment of the Pear Garden training institute, a school that facilitated innovative and popular theater. Today Chinese actors are still known as Pear Garden students just as actors in the West refer to themselves as Thespians. The new works developed at the Pear Garden were exported to Japan and other parts of Asia.

Gradually, the construction of buildings designated exclusively for theatrical productions emerged. Because of new printing inventions (movable type), Chinese tales were made widely available to theater companies, and were narrated by professional storytellers at Tea Houses or dramatized in puppet and shadow plays. Traveling theater troupes performed in Tea Houses, Goulans (theaters), as well as for the Emperor's birthdays. With the invasion of the Mongols, native Chinese intellectuals, now excluded from government, turned to culture, especially to music and drama. Despite social repression, a golden age of drama helped solidify Chinese theater. The plays were informed by history, with emphasis placed on loyalty to family and friends, devotion to work and duty, and justice. Both men and women performed and many of the companies were named for their leading actress. Elaborate costumes and makeup provided dramatic appeal.

Dramas in China were sophisticated explorations of morality and the human experience, although the stylistic form differed between the North and the South – the Northern style was traditional and the South was more avant-garde. In 1790, to celebrate the Emperor's birthday, artists arrived from all regions of the North and the South to perform. At this event, they combined their theatrical styles and called

it 'Capital Drama,' which later became known as the Beijing Opera. This new form was defined by rigidly controlled conventions of acting, dancing, singing, and movement. In Beijing Opera:

- the dramatic roles are divided into four main types – males, females, painted-face (subsidiary characters), and comic characters;
- each character describes themselves on their entrance;
- their movements are related to dance and/or mime;
- every gesture is symbolic and specific to each word uttered;
- the specificity of the symbolism is carried through in the costume design, accessories, and head-gear;
- rigorous training is required;
- different dialogues can be sung or spoken during the production and yet the audience understands the performance primarily through the movement vocabulary.

Since all regional Chinese drama integrated music and movement, when Western drama was introduced in the 1920s, this style of drama became known as spoken drama. Following the early roots of Chinese theater that began in Tea Houses, the practice of eating, drinking, and fluid arrivals and departures by the audience remains today, even for performances of spoken drama. Chinese theater remains vibrant, although like all world cultures, theater reflects the amalgamation of multicultural practices.

Japan

Early Japanese theater is shrouded in mystery until Buddhism was introduced in the sixth century. Prior to this period, what was known is that theater was related to Shinto rituals. With Buddhism came influences from many cultural traditions, especially from Korea, China, and India. By CE 1000, there were two types of theater, one to celebrate the harvest that was performed at Shinto shrines and the other to celebrate the ritual elements of Buddhism at Buddhist temples. At first, these ritual dance theaters were performed by priests but as they become more popular, professional performers were employed.

The rise of the Shoguns, in the twelfth century, brought about strict class structures (warrior, merchant, artist, and artisans, farmer and peasant classes), but by the fourteenth century, the artist-artisan class was eventually given protection and raised almost to the level of the Samurai Warrior. With this support, Noh theater came into being. In fact, all the permanent Noh dramas in repertory today were written in the fourteenth century. This form of drama grew out of the early acrobatic masked dances that were accompanied by songs and the ritual elements of Zen Buddhism. Noh classifications fall into five themes or categories of plays: (a) praising god, (b) warriors, (c) women, (d) deranged people or schemes of subterfuge, and (e) demons, devils and the supernatural. Noh performing style relies on indirectness, simplicity, suggestion, and restraint, with the focus given to movement and dance performed in slow motion. The stylistic elements of Noh theater persist, including:

- professional performers are almost always men;
- the lead character wears a mask but all other characters remain unmasked;
- to accompany the dances the chorus narrates and sings;

- there is no scenery;
- few props are used except fans;
- costumes are much simpler than Chinese costumes;
- there is minimal rehearsal since all performers have been well-schooled in their roles;
- between each Noh play short farces, called Kyogen, are performed.

This performance style and symbolic design made Japanese theater distinct from Chinese theater, including the demands placed on their audience to pay close attention (compared to Chinese audiences who came and went as they pleased).

Kabuki, a non-aristocratic form of Japanese drama, was established in the seventeenth century, a period of time when Japan moved deeper into isolationism. After the collapse of the Shogunate in 1868 other forms of Japanese drama such as Doll theater began to flourish. Both Doll theater and Kabuki presented sketches of domestic urban life. Originally, Kabuki was performed entirely by women; however, it quickly became synonymous with prostitution and so the performers were restricted to young men. The same problem of seductiveness persisted and so young men were also banned; performances were then relegated entirely to men who were required to shave their heads in an attempt to reduce sensual appeal. As Kabuki became popular, permanent companies performed a six-play season and employed a staff and playwrights (who were often also novelists or journalists), a practice that resembled European theater during Shakespeare's time. Most of the plays from the seventeenth century lasted approximately 12 hours divided into four sections.

At the same time as the fall of the Shogunates, many of the restrictions of the theater were lifted and by the latter part of the nineteenth centuries, women were once again allowed to perform, youth theater opened, and Western style drama was introduced. For the first time Japanese theater focused on more realistic presentations of drama. By the early twentieth century, Stanislavski's teaching had been adopted by Japanese theater practitioners and later, in the twentieth century, many indigenous theater artists, notably Tadashi Suzuki, adopted a unique eclecticism combining Method Acting technique with traditional Japanese stylistic elements. Today Japanese stage designs and performances embed religious symbols into contemporary themes. At its best Japanese theater reflects the simplicity of Eastern values with Western realism.

Africa

Africa, believed to be the continent from which humanity originated, was also the first known region to document theater. Egyptian writings from 4000 BCE recorded a rich culture of theater where the seeds of Eastern and Western traditions germinated. From its first productions to works performed today, African theater is marked by a rich confluence of song and dance that is fully integrated into storytelling and day-to-day African culture. The elements of physical gestures, rhythmic structures of dance and music, and narrative storytelling were never separated in African theater. From the small tribal community that gathers to celebrate or mourn, to the urban audiences that meet in large formal modern performance halls, African theater utilizes legends to explore the human condition and continues to maintain its close ties to music, dance, and storytelling.

Determining the roots of theater on the African continent is difficult to pinpoint due to the geographical remoteness of many regions, the multiplicity of languages, and the pattern of transmitting culture in non-written forms. Language had less importance in performance traditions than did music, dance, gesture, or mask, and audiences were part of the performance, in either ritual or ceremony. Most of African theater is deeply integrated into everyday life of the society; it is not a discrete event. Because much of Africa was subjected to religious and political colonization, the continent remains in flux. Borders shift to reflect the current political powers and with these changes traditional African theater (storytelling and long narratives passed down orally) has either been lost or truncated. Further, the slave trade greatly influenced the spread and dilution of cultures.

Tracing some of the African theater traditions requires exploring old kingdoms that existed pre-colonization. For example, the Northeastern section of Africa, comprising Egypt and many of the Arabic countries, followed Hellenistic (Greek) and Byzantine (Eastern) traditions. In Nigeria, theater occurred during funerals and other significant occasions and became the basis of Yoruba Opera (commonly known as Yoruba travelling theater that originated from the Oyo Yoruba kingdom and performed in regions where Yoruba-speaking populations reside). Similar to Yoruba Opera, the Gahanian 'concert party' used comedy and music to dramatize contemporary topics and to emphasize the need for a strong community. These objectives were amplified by the traditional practice of call-and-response interactions between audiences and storytellers. Much of the storytelling in Central Africa dealt with either fictional or historical events and retained a narrative rather than a dramatic structure (dramatization). These storytelling events were part of the early traditions of portraying rites of passage, crop gathering, and seasonal changes. They were performed in open spaces, with the audience encouraging or voicing skepticism and the performers responding with digressions and improvisations. As colonization increased in Central Africa, the storytelling included themes of oppression.

A large swathe of the Atlantic coast of Africa was heavily influenced by Portuguese merchants and their slave trade activities. Theater in these regions promoted the ideals of Catholicism, but once the African Atlantic seaboard countries gained independence, they adopted European theatrical forms while blending traditional tribal rituals as a way to rediscover their indigenous voice. Like other regions in Africa, South Africa experienced similar oppression; however, due to the conflicting interests and struggles between the Dutch and English a policy was instituted that forced native populations to relocate to territories (similar to the practices in North America where Native tribes were relegated to reservations). South African theater galvanized, responding to the injustices of the official government Apartheid policy. The theater community attempted to raise consciousness and demand equality, and with the eventual dissolution of Apartheid, coupled with the wealth of the region (particularly gold and diamonds), theater in South Africa became renowned for its strength of expression. Whether through government sanctioned Afrikaner theater, indigenous black companies working outside subsidized theater, or original companies established pre-Apartheid, South African theater is perhaps the most

successful at combining tribal traditions with European forms. South Africa remains a powerful example of the effectiveness of theater as a social movement.

In general, most indigenous African theatrical work was lost during colonization but what did survive is an emphasis on sacrifice, self-knowledge, and the divinity in all things. What has endured throughout Africa is the union of storytelling, song, and dance. Theater remains at the heart of African culture, a culture that embraces full participation from the performers and their audience.

Latin America

Like the continent of Africa, indigenous theater in South and Central America was powerfully influenced by the colonization of Spanish, French, and Portuguese cultures. Another integrative influence on theater was the importing of African slaves into South and Central America. Over time, these cultural values melded into powerful forms of theatrical events. Professional theaters and folk theaters influenced each other, although sadly few indigenous forms of theater remain intact today. What is clear is that borrowing models from other theatrical cultures was not done indiscriminately; they were adapted to effect change and draw attention to sociopolitical exploitation and marginalization.

For example, by 1765 Spain banned religious drama in an attempt to assert crown control over the church, a practice that generated great resentment and signaled the erosion of Spanish influence on Central and South American colonies. After Napoleon conquered Spain in 1808, satire was more open and sharp; playwrights used characters drawn from indigenous peoples and made comic heroes out of them, a style that strongly resembled the minstrel shows of the Southern United States. When Mexico secured independence in 1821, there was a strong need to promote local playwrights, in particular, plays that were rooted in comedy, melodrama, and satire. It was not until the First World War, when European companies could no longer finance tours in South America, that Latin America was able to establish its own theatrical identity, incorporating folk traditions and indigenous music.

Living Theater

Indigenous theater remains a powerful medium for communication. National, regional and local communities offer theatrical experiences as a positive vehicle for individual and social development and a viable means of expression for its members. Theater can be targeted to appeal to children, adolescents, the elderly and special interest groups (disability, sexual orientation, racial minorities) and it can be offered in diverse locations. The theatrical purposes range from pure entertainment to education, including propaganda.

Since the beginning of theater, communities have sponsored festivals that feature professional and community theatrical groups. People gather to witness and share in these massive events. One of the most popular and perhaps the largest such festival is the Edinburgh Festival, with over a hundred events occurring in multiple venues located throughout the city. Similar popular and successful theatrical festivals

take place on every continent of the world and attract audiences and performers from diverse economic and social backgrounds.

Seismic shifts in theater persist; however, according to Martin Esslin, what endures is a pattern of change that is either externally focused on the social-political structures of the community or the internal psychological reality of the character. Major theatrical movements that reflect these two patterns can be illustrated in Brechtian theater, where the stage became a platform for social research and experimentation versus Theater of the Absurd (Camus, Sartre, Beckett, Pirandello), in which a vocabulary and stage convention developed to portray the interior mind of the characters. Other theatrical shifts emerge through merging existing conventions into a unique 'new' genre. Such a result is evident in today's Musical Theater; although its early roots can be traced to the British Musical Hall, vaudeville, burlesque, pantomime, and operetta. In fact, theater began with an integration of music and dance and only later did they become separate art forms.

Theater is multidimensional; many things happen at the same time such as dialogue, suspense, timing, context, and levels of discourse between the characters, the characters and the playwright, the characters and the actors, and the characters and the audience. During a theatrical event, something happens, even if everyone continues *Waiting for Godot*.

Theater as Healing and Theater as Witness

Theatrical experiences can promote healing. For example, youth theater programs are designed to help develop competencies, increase feelings of self-worth, and encourage the recognition of strengths and assets. Plays are written specifically for children and adolescents and performed to engage and to educate. According to Carol Lorenz, a significant shift took place during the 1960s, one in which playwrights began to portray the young as psychologically and intellectually complete human beings, whose experiences deserved to be told. Susanne Dutton pointed out that using arts in the field of social work is a common practice, especially in settlement houses. In these settings, at-risk youth are given opportunities to explore problems and conflicts through interactive efforts to create and perform theater works that speak directly to this age group and to the issues that are troubling them.

The originator of psychodrama, J. L. Moreno, moved away from the practice of playwrights constructing drama. In psychodrama, the performers and the audience are actively engaged in the creative process of improvisation. According to psychodrama theorists (Kipper, Hundal, and Shemer), spontaneity serves as a measure of mental health. Theorists such as Abraham Maslow shared the belief that spontaneity is related to psychological health, believing it to be a necessary condition to attain self-actualization. According to Phil Jones, drama therapists determine effective therapy by observing and evaluating core processes including:

- dramatic projection (individuals can take on fictional characters or roles and project themselves into the dramatic material);

- dramatic performance and therapeutic empathy and distancing;
- role-playing and personification;
- interactive audience and witnessing;
- embodiment;
- playing life-drama connections;
- transformation.

Moreno's concept of vibrant role-playing is evident in all psychodrama programs, especially those found in educational theater, theater of the oppressed, and playback theater.

Theater of Witness further integrates theater with theories and treatment practices gleaned from trauma specialists. Theater of Witness practitioners believe that theater offers a place for the collective integration of traumatic memories, a practice that goes back to the beginning of time. In fact, the earliest form of Theater of Witness is found in Ancient Greek theater; the chorus, innocent of all crimes, witnessed, protested, and lamented the tragedies of its citizens. According to Aristotle, the purpose of tragedy was catharsis, a concept that was fully embraced by Freud in his psychoanalytic therapeutic talking cures. The goal is to transform inner experiences, especially experiences of violence, incest, and revenge. Theater of Witness is a genre that operates around the world through such organizations as the Playhouse of Derry and the International Trauma Studies Program. Initiatives are undertaken to engage intergenerational cross-community groups to portray their own journey of reconnection, reconciliation, healing, and acceptance in performances that are raw, honest, and powerful. The intent of this form of theater is to provide people a forum to ease their pain and hurt while simultaneously transforming these hurts into narratives that are witnessed by others.

According to Ellen Kaplan, creating theater that is rooted in personal story is best managed by oscillating between empathy and distance. This oscillation facilitates the healing power of traumatic stories. Post-apartheid South Africa is a vibrant example of theater as a tool for the recuperation of politics and culture. It recounts stories of unspeakable cruelty, lets sufferers know that they are not alone, and provides models for how to survive. Further, according to Stephen Wangh, unlike psychoanalytic writers who tend to avoid discussions on forgiveness, playwrights, especially those involved in theater of witness drama, frequently depict forgiveness as a psychological means to resolve cycles of anger and revenge, emotions and intentions that can leave survivors stuck in life-threatening behaviors.

Many theater educators are now offering courses in Theater of Witness including California Institute of the Arts, University of Cape Town, and NYU. In these classes, students are asked to face the current and continuing suffering of individuals and communities around the world. They are asked to bear witness to contemporary genocides and to describe what they learned in the process of exploring these topics. They integrate (a) literary theories of witnessing and testimony, (b) historical and political backgrounds that led to atrocities, and (c) psychoanalytic theories that diagnose and treat trauma survivors.

Further Research Studies in Theater

Theater is an ancient practice that exists worldwide. It is a dynamic relational art form that places audience participation

in a central role. Paul Sullivan and John McCarthy have eloquently argued for research that accounts for the lived experiences of artists and their audiences. They call for an examination of esthetic experience as it unfolds; a dialogical engagement between artwork and audience. Keith Sawyer and Stacy DeZutter argue that theater may be better understood as 'distributed creativity,' a theoretical framework that explains theatrical processes that are collaborative in nature in which a shared creative product is generated. They propose that through an interdisciplinary combination of interaction analysis and qualitative methodologies researchers will be better able to gather findings that explain creative processes that are always distributed amongst those engaged in the creation of theatrical productions, a practice that Sawyer's implemented while investigating 'improv' theater.

Researchers, like James Kaufman, have demonstrated that playwrights, although not as pronounced as poets, are vulnerable to shortened life-spans, emotional disturbances, and more personal tragedies than nonartists. Thomson and Jaque found that actors had increased vulnerability for dissociative disorders as compared to a healthy control group, a result that echoes Kaufman's findings for playwrights. Kogan and Kangas found that actors, directors and playwrights, although thoroughly trained and practiced, are often late-bloomers, as compared to other artists in the performing arts. Further, they found that theatrical experience prior to university was a strong predictor for a career in theater. Nancy Andreasen, in her book, *The Creating Brain*, recounted a conversation with Neil Simon, one of the great twentieth century playwrights. Simon claimed that he "slips into a state that is apart from reality," "I don't write consciously – it is as if the muse sits on my shoulder," "my mind wanders – even when I talk," and "I've always felt invisible." Andreasen cited researchers whose work offers explanations for Simon's comments, including cognitive patterns of divergent thinking, less cortical inhibition of sub-cortical processes, and dissociative behaviors that promote detachment and altered states.

On a different note, Canadian researchers have adopted a unique investigative stance to gather data. They have literally staged data and used theater as a tool for analysis and knowledge transfer in health research. Since theater engages complex questions of the human condition it can communicate health-based information to communities and shape awareness and understanding. This approach reinforces the theoretical approach of Zorana Ivcevi and others who claim that since creativity exists in space and time, any discussion of creativity must begin with a definition of creativity and situate the research in relationship to the definition. Regardless of methodology and research design, what remains challenging for anyone investigating theater is the breadth of this topic. As a result, research in theater remains as broad as the topic itself.

Conclusion

Theater is a shared event that presents human experience in the present moment. Theater-making is created in community and the place for the storytelling is the theater. Humans are storytellers and these shared stories record our history and culture; they help define our humanity as we navigate through time

and place. Whatever the physical and geographic location, theater has an artistic life only when occupied by a performer, an audience and a story to be told. Theater may portray the traditional Western perspective of conflict, change, and progress with humanity as the principle agent for good and evil, or the Eastern view that humans seek to transcend temporal limitations and achieve union with the mystery of being. Regardless of perspective, genre, or stylistic form, theater remains dynamic. It reflects cultural values and unifies community; it remains a vibrant expression of our humanity.

See also: Acting; Collaboration; Flow and Optimal Experience; Improvisation; Zen.

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Theories of Creativity

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Glossary

Accuracy One criterion for evaluating the usefulness or success of a theory, in terms of the extent to which it accounts for observed data.

Armchair speculation A colloquialism for a first-person, subjective understanding of the nature of creativity, which is not explicitly elaborated into a set of testable hypotheses or subjected to empirical study. Prior to the advent of modern scientific methods of studying creativity, such speculation was the primary way the topic of creativity was understood. A number of historical creators have provided records of their thoughts on the topic in this way.

Fruitfulness Another criterion for evaluating the usefulness or success of a theory, in terms of the extent to which it identifies new phenomena or relations between phenomena and generates testable hypotheses.

Metaphorically oriented theories Theories that offer a somewhat speculative stance focusing on provoking new

understandings and possibilities, rather than on rigorously accounting for phenomena.

Reliability A criterion for assessing the measurement of some construct, concerning the consistency of a set of measures.

Scientifically oriented theories Theories that have an underlying goal of mapping the empirical reality of creative phenomena and that aspire to traditional scientific standards: a search for objective truth, generating empirically falsifiable hypotheses, and developing formal or computational models.

Theory Generally speaking, a collection of concepts, together with rules expressing relationships between such concepts, which account for empirical data and make predictions about future observations. In creativity research, theories may be heuristically divided into more scientifically-oriented theories and more metaphorically oriented theories.

Validity A criterion for assessing the measurement of some construct, concerning the accuracy of measurement.

Introduction

For millennia, human beings have pondered the nature of creativity. Much of this speculation has accompanied and served as commentary on the spectacular creative achievements of our species, with creators themselves often furnishing detailed descriptions and explanations of their own creativity. Until fairly recently, theoretical conceptions of the nature of creativity have been rooted in first-person introspection or on case-study-like familiarity with the works of a small number of creators. However, in the last half century or so, scholars and researchers – mainly from psychology, but from other domains as well – have tried to advance on this armchair tradition. They have applied more rigorous research methodologies, increasingly sophisticated analytic techniques, far richer datasets, and (often) a pragmatic, applied orientation. Importantly, their approaches have also been informed by and grounded in knowledge from other relevant domains – including, but not limited to, subdisciplines within psychology. The resulting surge of research activity has yielded a diverse array of theoretical approaches for understanding creativity. The purpose of this article is to describe contemporary theories of creativity and, at the end, to offer a critical but hopefully constructive appraisal of current theories and their promise for the continued informing of the nature of creativity.

Ways of Understanding Theories of Creativity

Pluralism

A generous-spirited way of understanding contemporary research about creativity is to emphasize *pluralism*, whereby a multitude

of perspectives, with different assumptions, definitions, and methods, operating at different levels of analysis, and making connections with various other disciplines, all contribute to a robust understanding. However, when faced with an array of perspectives, the need to characterize commonalities among theories, while still recognizing differences, becomes apparent. Here, to set the stage for an exposition of the main categories of creativity theories, four such frameworks are discussed: a more scientific versus a more metaphoric quality, a purely theoretical versus applied focus, level of creative magnitude, and emphases among the so-called six P's of creativity. While there is some overlap among these four, they may be regarded as largely independent, so that any particular theory can address any combination of the levels of these frameworks.

Scientific Versus Metaphoric Theories

One common distinction, in many areas of study, is between more overtly 'scientific' theories versus more metaphorical ones. Scientifically oriented theories have an underlying goal of mapping the empirical reality of creative phenomena and aspire to traditional scientific standards: a search for objective truth, generating empirically falsifiable hypotheses, and developing formal or computational models. In contrast, metaphorically oriented theories offer a more speculative stance focusing on provoking new understandings and possibilities and offering a moderating counterbalance to the sometimes stark empirical focus of scientific theories. Such theories are of maximal use when they balance speculation with agreed-upon methods of empirical exploration and peer review. The varied, complex, interdisciplinary quality of creativity naturally lends itself to exploration by both kinds of theoretical orientations.

Purely Theoretical Versus Applied

Creativity researchers have varied goals. For some, it is understanding creativity as its own phenomenon, in a disinterested, 'pure' scientific way, without any overt interest in the practical applications or implications of discoveries. Others' goals are more explicitly pragmatic – usually, to increase creativity by identifying factors associated with its natural development (and to create environments with such characteristics) or by designing specific interventions to promote creative thought. While some theories focus more on one than the other, most have implications for both pure and applied research.

Levels of Creative Magnitude

Another framework concerns what may be called level of creative magnitude. Not all instances of creativity are equal. A standard distinction is between 'Big-C' (truly great, history-making instances of creative breakthroughs among eminent individuals) versus 'little-c' creativity (a private minor insight or realization in an ordinary person). In recent years, two additional categories of creative magnitude have been proposed: a 'mini-c' category provides more room for subjective or personal instances of creativity; a 'Pro-C' category allows for professional-level creators who have not yet attained eminence, but who are well beyond little-c creators in knowledge, motivation, and performance.

A focus on a particular magnitude will constrain a researcher's basic questions, sources of data, and methodologies. Since they are by definition less common, widely acknowledged Big-C or Pro-C achievements are more often approached by the analysis of archival data (creative products, laboratory notebooks, sketches, etc.) or by carefully targeted laboratory or case study investigations of select individuals. In contrast, little-c and mini-c creativity lend themselves to more varied methods, including laboratory experiments, paper and pencil surveys and inventories, microgenetic studies of creative behaviors, and introspective self-reports of the subjective aspects of the creative experience.

The Six P's of Creativity

Another common framework for capturing different aspects of the phenomenon of creativity is the so-called six P's of creativity: *process, product, person, place, persuasion, and potential*. Since this alliterative framework nicely organizes many issues in the study of creativity, it is a useful way to compare the scope of different theories.

Theories that focus on the creative process aim to understand the nature of the mental mechanisms that occur when a person is engaged in creative thinking. Process theories typically identify different specify stages of processing or particular mechanisms as the components of creative thought. Another approach focuses on creative products: works of art, inventions, publications, etc. Products can usually be counted, permitting quantitative objectivity, and they are often available for judging, so inter-rater reliability can be readily determined – two substantial advantages; however, products themselves say little about their creators or the creative process that engendered them.

Studies of the creative person (or personality) tend to focus on identifying and understanding individual difference traits that are associated with creativity, such as intrinsic motivation, wide interests, openness to experience, and autonomy; some traits also seem more pervasive either among persons in artistic or scientific domains. The actualization of creativity also depends on the place or setting in which an individual resides. Research on place factors is especially useful in defining such interactions between persons and environments, which tend to be optimal for creativity when there are opportunities for exploration and independent work and when originality is valued.

Another view describes creativity as persuasion: creative people change the way others think, so they must be persuasive to be recognized as creative. This notion shares assumptions with a number of theories, including Mihalyi Csikszentmihalyi's systems model (described below), in which persuasive individuals are the ones who influence the direction taken by a domain. Finally, the notion of creative potential addresses the need to examine and understand the latent capacity for creative thought in children and others, who may have what it takes ultimately to be creative, but who require educational opportunities or other support before they can do so. Obviously, the goal of realizing creative potential is a major goal in education, so studies of creative potential often have a strong practical focus.

Categories of Theories of Creativity

Overview

Ten major categories of theories are now described: *Developmental, Psychometric, Economic, Stage and Componential Process, Cognitive, Problem Solving and Expertise-Based, Problem Finding, Evolutionary, Typological, and Systems*. The goal is to provide a big-picture overview of each type. Most theories described here have been discussed in the literature for at least several decades, boast considerable research support, and span multiple P's, levels of analysis, and methodologies. Excluded are theories that are limited to understanding a fairly narrow aspect or subtopic – such as creativity's relation to mental illness or to personality, its biological underpinnings, cultural differences in creativity, and so on.

Developmental Theories

Developmental theories pragmatically aim to understand the roots of creativity, as suggested by the backgrounds of Big-C creators, but they also often suggest how to design environments to fulfil creative potential. They mainly emphasize the person, place, and potential aspects of creativity, and range from mini-c to Pro-c. Early developmental theories were devised by examining the lives and backgrounds of eminent creative persons; these suggested that particular developmental experiences were correlated with later creativity, such as exposure to diverse experiences and not being overly restricted.

Other theories focus on family structure (e.g., birth order, ordinal position within the family, age interval between siblings, etc.). For instance, evidence suggests that middle children often rebel against their parents and the *status quo*,

to attract attention away from older siblings whose maturity earns them praise. Rebellion may occur within the context of the family, in one's thinking, or, during adulthood, in artistic or scientific revolutions.

Longitudinal methods provide another powerful perspective on development. Findings from this tradition indicate that during their childhoods, the truly gifted had the support to make cognitive and emotional transitions – one from general to creative talent, and the other from capability to a motivational state which leads directly to actual achievement. Such studies reinforce developmental theories of creativity that take into account cognitive processes, motivation, affect, and personality.

Psychometric Theories

Psychometric theories focus on measurement, and as such they inform all other creativity theories. Emphasizing products over the other P's, they range from little-c to Big-C creativity and are concerned, among other things, with the reliability (agreement or consistency of measurement) and validity (accuracy) of assessment, which are issues in all creativity research. Besides establishing basic principles of the measurement of aspects of creativity, psychometric theories have also addressed issues like how creativity differs from intelligence, the relation between performance on convergent thinking (one right answer) tasks and divergent thinking (many correct answers) tasks, and the extent to which creativity is rooted in particular domains of activity (like music, mathematics, or writing) versus being a domain-general ability.

Economic Theories

Another category of theories draws on economic metaphors. The macro-level quality of these theories encompasses all of the P's except process, and spans little-c to Big-C creativity. There are several economic or investment theories of creativity. Some describe the market for creativity, which illustrates macro-level processes and interactions involving the allocation of resources. Markets can provide benefits to certain behaviors or impose costs upon them, which can be defined in psychological terms. Other research has examined the market for creative behaviors, going so far as to define a creative class or segment of society, and arguing that a key component of the market for creative work is tolerance; unconventional people sometimes need to be tolerated, and creative societies do a good job of that. Other work has emphasized investments in creative behavior, in particular that creativity can result when a person buys low (i.e., invests in an idea which is currently unpopular) and then sells high (i.e., the idea gains respect).

Stage and Componential Process Theories

As noted earlier, many models of the creative process have been proposed. Some attempt to understand the creative process in terms of stages, which can be sequential or recursive; others focus on underlying componential cognitive processes. Such models range from mini-c to Big-C creativity and obviously emphasize process over the other P's.

Stage theories usually try to understand how moments of creative insight occur, typically by positing a particular sequence of processes – for instance, Graham Wallas's venerable model of preparation (gathering information and defining a problem), followed by incubation (taking some time away from the problem), followed by illumination or insight (having a sudden realization of the answer), followed by verification (applying the solution). Since the linearity of such models has been largely discredited, more recent stage models have acknowledged the need for recursion, whereby an individual may cycle through the stages multiple times, in various combinations.

As an alternative to sequential or recursive stages, some recent theories have defined the creative process in terms of component mechanisms or processes, which operate in a more inter-connected manner. Various componential frameworks emphasize factors like domain-relevant skills, cognitive style, knowledge of heuristics for generating novel ideas, attitudes towards specific tasks, and perceptions of one's motives, and how these components interact to generate novelty.

Cognitive Theories

Cognitive theories emphasize the creative process and person: process, in emphasizing the role of cognitive mechanisms as a basis for creative thought; and person, in considering individual differences in such mechanisms. Some cognitive theories focus on universal capacities, like attention or memory; others emphasize individual differences, like those indexed by divergent thinking tasks; some focus on conscious operations; others, on preconscious, implicit, or unintentional processes.

One classic cognitive theory, by Sarnoff A. Mednick, argues that creative insights can result from associative processes in memory. In this view, ideas are chained together, one after another, and more remote associates tend to be more original. This perspective argues that more creative individuals tend to have flatter hierarchies of associations than less creative individuals; in other words, more creative people have many more relatively strong associates for a given concept, rather than only a few. This is thought to provide greater scope for the simultaneous activation of far-flung representations, which many believe to be an important engine of creative thought.

Along similar lines, another cognitive theory focuses on how concepts are combined to generate novelty. Research suggests that conceptual combination – bringing two different sets of information together – is often involved in creative ideation, that original insights are more likely when two disparate features are brought together, and that connections between these concepts might only be seen at a very high level of abstraction. This kind of thinking has been called metaphoric logical, the idea being that something like 'angry weather' is only comprehensible in a nonliteral fashion. Such processes may suggest creative alternatives to well-worn lines of thought.

More generally, research in the 'creative cognition approach' tradition, another important contemporary view of creativity developed mainly by Ronald A. Finke, Steven M. Smith, and Thomas B. Ward, has likewise emphasized ideas drawn from cognitive psychology (e.g., conceptual combination, conceptual expansion, creative imagery, and metaphor) to understand how individuals generate ideas and explore their implications in laboratory-based invention and design tasks. Such processes

are thought to play out in two fundamental regimes of thought: generating ideas and exploring their implications. In practice, the two are strongly interleaved and combined in the 'geneplore' model of creative thought (from *generate* + *explore*).

Finally, metacognitive processes (thinking about one's own thinking) are also frequently tied to creativity. Many tactics for increasing creative problem solving have been proposed and popularized, including 'think backwards,' 'shift your perspective,' 'put the problem aside,' and 'question assumptions.' Tactical thinking is especially useful for programs designed to facilitate creative problem solving since they are a function of conscious decisions and can be employed when necessary.

Problem Solving and Expertise-Based Theories

A related major category of creativity theories, again drawn from cognitive psychology and most apparent in the research of Nobel Laureate Herbert Simon, emphasizes problem solving processes and expert knowledge. This is largely a theory of the creative person and process: person, in emphasizing domain-specific expertise as necessary for significant creative achievements; and process, in emphasizing how traditional cognitive psychological concepts like problem representations and search through problem spaces explain how people devise creative solutions to problems. Such principles can be readily applied to ill-defined problems, which are under-specified and which admit multiple 'good enough' solutions, rather than one 'correct' answer. Ill-defined problems can often be broken into several well-defined problems, which can then be solved in familiar ways. Moreover, one can search not only for a solution, but also for a way to formulate a problem.

The problem solving/expertise view boasts considerable support, from many lines of evidence. Many of the processes and structures described in the creative cognition approach can be straightforwardly related to those of the problem solving/expertise view. Archival studies of great creators reinforce the importance of domain-specific knowledge for high-level creative achievement, for instance in the so-called 'ten-year rule,' whereby at least a decade of intensive work in a domain is required before a creator produces any original works of lasting value. The archival study of creative episodes taken from the notebooks of eminent scientists has also generated a number of computational models of the creative process, which have replicated many major scientific discoveries.

Overall, the problem solving/expertise view regards creativity as a largely rational phenomenon, in both being amenable to rigorous empirical study by researchers, and to meaningful strategic guidance and long-term learning by creators themselves. Thus, another advantage of this view is pragmatic: its foci are strategic factors that individuals can partly control; at the same time, the problem solving/expertise view acknowledges that Big-C problems are extremely difficult.

However, this view has some limitations. For instance, expertise is a necessary but not sufficient condition for Big-C creativity; many other factors also contribute to high-level creativity. Also, the expertise view arguably overstates the role of cumulative deliberate practice, at the expense of talent. Finally, some have criticized the computational approach to creativity as fundamentally misguided.

Problem Finding Theories

Problem finding, another influential view of creativity, originally postulated by Jacob W. Getzels and Mihalyi Csikszentmihalyi, can be seen as a reaction against the traditional problem solving approach to creativity. The problem finding view holds that the problem solving view is inadequate to explain how creators come to realize that a problem exists in the first place and how they are motivated to bring their subjective experience to understand the problem. Problem finding is often regarded as independent of problem solving, and it is mainly as a theory of the creative process; it can also be seen as a theory of the creative person. In terms of creative magnitude, problem finding can often be construed as an instance of mini-c creativity, though there is also room for higher levels.

Early research on problem finding focused on understanding the exploratory behavior of creative visual artists, with a strong emphasis on their motivational factors and existential concerns. Since problem finding is more subjectively-oriented and harder to define than problem solving, it is more difficult to cite evidence definitively bearing on problem finding, either pro or con. The problem finding view may also overemphasize on-line discovery, at the expense of considering habitual behavior patterns.

Overall, the distinction between the problem solving and problem finding frameworks may be less due to substantive differences between the theories and more a matter of the taste of individual scholars. In any case, more recent models have often focused less on such labels and more on the nature of the underlying processes, using terms like 'problem construction' to encapsulate the constellation of processes involved in coming up with a creative solution to an ill-defined problem.

Evolutionary Theories

Researchers have proposed several theories of creativity drawing on ideas from evolutionary biology. Of these, a strong candidate for the most comprehensive general theory of creativity is the Darwinian model of Dean Keith Simonton, which, to varying extents, covers all of the P's of creativity: person and potential, in identifying dispositional and developmental idiosyncrasies associated with the realization of initial creative potential into actual creative achievements; process, in laying out a two-step model of ideation and elaboration, in which chance combinations of ideas play a paramount role and whose complexities are hard to control; product, in noting sometimes unreliable initial assessments versus longer-term stable judgments of creative artifacts; place, in identifying social factors leading to outstanding creativity; and persuasion, in emphasizing how social dynamics establish verdicts of creative outcomes. More than any other theory, Simonton's Darwinian view aims to understand the nature of genius, eminence, and Big-C achievements.

The basis of the Darwinian model is a mental process involving the blind generation and selective retention and elaboration of ideas. Ideas are combined in some blind fashion, typically below the threshold of awareness; the most interesting combinations are then consciously elaborated into finished creative products; these in turn are judged by other people. This process can be elaborated into a mathematical

model that accurately describes how creative productivity unfolds over the lifespan, and a great deal of quantitative archival evidence supports the predictions of the theory. Indeed, in general, it is probably fair to say that the model's quantitative basis gives it a rigor unsurpassed by any other major theory of creativity.

The Darwinian view has major psychological implications. Given the complexity of the creative process, creators should have little control over guiding the progress of their works. Creators should also not be particularly good judges of their ideas or works. Moreover, once works are finished, creators have little control over their fates, since this is a social judgment; thus, mass-production is the optimal strategy for those seeking eminence.

Despite its comprehensiveness, the Darwinian view can be critiqued along several lines. It arguably overemphasizes the role of chance factors in explaining creativity. Also, despite its mathematical parsimony, process particulars are left unspecified. Moreover, an array of theoretical arguments has also been offered that dispute fundamental premises of the Darwinian view, as well as objections based on empirical data that do not conform to the predictions of the theory. Finally, however well the Darwinian view works as a first approximation to many phenomena in the study of creativity, it explains little of the considerable error variance in relations between productivity and eminence, age and productivity, the production of masterworks versus minor works, or in creators' varied career trajectories. Understanding such individual differences is a focus of the next category of theories.

Typological Theories

One approach to understanding variation in creators' personalities, working methods, and career trajectories has been to posit typologies of creators, who differ in systematic ways. A number of such frameworks exist, many of which have elements in common; however, at least as often, they differ in their particulars, so that different typologies can be difficult to relate to one another. As a group, however, typological theories differ from the nomothetic (or universalist) emphasis of other theories, in aiming to explain variability among creators rather than overall trends. Various typologies touch on aspects of all of the P's and levels of creative magnitude.

Typologies are most often cast as a set of categories, often construed as mutually exclusive. This is convenient for readily understanding the big picture, but it may be misleading when a typology is generalized too broadly, or individuals are made to try to fit into a category they may only partially exemplify; this latter point also raises the issue of potentially poor reliability in categorizing individual creators. Setting up mutually exclusive categories is also limited in excluding the possibility of an underlying multidimensionality, which can seem antithetical to the multifaceted nature of creativity.

An alternative is to cast individual differences not in terms of categories, but in terms of multiple continuous dimensions, which creates a space of possibilities in which a particular creator can be located. Going even further, at their best, typological theories not only note the factors along which creators differ, but attempt to relate these factors to each other across multiple levels of analysis.

Considered as such, typological theories are among the most promising for achieving a richly integrated, multilevel understanding of creativity, as creativity research moves forward. Not the least virtue of such an approach is the potential rapprochement between historically opposed camps in the study of creativity, such as the problem solving/expertise and Darwinian approaches, both of which can be at least partly absorbed into typological models. It is debatable whether such a unified theory of creativity is possible – or even desirable, from the standpoint of pluralism raised at the outset of this article. However, taking into account the unique and highly varied characteristics of individual creators is an issue that any comprehensive account of creativity ultimately has to face. These higher-level themes are also characteristic of our final category of models: 'systems' views of creativity.

Systems Theories

Some of the broadest and most ambitious theories of creativity take the view that creativity is best conceptualized not as a single entity, but as a phenomenon emerging from a complex system with interacting subcomponents. Such 'systems' theories take a broad and often quite qualitative contextual view of creativity. A number of such theories have been proposed, almost all of which address each of the P's, though with different emphases, depending on the relevant level of creative magnitude.

One influential systems theory, devised by Mihaly Csikszentmihalyi, takes as its starting point not the question, "What is creativity?" but rather, "Where is creativity?" In this view, creativity emerges via three interacting components:

1. the domain, or body of knowledge that exists in a particular discipline at a particular time;
2. the individual, who acquires domain knowledge and produces variations on the existing knowledge; and
3. the field, comprised of other experts and members of the discipline, who decide which new works are worth preserving for the next generation.

Each has a role in determining what counts as creative.

This perspective involves multiple factors and takes a very broad view of creativity, emphasizing the ubiquitous role of place (or environment) among the P's, especially for Big-C achievements. It also elaborates the nature of the creative person by detailing how individuals other than the creator contribute to the emergence of creativity and de-emphasizes internal processes and individual contributions, placing more stress on collaborative creativity and the societal conditions which can best foster genius. It likewise highlights issues like the importance of 'gatekeepers' (e.g., journal editors, gallery owners, etc.) who play a major practical role in determining which contributions will be given the opportunity to be judged as creative.

This framework has many advantages, not the least of which is acknowledging the importance of extra-personal, sociocultural factors, which were previously underemphasized in creativity research. However, the qualitative nature of the model makes it difficult to test hypotheses unambiguously, and its strong interdisciplinarity could be a pragmatic roadblock – though for a rich understanding of creativity, many

more variables and levels of analysis need to be considered besides a quantitative, empirical approach to individual traits.

An alternative systems view, pioneered by Howard E. Gruber, is the 'evolving systems' approach. This has mainly been applied to understanding the unique attributes of the creative person, via detailed archival case studies, which are motivated by a particular question – for instance, how Darwin devised the idea of evolution by natural selection. Such case studies focus less on understanding the particulars of one creative act than on how those particulars fit into an individual creator's goals, knowledge, and reasoning, plus larger social forces and creative paradigms.

The emphasis of the evolving systems approach is on dynamic, developmental processes that play out in complex ways and contexts, over varied timescales. Several key concepts provide a framework for understanding creative individuals in the midst of such complexity. One is the notion that great creators use an 'ensemble of metaphors' in their thinking, which together characterize a developmental process leading to creative meaning-making. Another is that of a 'network of enterprises,' a system of goals that describes how an eminent creator may work on seemingly disparate topics and projects, consecutively or concurrently, and continually evolve a sense of the relations between the topics. Such analyses put considerable interpretive pressure on researchers, particularly in absorbing the details and global qualities of a large amount of material and in avoiding pat, hindsight-biased conclusions about a creator's entire career. However, if used judiciously, this method has the potential to characterize a creator in a dynamic way with a qualitative richness and rigor that is probably unmatched by any other approach.

Future Directions for Creativity Theories

Pluralism – Again

At the outset of this article, pluralism was put forth as a way of celebrating the diversity of creativity theories currently in the literature. The principle of pluralism may also prove useful in guiding future directions as scholars develop, refine, and connect theoretical perspectives. Such connections between different theoretical perspectives could potentially lead to attempts at grand, unified theories of creativity; however, unified theories or not, making connections would strongly benefit creativity research anyway, as researchers better situate their theories in the broader theoretical and empirical character of the domain, acknowledging and incorporating the plurality of perspectives that have taken root and flourished. This applies to all of the principal frameworks outlined earlier – including the six P's of creativity, the various levels of creative magnitude, a pure research versus applied focus, and a more scientifically oriented versus metaphorically oriented approach.

What Do We Know? A Critical Reconsideration of Theories of Creativity

In the light of the preceding exposition and discussion of current theories, let us revisit a theme somewhat related to the scientific-metaphoric distinction: the question of what researchers have actually learned about the nature of

creativity, and what role theories have played in that process of discovery.

Creativity researchers are in a somewhat uncomfortable position. At any level of magnitude, creativity by definition involves variety and unpredictability, which raises a host of conceptual, methodological, and measurement complications. Beyond that, a more subtle, but also more insidious, issue is that creativity as a topic of study is not some independent natural science phenomenon, whose physical workings can gradually be understood in reasonably objective terms. Rather, creativity is an all-too-human enterprise, one which our most illustrious forbears – Newton, Michelangelo, Mozart – probably had a far richer experience of – and, perhaps, deeper knowledge of – than virtually any contemporary creativity researcher.

This simple observation presents enormous conceptual and practical difficulties. This is especially true for researchers of Big-C Creativity, who must grapple with phenomena of unmatched depth, richness, and complexity, and who must achieve some multidisciplinary understanding of the particulars of the domain of expertise of their subject. (The issue is somewhat less threatening in the realm of little-c creativity, since the creativity of researchers can – hopefully – reasonably be expected to exceed that of most of their subjects.) It is an open question, to what extent any contemporary theory is a substantive improvement on the best armchair speculation antedating the modern psychological approach to the study of creativity. Indeed, from a hard-nosed, ultra-scientific perspective, many so-called 'theories' of creativity are arguably not well articulated or substantive enough to be informative about the phenomenon one way or the other.

The written record of eminent creators' armchair theorizing about creativity thus stands as an elephant in the creativity theory room. If the study of creativity is to be scientifically respectable, it surely needs to go beyond what could merely be arrived at by intuition, like any mature empirical discipline. This includes making falsifiable and counterintuitive predictions (not just commonsense postdictions), as well as making contact with well-developed neighboring domains and spanning multiple levels of analysis. Doing so need not imply a single unified theory of creativity or an abandonment of metaphorically oriented theories, but it does require high critical standards. A well-developed theory of creativity also does not entail making error-free predictions. In many ways, the domain of creativity research is more similar to contingency-intensive disciplines like history or biology, both of which have seen the development of rigorous, beautiful theories with great explanatory power, even if they cannot literally predict the future in great detail.

In considering the prospects and nature of reasonably rigorous theories of creativity, several criteria for the value of a theory are worth remembering. One is accuracy, or correctness: Does a theory make good predictions and yield reliable knowledge about a phenomenon? Another, however, is fruitfulness: the capacity of a theory to disclose new phenomena or relations among phenomena and to generate testable hypotheses. Some very accurate theories are sterile; some wrong theories are nevertheless very generative. In the history of science, many wrong ideas have been enormously useful, if only because the process of disproof can lead to greater knowledge and integration. For a topic like creativity, where precise predictions may not

be a reasonable goal, fruitfulness may be the better criterion of a theory's usefulness.

How have current theories of creativity fared by these two criteria? Given the complexity of the phenomena of creativity, it is encouraging that many contemporary theories are able to do a reasonable job accounting for existing data. However, ironically, despite the variety and number of theories in the literature, it is not clear that they do well by the criterion of fruitfulness. For instance, it does not seem unreasonable to claim that a book like Eckermann's *Conversations of Goethe* contains more wisdom and would spawn more hypotheses about the nature of creativity than virtually any contemporary psychological overview.

Along these lines, it is also arguable that what is really needed to advance the study of creativity is not a proliferation of more theories, but instead, more, better, and richer data, which could be used to put useful, direction-providing constraints on existing theories. Allied to such datasets, the application of more sophisticated statistical methods – including latent variable models and hierarchical or multilevel analyses – would go a long way to documenting and enabling an understanding of the richness of creative phenomena. Importantly, these would also serve to encourage the development of theories that were conceptually equipped to take advantage of such added empirical rigor.

In terms of subtopics within the study of creativity, the potential for the development of theories that go beyond the armchair seems most promising for non-first-person, multivariate aspects of creativity – precisely the aspects that are not amenable to introspection. These include the details of and variability in the creative process, the neural and other biological bases of creativity, and larger-scale sociocultural and trans-historical patterns. Empirical study can greatly benefit, or at least most uniquely contribute to our understanding of these aspects of creativity, which would indeed constitute a real advance on the long tradition of armchair speculation.

Conclusion

The variety of current creativity theories has pluses and minuses. On the plus side, there is a pluralistic array of perspectives available, which admirably attempt to understand many aspects of this complex phenomenon, which account for current data reasonably well, and which have the potential for a great deal of integration and cross-connection. On the minus side, many theories, generally speaking, have not progressed far beyond earlier speculative claims and have often failed to spark the identification of new phenomena

and counterintuitive testable hypotheses. While it is too early to forecast the fate of theories of creativity, and the enterprise of studying creativity more generally, it seems likely that the two will rise or fall together. For any real conceptual progress to occur, existing theories must be continually constrained by more and better data and analyses, and generate new constructs for measurement and analysis in their turn.

See also: Componential Models of Creativity; Enhancement of Creativity; Expertise; Historical Conceptions of Creativity; Implicit Theories; Insight; Problem Finding; Tactics and Strategies for Creativity.

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Relevant Websites

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- http://en.wikipedia.org/wiki/Scientific_theory – Wikipedia entry on scientific theories – basic information, including criteria and scientific laws.

Therapy and Counseling (Creative Process in)

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Glossary

Creative process The act of creating, usually involving several stages or phases, that includes various dimensions of creative thinking and emotional expression or involvement.

Homospacial process Actively conceiving two or more discrete entities occupying the same space, a conception leading to the articulation of new identities.

Janusian process Actively conceiving two or more opposites or antitheses simultaneously.

Psychotherapeutic creativity The generation of relational products that result from adaptive and innovative responses

to everyday occurrences, which demonstrate newness and meaningfulness to the creator and those with whom the creator interacts.

Psychotherapeutic creative process The act of generating new and meaningful change in emotions, thoughts, and behaviors.

Relational creative products Products that involve interactions with one's self and others and include the generation of new and meaningful change in emotions, thoughts, and behaviors.

Creativity in Counseling

Creativity in counseling does not come solely from the counselor, but rather from a shared struggle of two people trying to grow. One seeks guidance in finding new ways of being in the world, while the other offers expertise and facilitates the seeker's creation of new ways of being. It is this dance between seeker and facilitator where the creative process emerges. The type of therapeutic relationship that leads to creative outcomes is a collaborative one. One in which clients are viewed as expert on their own lives and the counselor support clients by helping them to identify, access, and effectively utilize their internal resources.

Research has shown a link between the creative process and the counseling process. Both processes encourage the movement from rigid, repetitive patterns of thought and behavior and emphasize the integration of thought and emotion resulting in more dynamic and adaptive modes of thought and behavior. Many of the factors pertinent to creative production are mirrored in the counseling process. These factors include openness to experience, access to intense affect, broadly focused attention, flexibility of thought, courage, perseverance, risk-taking, and delay of gratification

The focus of this discussion is on creative process, which attempts to explain how collaboratively client and counselor work toward creative outcomes. What steps are necessary to take a client from being stuck to a newfound perspective or way of being? The research literature provides two such explanations. The first theory suggested by Albert Rothenberg emanates from the psychoanalytic and cognitive perspectives in which he suggests there are two cognitive processes, namely the janusian and homospacial processes, which lead to creative outcomes in counseling. The second theory, suggested by the author of this article, comes from the humanistic perspective offers the psychotherapeutic creative process model to explain the creative process in counseling.

The Creative Process

Before looking more closely at these two explanations of the creative process in counseling, it is important to clarify what the creative process is in broader terms before applying it to the more narrow counseling context. Wallas' four-stage model of creative process, one of the most noted models of the creative process, suggests the process steps of:

1. *preparation* – the initial sensing and exploring of a problem;
2. *incubation* – problem is not consciously pursued and unconscious mental processes are involved;
3. *illumination* – sudden flash of insight when a new idea, solution, or relationship emerges; and
4. *verification* – the incomplete product of the illumination stage is revised, refined, and corrected.

This four-stage model can be applied very effectively to the psychotherapeutic process. When a client first seeks help from a psychotherapist either he/she already has a good idea of what the problem is or looks to the therapist to help him/her to discover what the problem is. During this phase of therapy, client history and life story is explored for the purpose of gaining knowledge and understanding of the client's experience and resultant difficulty. This phase mirrors the preparation stage of Wallas' model.

The incubation stage is an ongoing part of the psychotherapeutic process. Often when a client begins therapy he/she is warned that the 'unconscious pot will be stirred' and to not be surprised if and when unexpected emotions surface. This experience of stirring the unconscious is similar to what is described during the incubation stage.

The stage of illumination mirrors those moments in psychotherapy when the client suddenly gains insight and/or understanding into his/her experience. It is often expressed as, "I never thought about it that way!," or "I think I know what to do now," or "I can't believe that I never saw that before." There is a new awareness of his/her situation that previously was not there.

Verification is demonstrated in psychotherapy when the client tries the new insight or solution on for size. Does it seem to fit? During this exploration the client and therapist tinker with revising and refining until a good fit is found. Once internal agreement is determined, the client then has the opportunity to verify how his/her solution works in the 'real world.'

A second creative process model generated by Guilford views the creative process as creative problem solving. Guilford's creative problem solving model consists of six stages:

1. input sensing, also referred to as problem identification;
2. filtering, which is the process of determining whether or not to proceed with processing;
3. processing, which involves specific answers begin to be generated;
4. production, in which convergent or divergent answers are produced;
5. evaluation, which includes answers are tested, new information obtained, new tests of problem's structure, new answers generated, new answers tested; and
6. goal resolution in which creative solution is found.

Guilford's creative problem solving model of the creative process can be applied to the counseling setting as well. Clients come to counseling with an identified problem or with the help of the therapist identify the problem. The client and therapist then collaboratively determine what information is extraneous and what is relevant. The relevant information is then processed, which can lead to new insights. These new insights are then evaluated and depending upon the results of the evaluation the new insight leads to problem resolution or the need for further informational processing and insight refinement.

While both of these models have proven useful in general discussions of creativity, they are not adequate explanations for the creative process that is inherent in the counseling process. What makes the counseling process unique is it occurs in a relational context. Two individuals work collaboratively in a counseling setting and the product of the collaborative relationship is a creative outcome for the client.

The Mutual Creative Process and Therapeutic Action

Albert Rothenberg examined intrapsychic processes involved in the act of creation. While Rothenberg contends that these processes are vital to creativity in numerous areas, he focused specifically on their use in the practice of psychotherapy. The creative process in psychotherapy begins when client and therapist can agree that the client's problems derive from patterns of living, unconscious conflicts, or life history experiences. An important part of this agreement involves the client seeing the connections between conflicts and maladaptive patterns and the symptoms and suffering for which the therapist's help is sought. Rothenberg contends that this process of acknowledgement can be quite time consuming, but necessary for the creative process to commence. He views this process as preparation and likens it to the preparations that a creative artist must engage in before

creation of art. While Rothenberg sees the client as active participant in the creative process, he views the therapist as instigator of the mutual creative process via creative activity. The client could be viewed as the actor in a play, while the therapist plays the role of director. The therapist's absorption in and love for the material of psychotherapy comes before the client's interest. It is the therapist's love and absorption that fuels the entire therapeutic transaction and it a major instigating factor in the creative process. Without this love and absorption, Rothenberg contends, the creative process could not take place. The client's motivation to participate in therapeutic creation becomes facilitated by the therapeutic interaction. Through the establishment of the therapeutic alliance, the client begins to develop a sense of worth and a feeling of ability to make changes and produce creative effects. This therapeutic interaction results in what Rothenberg refers to as the mutual creative process.

The Homospacial Process in Counseling

Rothenberg proposes that the central mechanisms of creativity include the mental operations he has labeled the homospacial and janusian process. He contends that the therapist's understanding is a generative function of the use of the homospacial and janusian processes. This understanding is a core facilitator of the creative process and is achieved via the therapist's interventions, interpretations, and overall approach and provides the platform from which the client develops insight, resolves conflict, makes choices, and develops new attributions and structures. One last condition is necessary for the creative process to occur. The client has to appreciate that the risk of change is a worthy endeavor. This appreciation is made possible when the therapist helps the client feel understood in a meaningful way and therefore can undertake the risk of engaging in the creative therapeutic process.

Rothenberg believes there are numerous ways to transmit understanding however, the homospacial and janusian processes are creative modes of transmitting understanding. The sort of understanding that Rothenberg refers to is akin to empathy. Empathy means to understand as well as to share in a manner that goes beyond having the same surface feeling. It means to understand the essence of what the client is experiencing. In the psychotherapeutic transaction, according to Rothenberg, empathy involves the homospacial process. The homospacial process consists of actively conceiving two or more images occupying the same space simultaneously. This conception leads to the articulation of new identities. The therapist activates the homospacial process by cognitively and affectively formulating multiple entities as occupying the same space. The therapist conceives his self representation together with the client in the same space. In this process, the therapist superimposes his representation of himself with his mental model of the client. For example, the therapist may conceive of himself as sitting where the client is, which would consist of a mental image, as well as mentally represented word and sound experiences he has

had in sessions with the client. All five of the senses can be involved. The mental model results from an extended association with the client, including a systematic knowledge of the client and a life time of professional experience with human suffering, conflict, and crisis. Ultimately what is created is an empathic understanding of the client's lived experience. Rothenberg views the use of the homospatial process in the service of deepened client understanding as a creative act in personal relationships. Empathy produces interpersonal knowledge where it did not previously exist. This production of new knowledge deepens the therapist's understanding, lessens anxiety levels through unearthing of unconscious material and the therapist uses this understanding in his general approach or offers it to the client who can either verify, deny, or accept it. When the formulations are effective, the client usually introduces new material or collaborates in a mutual creative process.

The Janusian Process in Counseling

The janusian process consists of actively conceiving two or more opposites or antitheses simultaneously. During the course of the creative process, opposite or antithetical ideas, concepts, or propositions are deliberately and consciously conceptualized side-by-side and/or coexisting simultaneously. These formulations are constructed in clearly logical and rational states of mind in order to produce creative effects.

The janusian process requires an intensive knowledge of the client, which is gained during empathy development and the homospatial process. This intensive knowledge enables the therapist to identify salient themes in the client's past and current feelings, thoughts, and behaviors. Antithetical content is identified and made conscious. For example, a client may describe an experience where her thoughts and actions demonstrated superiority and inferiority simultaneously. This new awareness of disparity often is experienced with feelings of surprise, sudden realization, and sometimes breakthrough. The process is responsible for the production of insight and discovery.

As previously stated, Rothenberg emphasizes the mutuality of the creative process and therapeutic action. Both therapist and client are engaged in enhancing the client's self and social worth, as well as the growth and development of the ego. The client must present with the motivation and willingness to choose new patterns of behavior, just as a creative artist chooses to create new artistic content. The therapist needs to experience the activity of psychotherapy with another as a worthy endeavor and bring to the experience absorption and love for the material of psychotherapy. Rothenberg likens the therapist's experience to that of the artist's love and fascination of the words, paints, and sounds that are used to produce literary, artistic, and musical works.

Rothenberg states that once a client realizes the possibility for change, the therapist's creative skills facilitate the process. Once the client determines what creative outcome is desired the mutual creative process becomes activated. The creative therapist can guide the client through the homospatial and janusian process thus inducing and maintaining creative engagement for the purpose of gaining new and valuable effects.

The Psychotherapeutic Creative Process Model

The psychotherapeutic creative process model shares common features with Guilford's creative problem solving model and Wallas' creative process model. The psychotherapeutic creative process model was developed in order to address the relational aspects that are unique to the therapeutic setting, which creative process models to date have failed to adequately address. This model is the result of an extensive qualitative research study in which 20 therapeutic encounters, involving at least five sessions per encounter, were analyzed for creative process variables. The result of this analysis yielded the psychotherapeutic creative process model which consists of eight stages:

1. preparation for creative therapeutic outcome – problem identification, focused attention on the problem, and problem deconstruction;
2. exploration of problem resolution – exploration of problem solving strategies and exploration of potential benefits of problem resolution;
3. processing shift toward problem resolution – cognitive, affective, behavioral, experiential, problem awareness, intention, readiness shifts, shift from external to internal process, internalization of shift, and internalization of benefits of problem resolution;
4. problem insight;
5. transformation of shift/insight into creative action;
6. implementation of problem solving strategies – successful or unsuccessful implementation of problem solving strategy;
7. actualization of creative therapeutic outcome; and
8. evaluation of new behavior, cognition, or emotion – exploration of goodness of fit, exploration of benefits of problem resolution, identification of obstacles to sustainability, and reinforcement of creative change.

While it appears that this model unfolds in a linear fashion, it is important to make clear that this is not the case. The psychotherapeutic creative process is a fluid and dynamic process, at times multiple stages will happen simultaneously, out of order, or stages frequently revisited. The linear presentation is used only because of the limitation of the medium of reporting.

Stage One – Preparation for Creative Therapeutic Outcome

The first stage of the psychotherapeutic creative process model, preparation for creative therapeutic outcome, includes the process steps of problem identification, focused attention on the problem, and problem deconstruction. In many cases the client comes to the therapeutic encounter with a good idea of what the problem is, however the therapist is able to help the client further clarify, restructure, or redefine the problem in such a way that enables the client to begin to entertain more creative solutions. Yet other clients may know that they have a problem but lack any understanding of what the problem is, thus necessitating the therapist's more active engagement in problem identification. Regardless of what level of problem identification the client possesses at the commencement of counseling, therapist and client work collaboratively to clearly identify the problem.

Once the problem is identified, therapist and client begin to focus their attention on the problem which involves conscious examination of the client's emotions, thoughts, and behaviors connected to the identified problem. This focused attention manifests in problem deconstruction. Problem deconstruction involves exploration of the problem components. The process of deconstruction yields valuable information about how the problem began, what sustains the problem, what gets in the way of the client solving the problem, what benefits are derived from engaging in the problem, what outside forces enable the continuation of the problem, and what solutions have been tried, but failed. As the client and therapist actively engage in this stage one process, the client begins to experience a sense of understanding regarding the problem.

It is important to note that filtering is a part of the psychotherapeutic creative process model. Filtering describes the decision process clients go through regarding whether to focus their attention on a problem or to set it aside and focus elsewhere. As client and therapist work toward problem identification, additional problems may come to light that are related to the problem that brought the client into counseling. An assessment must be made to determine whether or not these newly identified and related problems are relevant to the production of creative therapeutic outcomes. If the new problem is determined to be irrelevant, the conscious decision is made to set the problem aside, thus filtering out the extraneous problem. Filtering intervenes throughout all stages of the creative therapeutic process model.

Stage Two – Exploration of Problem Resolution

The second stage, exploration of problem resolution involves the exploration of problem solving strategies and potential benefits of problem resolution. Before a shift toward problem resolution occurs, it is important to identify benefits that may result when problem resolution is achieved. This exploration results in motivating the client toward change. Often the client receives unconscious benefits from maintaining the problem. During stage one, part of the problem identification process is to make conscious the benefits that come from sustaining the problem. It is equally important to provide the client with the opportunity to explore the benefits that will come with the creative therapeutic outcome.

Once the client is able to generate a list of benefits, discussion of problem solving strategies, including identification of previously unsuccessful strategies, occurs. It often proves useful to revisit these strategies, identify what may have gone wrong, explore alternative approaches to previously failed problem solving strategies. Filtering becomes important during this exploration, as some problem solving strategies might never prove successful and therefore should be filtered out. However, if client and therapist can identify the stumbling block that prevented a viable solution from being realized, develop an alternative approach, a previously failed strategy can be transformed into a viable one.

Divergent thinking, which is a kind of thinking that involves thinking in different directions for a variety of answers to questions that have many right answers, facilitates the process of problem solving strategy exploration. Rarely do life problems have only one solution. Client's are asked to suspend the internal

critic that often gets in the way of divergent thinking and encouraged to actively pursue numerous problem solving strategies.

Stage Three – Processing Shift Toward Problem Resolution

The third stage, processing shift toward problem resolution signals a qualitative shift in the creative psychotherapeutic process. During this stage the client shifts from focusing on the problem to focusing on the problem resolution. As the therapist and client collaboratively explore problem solving strategy options, the client begins to process and internalize the material generated thus far in the process. This process of internalization leads to an internal shift. A shift is defined as an internal movement, in which the newly internalized material acts as a catalyst. At this juncture a once stuck client becomes freed from the mire of the problem and is now able to begin the transformational process of creative change. There are numerous shifts that can occur. These include cognitive shift, affective shift, behavioral shift, experiential shift, problem awareness shift, intention shift, readiness shift, and shift from external to internal processing. The client is not limited to just one type of shift. Multiple shifts can occur simultaneously. Inclusive in this phase is the client internalizing the shift(s) and internalization of the benefits of problem resolution. Therapist and client actively and collaboratively dialog about the shift and this dialogue serves to validate and reinforce the shift that occurred thus facilitating internalization of the shift and the benefits of problem resolution. Filtering can occur at this point as well.

Stage Four – Problem Insight

Processing shift toward problem resolution leads to problem insight, the fourth stage of this model. Problem insight, refers to a core understanding of the nature of the problem and the necessary steps to take toward problem resolution. It is important to note that problem insight can occur at the earlier process step of exploration of problem resolution or even during the preparatory process stage. However, it was observed that in most instances, problem insight occurred following the third stage – processing shift toward problem resolution.

Stage Five – Transformation of Shift/Insight into Creative Action

During stage five, problem insight leads to the client becoming proactive in which the internalized shifts and problem insight gained during the previous two stages is transformed into creative action. Creative action takes the form of implementation of problem solving strategies collaboratively generated by the therapist and client. Creative action can take the form of therapist and client collaboratively developing an action plan to deal with the problem and the client then implements the plan in the real world. Creative action can also occur organically without explicit plan formulation. Once problem insight occurs, the client when faced with the same problem in the real world will automatically respond in a new way. For example, once a client is able to identify and label the problem as difficulty setting limits with others readily identifies this problem when encountering it again automatically, without having articulated a plan

with the therapist, responds in a new way, using new thoughts and behaviors that are adaptive. Problem insight results in automatic creative action on the part of the client.

Stage Six – Implementation of Problem Solving Strategies

Stage six involves the successful or unsuccessful implementation of problem solving strategies. If a problem solving strategy is implemented successfully, actualization of creative therapeutic outcome occurs. Creative therapeutic outcome is manifested with behavioral, cognitive, and/or affective change. If unsuccessful implementation of problem solving strategies occurs, the therapist and client then loop back to any of the previous stages – preparation for creative therapeutic outcome, exploration of problem resolution, or processing shift toward problem resolution – for reworking and refinement of the problem and possible resolutions.

Stage Seven – Actualization of Creative Therapeutic Outcome

This stage involves the actualization of client creative change in which new behaviors, cognitions, and/or emotions become a reality. The client exhibits either new behaviors that are functional and adaptive; thoughts that enable the client to rationally and adaptively deal with challenges; or emotional reactivity that is appropriate and proportional. The client has effectively navigated the necessary process steps to achieve a creative therapeutic outcome.

Stage Eight – Evaluation of New Behavior, Cognition, or Emotion

This stage involves the exploration of goodness of fit of new behavior, cognition, or emotion, exploration of benefits of problem resolution, identification of obstacles to sustainability, and reinforcement of client creative change. Goodness of fit involves the determination of the suitability of the creative therapeutic change to the client's life. Whenever change occurs, there is a chance that initially the client may express awkwardness, discomfort, or feeling of incompetency. It is important during this stage for the therapist to help the client navigate the uncertainty that comes with newness. The challenge is to discern between the discomfort that comes with adjustment to change and a solution

that is a poor fit for the client's life. If the determination is made that adjustment difficulty is the source of discomfort, then the therapist provides support and guidance to enable the client to sustain the change until adjustment is achieved. However, if goodness of fit is the problem, then it is necessary to return to stage three for further processing of problem resolution.

Once the creative therapeutic outcome has become actualized, exploration of benefits of problem resolution is key to sustain client creative change. Benefit identification acts to reinforce problem resolution and resultant creative therapeutic outcome, thereby increasing the likelihood that the client will continue on the path of resolution and avoid returning to maladaptive behaviors, thoughts, and/or emotions. Equally important is identification of obstacles to sustainability. When clients experience the success of problem resolution, it is easy to focus only on the exhilaration and relief of being free from the problem. It is important to inoculate clients by exploring obstacles to sustainability of creative change and generating strategies to deal with potential obstacles. Ultimately, exploring benefits and obstacles serve to validate and reinforce creative client change.

See also: Dreams and Creativity.

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Relevant Website

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Time

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Glossary

Creativity complex The notion that creativity is a syndrome and is multifaceted.

Future problem solving A program in which children practice solving realistic, open-ended problems.

Impulsive cognitive style The tendency to work quickly. (cf. Reflective Cognitive Style).

Incubation Time away from a problem – at least consciously. The person may continue to work on a preconscious level, with an ‘ah-ha!’ occurring when a solution is found.

Let it happen strategies Tactics that involve leaving the problem for a time, allowing incubation and the like to contribute to the problem solving effort.

Old age style Intentional changes made by artists, often in the seventh or eighth decades of their lives.

Reflective cognitive style The tendency to take one’s time when working.

Stage model of creative thinking Proposed by Graham Wallas in 1926, with preparation, incubation, illumination, and verification stages. Time is absolutely required by the second stage and probably necessary for the first and fourth as well.

Ten-year rule Data suggest that ten years of work, or 10 000 h, need to be invested into a domain for expertise to develop.

Time in Personal Processes

Creativity is often defined as a syndrome or complex, the premise being that it is multifaceted. Not surprisingly, then, several different aspects of creative behavior have been connected with time.

Time has, for example, been tied to the cognitive bases of creative thinking. Creative thinking has been defined in associative terms, with the prediction that individuals tend to generate problem solutions in concatenated chains of associations. The first few associations are usually rote, obvious, and unoriginal, but the later and more remote associations become increasingly original. Time is relevant to the associative basis of creative thinking because it takes time for an individual to move through the obvious ideas to find the remote associates. These predictions about remote ideas being original have been repeatedly confirmed. One of the most commonly cited models of the creative process was proposed in 1926 by Graham Wallas, indicating that problem solving consisted of the four stages of preparation, incubation, illumination, and verification. Incubation implies that some time must elapse. During that time the individual is not consciously working on the problem – but is working on the problem on a preconscious level. The preconscious often succeeds in solving the problem because it encounters fewer constraints than the conscious (and logical) efforts. In 1971 J. P. Guilford claimed that Wallas’ description of the stages is primarily designed for problems of great importance – problems that demand a long period of work. Guilford proposed that Wallas’ steps are involved in solving ordinary everyday problems, but they are compressed.

The need for incubation (and time) was also noted by Sidney Parnes. He distinguished between ‘make it happen’ and ‘let it happen’ strategies for creative problem solving. The former are exemplified by very intentional and systematic tactics, such as working backward (starting with the solution and

trying to work back toward the initial state) or turning a problem on its head. The latter are exemplified by things like taking a walk or turning to another task; the assumption is that incubation will occur. This in turn assumes that time (for incubation or at least thinking and processing) is useful.

Incubation is often preceded by the state of fixation. That may lead to an impasse, which is an affective result of the lack of progress. The affect is characterized by negative emotions emerging and the person feeling stuck. He or she may quit consciously considering the problem. This is the time that is required for incubation. In other words the time that is not predated by fixation cannot be regarded as incubation.

Flora Beeftink, Wendelien van Eerde, and Christel G. Rutte examined the differences between interruptions and breaks (often a matter of choice) on impasses and insights. In interruption condition, participants are forced to switch tasks at a predetermined moment; in breaks they could switch tasks when they chose to do so. Both breaks and interruptions contributed to impasses, but interruptions did not contribute to solving more insight problems unlike breaks.

Time may be required by one of the most general of the tactics used for creative problem solving: changing one’s perspective. Changes of perspective can break a mental set or routine and allow creative insight. Perspectives are often changed literally, by finding another viewpoint or way to represent the problem. A new perspective can also be found simply by taking time away from the problem. Every writer knows that one’s own work can be difficult to edit if immersed in it. But if you take time away, editorial work is easier. We become more objective and sensitive to details. The same is true in other areas, where time provides perspective. Unlike incubation, where the preconscious continues to work on the problem, here it is actual and complete time away from the task.

Howard Gruber described how many seemingly instantaneous and sudden insights are actually protracted and spread out

through time. He suggested that insight is *not* a sudden process. Each insight supposedly has a developmental history. According to Gruber, mastery of creativity requires repeated practice which implies that a great deal of time must be available and is then invested. For this reason, hard work and repetition are important for creativity. He called this process *constructive repetition* and defined it as a conscious repetition and revision of a concept to establish its best form for a creative product. As an illustration, Beethoven revised his works 20 or 30 times before he decided the acceptable form of the piece. This is contrary to the popular conception of insights as sudden. The illumination may seem sudden but what led up to it may require that time be invested.

The creative individual may rely on certain cognitive capacities and abilities, such as those mentioned above, when working, but he or she must also be interested in using those capacities or abilities. This interest is described as 'intrinsic motivation.' If intrinsically motivated, the individual will invest time and effort into a task, problem, or domain. Importantly, an event may increase or decrease intrinsic motivation depending on its meaning to the recipient. According to cognitive evaluation theory, if an event is perceived as a pressure to reach a particular goal (as controlling), intrinsic motivation is undermined. On the other hand, if an event is perceived as an internal locus of causality for behavior (as informational rather than controlling), it enhances intrinsic motivation. Therefore, perception of time limits counts. According to Richard Koestner, in a creative activity, people who have no-limit or informational limit spent more free choice time, an indication of high intrinsic motivation, than people who have controlling limits. When it comes to products, Koestner found that the no-limit condition was superior to controlling condition in terms of creativity ratings. Higher technical quality of the products was evident in informational limit condition than the controlling condition.

Timed Tests

Creative potential is often estimated with special tasks or tests. When these tasks or tests are administered, special instructions must be given. Otherwise respondents tend to view the tasks as similar to the academic tests most of us have experienced, and when they do that, creativity is a low priority. On academic tests it is important to find the correct answer, spell it correctly, and earn a high grade. When generating original responses to an open-ended task, there may be no correct answer. There may be many appropriate answers, some of which are original and some of which are not, but there is no one correct answer.

For originality on the part of the respondents, grades, conventional answers, and time must be deemphasized in the task instructions. Instead of imposing a time limit, examiners should allow the individual to make the pertinent decisions about investing time and effort for him- or herself. By allowing individuals to decide for themselves how much or little time to allocate to the task, the distinctiveness of divergent thinking (and originality) from convergent thinking is maximized. Performance on the test is determined by the respondent's intrinsic motivation, which often facilitates creative thinking. The flexible time limits also allow the individual to find remote associates and perhaps incubate.

There is a common criticism of tests, including tests of creativity, which is the most tenable if they are timed. In the natural environment, creative work may rarely have a timed component, at least one that is similar to that used with tests. If we wish to predict real world creative work, the predictor should require the same tendencies as the criterion behavior. This implies that if creative work in the natural environment is rarely timed, so too should the assessment of creative potential be untimed. The rebuttal to this view is that tests are merely estimates of the potential for real-world creative activity, and that they must have constraints on them to allow them to be used in research and educational settings.

Culture

Clearly, cultural norms and expectations can limit an individual's creativity. He or she may not think of some possible solutions to a problem because they are taboo within the present culture. Adults in the United States, for instance, may not consider humor or play as contributions to creative work. Work is supposed to be serious rather than fun. Similarly, in the United States there is often pressure to work quickly and to be productive. It may not be easy to tolerate incubation and to appreciate the value of 'let it happen' tactics. Time is a valuable commodity and incubation may be seen as a waste of time. One step toward avoiding cultural blocks, like the prejudice against humor, play, and incubation, is simply recognizing that they are imposed by culture rather than absolutes.

Expertise as Time Invested

Some domains may require years to develop expertise. Various investigators have suggested that ten years (or 10 000 hours) need to be invested in a particular domain for expertise to develop. To the degree that expertise is necessary for creative work, this may indeed be a requisite investment. In some areas, expertise may be easier to obtain and require less temporal investment. (These may be domains which depend the least on familiarity with a body of factual information.) What may be surprising is that expertise can sometimes actually inhibit creative insight. Experts sometimes make assumptions that preclude original thinking. They sometimes have invested so much into their area of expertise that they are resistant to considering alternatives. Dean Simonton has described other requisites for high-level achievement. He pointed to three tendencies of eminent persons: they start their careers early, they are productive, and they live a long time. Time is involved in each of these. Time is also implied by economic and investment theories of creativity. These use the parallel idea that creative persons tend to invest a great deal into their work. Investments may be temporal. This may sound like another way of saying that expertise takes time to develop, but here it is more that the person concentrates, and frequently, on the task at hand or field of choice. It is possible that investments can work against creative success. In this sense the psychoeconomic theories of creativity support the idea that expertise can sometimes inhibit original thinking. Theoretically, an individual who has invested a great deal in one idea or line of thinking

would experience a 'depreciation' of his or her knowledge if new lines of thought supplanted the old, and this may lead them to resist new lines of thought.

Developmental Trends and Rates

Time is often used as a categorical independent variable. This is exemplified in longitudinal studies, where various follow-up assessments are conducted after a particular interval has elapsed. Louis Terman conducted the most famous longitudinal study, though his (gifted) subjects were selected based on IQ and traditional intelligence. Time is also implied by other developmental research, where changes depend on maturation and the passing of time. Some longitudinal studies have found discontinuities and changes that would not be apparent with any other research design. Other studies have found continuities. Consider Robert Albert's longitudinal study of exceptionally gifted boys. This investigation has been in progress for approximately two decades. One of the key findings of a recent follow-up assessment was that certain subjects were 'cross overs.' By this Albert meant that subjects had changed their interest from one domain to another. The change was apparent only because the longitudinal research design allowed a comparison of career interests and general preferences at several points in time. There are also continuities that can be uncovered only with longitudinal research designs. Mihalyi Csikszentmihalyi and Jacob Getzels, for instance, found that art students who invested more time in the preparation of the subject matter were more original – even 18 years later.

The domain specificity of the creativity peak was also highlighted by Harvey C. Lehman, and later by Dean K. Simonton, in research on exceptional achievement. This line of work suggests that philosophers and social scientists need a longer time to master products than poets and mathematicians. Usually poets and mathematicians peak in their twenties, but social scientists peak in their thirties or forties. Development is a lifelong process, and certain discontinuities appear late in life. Some may facilitate creative work. Many older artists are, for example, less concerned with criticism than they were when younger, and this can allow them to focus on authentic self expression and experiment in their work. Martin Lindauer and others have found that many of the most creative artists intentionally changed their style as they got older – often in the seventh or eighth decades of their lives. These changes to an 'old age style' may have contributed to the artists maintaining a fresh perspective and creative hand. Such changes and perspectives assume that time must pass – the old age style is simply not found in younger individuals. Elapsed time is sometimes not the concern. Time can also be used to calculate other indices of development, such as 'rate.' Rate is the standardization of occurrence as a function of time. Of relevance here are rates of development and rates of creative productivity that reflect individual differences. There is, for instance, evidence that various facets of thought develop at different rates. J. P. Guilford described in detail different kinds of ideational flexibility and how they mature and fail at different rates. Using Guilford's own terms, the 'flexibility of classes' is lost at a different rate than is the 'flexibility of transformations.' Support for this view has been provided by the research on divergent thinking.

Attributions of Creativity and Time in Interpersonal Processes

Time is required for some of the social, interpersonal processes that contribute to creative work or are involved in our judgment of it. Many researchers have argued that the attribution of creative ability is most accurate only after a long period has elapsed. That ostensibly gives the judges a better perspective. The need for a long-term perspective is evidenced by the changes that sometimes occur in reputations. Rembrandt, for example, was not the most famous artist of his time, but he is now one of the best known from his era. The work of Gregor Mendel was largely overlooked for 50 years.

An issue arises when eminence is defined in terms of social attributions. This brings into question of a creative genius being ahead of his or her time. If creative geniuses are ahead of their time, their genius might not be recognized. Records might not be kept of his or her work and no attention would be given to it. The assumption is that the reputation of creative exceptionalism emerges because of the social and cultural context. This may occur in two ways. The product may not receive much recognition during the creator's lifetime; or the exceptionalism may be recognized during the genius' lifetime, but forgotten after his or her death. In fact, necessary resources might not be allocated to the individual because of the lack of appreciation. In that light the creativity might never develop to the level necessary for exceptional achievement. A second interpersonal issue involves the possibility that immediate temporal constraints can undermine creative work. This was implied earlier, in the discussion of task instructions for assessments of creative potential. It was further intimated by the attributional process that some apply to judgments of creative performance. It can be explained by referring back to the economic theory of creativity, because there time was defined as a resource. Time can be invested in one's training or work. This is an interpersonal dynamic when other persons (e.g., parents, teachers, or supervisors) decide how much time we can invest in our training or work.

Time as Personal Construct

The research above, noting the inhibitive effects of time constraints, should not be taken to suggest that everyone will be disturbed by deadlines. Recall here that according to cognitive evaluation theory the influence of limits is only likely when they are perceived as pressure by the person. This is a kind of subjectivity of time. Along the same lines time may be conceived as occurring in routines and schedules, and these could easily be perceived as boring or repetitive. As such they may make it difficult to maintain one's creative efforts.

If routines are imposed by others, they tend to hinder creativity because they are a kind of pressure. Yet according to Mihalyi Csikszentmihalyi, not all routines harm creativity. Some persons work best under pressure. Moreover, time is a function of subjective interpretations, and different people will interpret time periods differently. The subjectivity of time, and the relationship between that interpretive tendency and creativity, is implied by research on 'flow.' Flow is characterized by a loss of self, and a loss of the awareness of time's passing.

The subjectivity of time and a second connection to creativity is suggested by the ability of certain creative persons to look beyond the present. This tendency is epitomized in the 'future problem solving' educational program and in the 'proactive creative work' of some creative persons. Proactive creative efforts may allow us to avoid problems, or solve them when they are minor, rather than solving them or dealing with them when they are so large as to be unmanageable. One part of the subjectivity of time can be explained by 'cognitive style.' Impulsivity and reflective cognitive styles have, for instance, been isolated, and they differ in terms of how much time is required or used by the individual. Perhaps one individual uses a great deal of time because they are not really aware of its passing. Indeed, that is one of the basic premises of the concept of flow. To the extent that creative insights are often protracted, impulsivity might decrease the likelihood of creative work.

Conclusions

Time is thus relevant to several cognitive and metacognitive processes that might be involved in some creative thinking. It is related to incubation and necessary for the remote associates that tend to provide original ideas. Time can be used strategically, in 'let it happen' tactics, and it may be indicative of investments and intrinsic motivations of creative persons. It should be explicitly deemphasized when using tests of creative potential. The cultural basis of time should be acknowledged, even as specifically associated with creative work, as should the value of time as a resource in most organizational and educational settings. Time is used in areas of creativity research in addition to what is reviewed in the present article. Gudmund Smith, for example, varies the exposure time in his Creative Functioning tests, and Norbert Jausovec examined heart rates

as related to stages in the creative process. The relevance of time is widely recognized and even more varied than the present overview might suggest. Very likely, most or even all of the ways that time influences creative behavior should be qualified. After all, virtually all other influences on creativity show optimal levels. Divergent thinking, for example, often supports creative problem solving, but only up to a point. You can be too divergent (and never bring an idea down to earth to make it useful). You can also be too independent, too conventional, too intrinsically motivated. Again, it may be that all influences on creativity are most effective at an optimal rather than extreme level. Time, then, may also have optima. Just to name one example, incubation may be a good thing for creative thinking, but perhaps only for a period of time and certainly not *ad infinitum*. The same optimization may apply to all temporal influences and correlates.

See also: Cognitive Style and Creativity; Cross-Cultural Differences in Creativity; Divergent Thinking; Economic Perspectives on Creativity; Eminence; Everyday Creativity; Expertise; Insight; Perspectives; Problem Solving.

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Henri-Marie-Raymond de Toulouse-Lautrec-Monfa 1864–1901

Artist

Oil paintings: *Le Cirque Fernando (1888)*, *A la Mie (1891)* *Dance at the Moulin Rouge (1894)*;
Posters: *Le Chat Noir*, *Le Moulin Rouge*, *Aristide Bruant*, *La Goulou and Valentin le Desosse*;
Lithographs: *Elles*

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HENRI DE TOULOUSE LAUTREC's paintings and prints are linked in spirit and draughtsmanship to the work of artists such as Daumier and Goya. Lautrec's acute rendering of gesture and movement, combined with the fluent vigor with which he disposed of line and color, ensures him a place among great 19th-century graphic artists. As early as 1900, Picasso, on arriving in Paris, paid homage to Lautrec by producing several paintings in Lautrec's style. Lautrec's artistic successors, among them Expressionists such as Beckmann and George Grosz, took a few pages from Lautrec's own book in their scathing portrayals of decadent German city life. More generally, Lautrec's mature style, in which he handled his media roughly and showed small concern for the conventions of Academic painting, makes him a precursor of Modernist painters. In the spirit of these painters, he treated the medium and the technique (i.e., oil painting and lithography) in such a way that the viewer could not evade the artifice of the process and the materials.



Henri de Toulouse-Lautrec, self-portrait c. 1882–1883 from Musée Toulouse-Lautrec, Albi. Used with permission from Giraudon/Art Resource, NY.

Background

Born into an aristocratic family, Lautrec was afflicted with a glandular disorder that permanently stunted his growth. Yet, even as a sickly child he was noted for his sense of humor and for his intense involvement in the social and visual aspects of life. It was in his large and close-knit family that he acquired amateur drawing skills. As a child he loved to sketch animals, especially equestrian figures and carriages. By his late teens he was taking informal art lessons with a deaf-mute friend, the professional painter of horses Renee Princeteau. Noting the boy's talent, Princeteau advised Lautrec to start taking his art lessons in Paris.

Lautrec studied successively in the workshops of two conservative Parisian painters, Bonnat and Cormon. Even though he was pleasurably challenged by the grind of drawing from plaster casts and nudes, Lautrec never distinguished himself as an academic artist. However, by virtue of living in Paris, Lautrec was exposed to formative cultural influences: the paintings of the Impressionists and Degas (whom he especially admired), Japanese prints, and the disreputable nightlife of Montmartre. It was the habitués and performers in the clubs, theaters, and brothels who became his subject matter. Between 1885 and 1896 he produced most of the oil paintings, lithographs, and posters for which he is famous. The first public successes came with his advertisements for various Montmartre dance halls and “boites a chanson.” He made memorable posters of key figures in the nightclub district, such as the balladeer Aristide Bruant and the performers Yvette Guilbert, La Goulou, and Valentin the Boneless. Critics say that Lautrec created a definitive vision of fin-de-siècle Paris, in much the same way that Baudelaire created a verbal description of a slightly earlier Paris. (See [Figure 1](#).)

In 1897 Lautrec confirmed his notorious reputation by publishing a collection of lithographs titled *Elles*. These were based on studies that he had made while living in a brothel. Between 1880 and 1900 he received commissions for advertisements and for illustrations as well as selling his works in a number of galleries in Paris and elsewhere in Europe. His mother supported him financially and emotionally throughout most of his life and was with him when he died in 1901 at the family estate. Relations with his father remained strained up to the end. Alphonse the Count had little respect for his son's “audacious scribbles” (as he called them) and was initially opposed to any posthumous showings of Lautrec's works.

Methodological Notes: The Systems View Of Creativity

Some social psychologists wisely advocate a systems approach to the study of creative individuals. These psychologists observe that in addition to intellectual gifts of one sort or another, social and historical circumstances must be propitious for individuals to achieve creative eminence. To put it more simply, if creative individuals are to emerge, they need to be present at a time and place when their special abilities are in demand. Thus, a systems approach to the study of creative people requires the researcher to go beyond a focus on the



Figure 1 Henri de Toulouse-Lautrec, French, 1864–1901, *At the Moulin Rouge*, oil on canvas, 1893–1895, 123 × 141 cm, Helen Birch Bartlett Memorial Collection, 1928.610. Photograph © 1998, The Art Institute of Chicago. All rights reserved. Used with permission.

special qualities of the creator and to include a consideration of the intellectual domain that this person has mastered and the social organization of the field in which the person's work is recognized. For this reason, the discussion of Lautrec that follows suggests both endogenous factors and exogenous factors.

The endogenous aspects of his creative activity are those associated with the gifts and afflictions with which he was born. The exogenous features of Lautrec's life include factors such as the happy accident of his birth into a loving and well-to-do family and the historical fact that Lautrec began to produce art at a time when the French Academy of Art was losing its grip on the French art world. What emerges from the discussion that follows is a sketch of his special traits, the luck, the misfortune, and the social and historical circumstances that, taken as a whole, contributed to his emergence as a significant artist.

When we look at Lautrec's life, we can identify several key factors: (a) his precocious gifts as observer and draughtsman; (b) thematic, technical, and emotional continuities between childhood and adult art; (c) the crucial role of emotional and financial support offered by his family; (d) Lautrec's persona as an artist; and (e) the impact of class and historical setting.

Lautrec's Precocious Gift for Sure and Vital Line and His Eye for Physical Gesture and Expression

The record of Lautrec's juvenile artistic activity suggests that he fits the profile for childhood giftedness. According to Winner gifted children possess three key traits: (a) precocious ability in a given discipline or area of knowledge; (b) an intense desire to master a given medium or skill; and (c) the drive to solve problems in their own way, rather than using formulas provided by others. In all respects young Lautrec was a typically gifted child.

Precocious drawing ability

Lautrec's drawings from a young age demonstrate the quality of his rendering skills and the rapidity with which he acquired them. Lautrec's graphic profile (based on his juvenile drawings and paintings) shows that he was a prolific and accomplished draughtsman. In this respect he is like many other visually gifted children who pour out huge quantities of drawings during their early years. It is evident that he possessed a high degree of visuospatial intelligence. About 2500 of Lautrec's drawings and paintings exist that date from ages 6 to 17. (These drawings were saved for purely sentimental reasons by his doting mother and relatives.)

As expected, not all of the drawings are phenomenally accomplished, but a significant number are noteworthy. In some of his earliest drawings of carriages and horses, he demonstrated an unusual mastery of line and movement. His use of sweeping contours to suggest the body of a horse in motion is unusual in the work of a 6-year-old child. As in the drawings of other, less gifted children, we find a mix of accomplished and less skilled drawing performance all in the same picture. Lautrec's sketches of his favorite subject matter—horses—are more accomplished than his renderings of birds—a less favored topic.

An examination of the collected juvenile work reveals the presence of multiple graphic streams. These streams indicate the early emergence of what Gruber and Davis call "networks of enterprises"—a hallmark of the way that creative individuals work. Among Lautrec's juvenile images one finds life studies, caricatures / broadsides, illustrations, and a visual vocabulary taken from both academic and popular art. Several of these varied approaches can also be found, all in the same work, in some of his adult creations. For example, in *Le Cirque Fernando* (see Figure 2), the sinister ringmaster is flat and cartoonlike, whereas the horse and equestrienne are rendered in a much more plastic manner.

Delight in mastery

As a child, Lautrec showed an intense desire to master new problems and to meet representational challenges. The sketches on the margins of his school notebooks and textbooks give us a glimpse of a child struggling successfully with all aspects of rendering: mastery of spatial depth, articulation of limbs, fall of clothing, and the interaction of figures with each other.

Although Lautrec's family encouraged him to draw and paint as a form of gentlemanly diversion, he did not receive formal lessons until middle adolescence. Yet sketches from his childhood reveal that he set himself all sorts of impromptu lessons and problems. In one case, we find a set of sketches of what are probably toy circus acrobats perched on the tops of several pages in his French Latin dictionary. (In his letters from the period he mentions his fascination with an American toy circus.) On each of five pages he shows a different tumbler or acrobat engaged in gymnastics on a pole. The ink sketches look as though they were all executed in one sitting and demonstrate how well his pen kept up with his prolific imagination. These sorts of drawings are typical of the material from this period and show that he actively pursued visual ideas and schooled himself in drawing. Later in his artistic apprenticeship in Paris, he wrote to his mother that he sorely missed the more demanding artistic standards set by an earlier painting



Figure 2 Henri de Toulouse-Lautrec, French, 1864–1901, *Equestrienne (At the Circus Fernando)*, oil on canvas, 1887–1888, 100.3 × 161.3 cm, Joseph Winterbotham Collection, 1925.523. Photograph © 1998, The Art Institute of Chicago. All rights reserved. Used with permission.

teacher (Bonnat). So even when it came to the drudgery of drawing from casts and nudes, Lautrec enjoyed the technical challenge demonstrating his delight in mastery.

Marching to the beat of a different drummer

As a child and adolescent, Lautrec curbed whatever impulses he may have had to arrive at his own solutions to artistic problems. He was not consciously iconoclastic, although one of his fellow students in the Paris studio school noted that even his life studies tended to be more expressive and eccentric than was quite acceptable. However, it was not until he was on the threshold of maturity that his original artistic tendencies showed themselves. Winner observed that in many instances gifted children do not go on to make significant contributions to the field in which they show such early promise. But, as we know, Lautrec's unusual childhood performance did bear fruit.

Three Continuities between Childhood and Adult Art

Rapid and characterful sketches

Lautrec's early drawings of animals sometimes suffer from an understandable lack of anatomical knowledge. But what they lack in this area they more than make up for in terms of emotional power. In his childhood and adolescent studies of animal expression and motion, Lautrec was developing skills that he was to use throughout his career. Some critics feel that above all, it is this capacity to identify the essential features of expression and gesture that makes Lautrec's images so memorable. Hughes says:

He would not generalize; every figure acquires a specific energy, and each countenance is its own face, not merely a mask of passion or a symbol of social role. A little bareback rider's squinched up face above the massive churning crupper of a stallion in the *Cirque Fernando*, 1887–'88; the Cyrano nose and signature black gloves of Yvette Guilbert. . . these images live on as obdurately as the traits of Dickens' characters.

In fact, one can identify some of the sketches that Lautrec made in his schoolbooks and textbooks that prefigure the

powerful renderings that were to come from his mature hand one or two decades later. Two examples illustrate this. On page 55 of a school notebook (dated 1875–1880), there is a sketch of a heavily muscled horse with an arched neck. In one of his first mature canvasses, *Le Cirque Fernando* (1888), we find the same horse (see **Figure 2**). The rear quarters are slightly below eye level, but we can still see the broad back and the equestrienne. Carefully observed anatomy and the characteristically low viewing angle are already present in the schoolboy sketch made 10 to 15 years earlier. Above all, Lautrec's energetic line is plainly there, defining both incarnations of the horse.

An equally compelling instance of the adult use of childhood experimentation with an expressive linear sketch can be found on page 552 of Lautrec's copy of his French Latin dictionary. There we find a drawing of a face made around 1878. The woman is rendered in a few sure lines and the portrait is noticeable for its closed eyes, wide cheekbones, thin lips, flaring nostrils, and high forehead. Her expression is supercilious. In Lautrec's lithograph of Yvette Guilbert, *Linger Longer Lou* (1898), we find a similar effect created by the same means: inflected lines that suggest thin lips, high cheekbones, closed eyes, and flared nostrils. In some of Lautrec's other studies of Yvette Guilbert we find the same blueprint, sketched in late childhood on the back page of his dictionary. It is as though he learned how to construct a particular expression, which then became part of his stock in trade.

It is plain from an examination of Lautrec's juvenile sketches that his gift for telling characterization based on a masterful control of line was first developed as a schoolboy and that this capacity informed his adult work. It is worth noting that the relationship between Lautrec's childhood work and his mature oeuvre bears out Gardner's 10-year rule. Gardner's idea is that with many creative individuals it takes a decade between the emergence of a novel idea and its mature expression. This is certainly the case with the two examples cited.

A strong affinity for narrative illustration: lautrec's seminal collaboration with bruant

Another connection between childhood drawings and adult work is Lautrec's lifelong penchant for narrative and humorous

commentary. From his earliest days, Lautrec was a student of the social scene and an inveterate satirist. Forced by circumstances to watch his able-bodied cousins play, he early developed the habit of observation. When he was convalescing at a health spa in the mountains, far away from his cousins, he amused his absent family by sending comic verbal and visual depictions of the hapless guests. A crisis in his uncle's vineyards became the occasion for an illustrated journal outlining the battle waged and won against the vine blight. At the age of 17 Lautrec collaborated with his schoolmate Etienne Devismes in illustrating a maudlin story about an old cavalry mare named Cocotte. Still later, in Paris, it was Lautrec's interest in illustration that led him into his first artistically productive (and commercial) collaboration with Aristide Bruant, café owner and balladeer.

Lautrec's affinity for illustration resulted in the development of important stylistic changes in his work. According to Murray, Lautrec's first serious collaboration with Bruant the nightclub singer led the artist to find a visual approach that was for the first time identifiably his own. To create the illustrations, the artist studied popular newspaper drawings. These images supplied him with a repertoire of genre scenes, and some of these were to become Lautrec's stock-in-trade. Murray also suggests that the collaboration with Bruant had a strong influence not only on Lautrec's subject matter but also on the manner in which he chose to depict the singer's lurid stories. Bruant's musical delivery was harsh and unrefined. Some of the same coarseness is reflected in Lautrec's choice of cheap materials (cardboard) and his deliberate lack of technical polish.

Thus, Lautrec's business association with Bruant was a truly formative relationship, resulting in his choice of what we now know as Lautrec's typical subject matter and the development of his typical visual treatment. As a result of Lautrec's working relationship with Bruant, his art began to move in the direction of what we, from our perspective, see as a proto-Modern aesthetic.

Emotional distance from his subject matter

There is an important emotional continuity between Lautrec's childhood and adult work. This is the consistent psychic distance that he maintained between himself and his subjects. He was doubly distanced from his subjects. This double distance was due to his painful awareness of his physical deformity (something he despairs of in his letters to his family) as well as to his cherished identity as a nobleman. As a child he was fascinated by animals of all sorts. About 40% of the existing drawings that he rendered between the ages of 6 and 19 are of animals alone or of animals with people. As an adult he was still "at the zoo," but this time he was a disabled nobleman looking at the underclass of Montmartre. It is no coincidence that a couple of critics have noted that Lautrec casts a telling but cold eye on his human subjects. Lautrec himself refers to his prostitute models lolling about "like animals."

It is probably due to his strong identification as an aristocrat that we look in vain to his studies of marginal people for a progressive social commentary. Some images are quite telling. For instance, the highly accomplished drawing of an African man dancing in a bar for the amusement of its clients

(*Chocolate Dansant*) carries no special critique of racism. Similarly, in the Dreyfuss affair, Lautrec took no sides at all. And although he illustrated the work of Jewish authors, he had no qualms about contributing illustrations to antisemitic novels as well. Social issues per se did not interest him. What concerned him was solving the formal and technical problems of portraying the inhabitants of the demimonde. Lacking both an aesthetic and a social agenda, he was a voluptuary. If he had a grand project at all, it was to be the engineer of his own psychological survival—and his art along with his gregarious activities was the principal means he used to achieve this end.

The Crucial Role of Emotional and Financial Support Offered by His Family

Theorists have written about the importance of the family as a support system for exceptionally able individuals. It is a common error to believe that genius will out, and that people with exceptional abilities do not need support or instruction. Quite the contrary—children with special abilities require the nurturance and intense support of parents and family. We can see the effect of such support in the case of Lautrec. Although his mother never had much appreciation for his art, she was a selfless and devoted parent. She took charge of his health problems and throughout his life made sure that Lautrec's material needs were supplied. Lautrec's father was another matter. Once it became clear that Henri would never ride to hounds nor look like a gentleman on or off a horse, Alphonse pretty much gave up on his son. There were periods during Lautrec's childhood that his father was not there for almost a year. On the other hand, the rest of the large family was close-knit and took delight in Lautrec's wit and imagination. This family became Lautrec's first audience. And it was the family (particularly his Uncle Charles) that encouraged him in his art.

However, the relationship between Lautrec and his family was by no means idyllic. Throughout his life, Lautrec was very dependent on his mother, and when she grew upset with his drinking and carousing, she abruptly left Paris without informing him. This sudden departure precipitated a psychological episode that ended with Lautrec briefly staying in an asylum. The incident reveals the difficulties that both mother and son experienced in dealing with each other. At the end of his days, Lautrec turned to his mother, who nursed him through his final illness.

Lautrec also may have considered commercial business to be a mark of independence. Even though there were no pressing financial reasons, Lautrec was fascinated by the idea of selling his work and of engaging in the *petit bourgeois* activity of producing posters and illustrations for trade. The notion of their son as a tradesman must have been at least as unpleasant to his patrician family as the certain knowledge that he was awash in the fleshpots of Paris. But Lautrec pursued his business ventures in Paris, perhaps for several reasons. First, he was not getting anywhere in the academic art world. He did not achieve success in his academic art exams. Thus he was forced to seek another audience for his artwork. Second, the prospect of earning money must have been emblematic of a certain degree of independence. Last, it may have pleased him to tweak his patrician family's sensibilities by threatening to succeed as a businessman.

Lautrec's Persona as an Artist

In addition to refining a style and subject matter that was truly Modern in spirit and attack, Lautrec contributed another element to the attributes of the modern artist. He actively constructed a flamboyant private and public life. With his outrageous antics, his notorious drinking and dressing up, he contributed to the stereotype of the artist as a public figure, the bohemian and tormented genius. Like his father, Lautrec was flamboyant. As Frey points out, both father and son liked to show off (in French *S'afficher*). Lautrec was of course best known for his *affiches*—his posters. The son elaborated his marginality by stressing his physical deformity through wearing odd costumes and by deliberately associating in public with his very tall cousin.

He behaved in ways that were calculated to shock and surprise the bourgeoisie (e.g., he spent months painting in a bordello). The prototypical Modern artist (and the Romantic artist before him) was always understood as an obsessed and intense person, one whose behavior was always close to the edge of—and sometimes beyond—the bounds of social convention. One critic has recently suggested that there is a strong parallel between Lautrec's artistic persona, with his entourage of Parisian followers and freeloaders, and the pop artist Andy Warhol's penchant for strikingly odd personal presentation and his retinue of camp followers.

The Impact of Class and Historical Setting

This article has already examined the factors that may have charged Lautrec's business venture with psychological meaning. There is little doubt that Lautrec sought recognition from his peers, and when it was not forthcoming from the academic world (one of his studio teachers informed him that his drawings were "atrocious"), Lautrec turned to the world of commercial art. As we know, he achieved a high level of success in this setting, for his posters were so sought after that on some occasions Parisians would rip them down to keep as soon as they were displayed. At the same time that Lautrec was having his public successes, the structure of the French art establishment was changing.

Standards for "good art" were in flux and artists organized themselves into alternative settings for the display and sale of work that met with official displeasure. The famous Salon de Refusees (an exhibition by artists of works that had been refused a showing in the French Academy) is an example of the avant-garde community taking matters into its own hands. But, during his lifetime, it was Lautrec's public work and his popular illustrations that helped establish his name. Yet the forces that were then eroding the power of the French academy

contributed to the rise of artistic Modernism, and it was the ascendancy of this aesthetic paradigm that assured Lautrec of his immense influence.

Summary

Several key features contributed to Lautrec's emergence as an artist of note: (a) his early and sustained fascination with a medium (drawing) for which he showed a precocious affinity; (b) a precocious capacity for close observation and rendering of animal movement and expression, which laid the groundwork for his studies of people; (c) the defining experience of being an intelligent and engaging child, who was often forced to observe the world from the sidelines (this sense of alienation was replaced in adulthood with a painful self-awareness of permanent physical abnormality and of aristocratic class identification); (d) a lifelong delight in entertaining others through dressing up and verbal and visual invention; (e) the emotional and financial support of family members (particularly his mother); (f) ambivalence toward his own family values (i.e., he identified strongly as a nobleman, but at the same time wanted to earn a living in bourgeois fashion as an artist); (g) a formal apprenticeship in the arts, starting with encouragement at the family level and culminating with study in two professional ateliers (this apprenticeship was not crowned with any recognition—his informal activity as a poster maker, illustrator, and frequenter of Montmartre bars was his true apprenticeship as this was the schooling that won him lasting fame; and (h) the luck to develop an unacademic representational style at time when the bastions of French academic art were crumbling.

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Transforming Illness and Visual Art

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Glossary

Compensation Compensation is the act of substituting something to take the place of another thing that is missing. Consciously or unconsciously, many artists have created in their work what they feel is missing in their lives.

Coping mechanism A coping mechanism is a method we use to cope with stress. When faced with serious illness, artists often use creativity as a coping mechanism to distract themselves from the stress and discomfort of being sick.

Resilience Resilience is the capacity to adapt to new circumstances and bounce back from hardships even when

life has not worked out as we had hoped it would or as we had planned. It is the ability to keep going forward despite setbacks.

Self-efficacy Self-efficacy is the way that people view themselves and their actions with the conviction that the things they do make a difference. Creating works of art brings a sense of self-efficacy and accomplishment.

Transforming illness The transforming illness is a time of poor health that acts as a catalyst for transformation because it becomes a challenge to surmount. By using creativity to cope with illness, artists have changed their work and their lives.

Creativity and the Transforming Illness

Nietzsche's phrase "What does not destroy me, makes me stronger" is evident in the transformational power of major illness. Throughout the centuries, visual artists of diverse backgrounds have used creativity to turn poor physical health into a transforming illness, an experience that alters both their lives and their work. There are as many types of transforming illnesses as there are people who have them. Artists have used conditions such as cancer, AIDS, arthritis, quadriplegia, learning disorders, vision problems, deafness, and the aftermath of serious accidents as opportunities for self-evolution. A transforming illness may be an acute episode or a chronic condition, yet whenever it appears, life takes a new trajectory and things are never the same.

Transformation occurs through an interface between an illness and a person's creative response to the illness, with specific aspects of the physical condition influencing both the creative process and the art produced. Some individuals have become eminent artists after a major illness while those that were already practicing professionals have had their way of working altered and their art deepened and changed. The transforming illness can occur at any age from the beginning of life to its end, and may happen more than once. By using creativity and physical illness as a combined impetus for transformation, artists can alter their personal experience, self-expression, and ultimately cultural history.

Aspects of the Transforming Illness

There are multiple aspects to the transforming illness such as resilience, using creativity as coping mechanism, self-efficacy, mastery, compensation, and the experience of flow. Using a debilitating physical condition to improve both your life and work is an example of resilient behavior. Resilience is the capacity to bounce back from setbacks and adapt to events in life that are neither comfortable nor planned. Artists will often

use creativity as a coping mechanism during illness as a way to manage stress. Our minds can generally focus on only one thing at a time, which makes creativity an excellent coping mechanism during illness because it can distract a sick person from physical discomfort by redirecting attention toward a creative activity. The folk artist Maud Lewis (Canadian, 1903–70), who had a lifetime of pain from severe juvenile rheumatoid arthritis, spoke about this distraction saying, "As long as I've got a brush in front of me, I'm all right." Arthritis became a transforming illness in Lewis' childhood because she turned to art as a way to pass the time when poor health kept her home from school. Despite severely limited use of her hands, Lewis became a professional artist. Preferring to use her right hand to paint even though her left hand was less affected by arthritis, Lewis propped up her right hand with her left one in order to keep working.

The distraction that artists experience during creativity is explained through what the psychologist Mihaly Csikszentmihalyi described as a time of flow. In this enjoyable state where self-consciousness fades away, people can become involved in a task to the extent that they have a diminished awareness of stimuli from the outside world. The positive feeling engendered during a state of flow acts to further whatever activity is generating the experience. When creativity produces the state of flow, it becomes an impetus to continue making art.

The creative expression that takes place during illness can also be a welcome experience of self-efficacy and mastery, imparting a feeling of strength that counteracts the weakness stemming from physical problems. In addition, artists have used the subject matter in their work as compensation for activities they feel have been denied them because of illness. After a debilitating traffic accident that required a long convalescence, the painter Frida Kahlo (see [Figure 1](#)) (Mexican, 1907–54) said, "As the accident changed my path, many things prevented me from fulfilling the desires which everyone considers normal, and to me nothing seemed more normal than to paint what had not been fulfilled."

Making art during illness can become a healing experience, which like the state of flow, further encourages the activity.

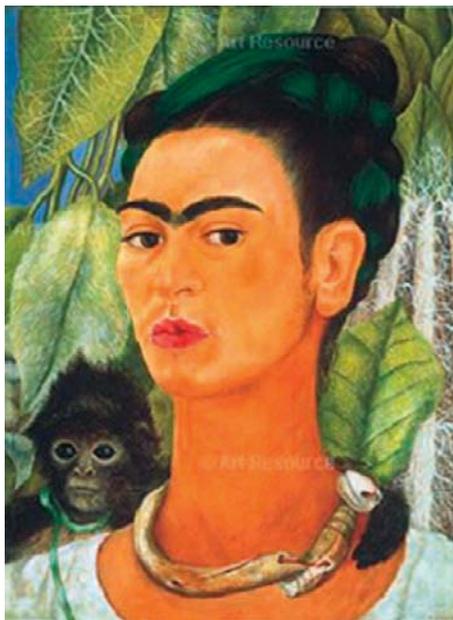


Figure 1 Frida Kahlo (1907–54) © ARS, NY *Self Portrait with Monkey*. 1938. Oil on Masonite, support: 16 x 12" (40.64 x 30.48 cm.). Bequest of A. Conger Goodyear, 1966. Location: Albright-Knox Art Gallery, Buffalo, New York, NY, USA. Photo Credit: Albright-Knox Art Gallery/Art Resource, NY Image Reference: ART389405.

The French painter Henri Matisse believed that not only was creativity healing but so were its products. He would hang his work around the beds of sick friends because he was convinced the bright colors would help them feel better as they did for him when he was sick.

The Early Transforming Illness

Many eminent artists began their careers as the result of an early illness. Some conditions were present at birth while others were contracted. Yet in all cases, the artists used creativity to pass the time when they were sick. The early transforming illness differs from its occurrence in adulthood because it is necessary for the child to have at least one attentive caregiver. In examining the lives of resilient children who came from backgrounds of hardship, the psychologists Emmy Werner and Ruth Smith found each resilient child had at least one nurturing relationship and that this supportive relationship was life changing for them. For young artists, the caregiver was not only nurturing but also encouraged the child's creativity and provided art supplies, which can be pivotal in an early transforming illness.

When Andy Warhol (American, 1928–87) became sick at age eight the art supplies his family gave him during his long months of convalescence shaped the work he would create as an adult. Warhol had rheumatic fever that progressed to chorea, an illness of the central nervous system that caused violent tremors. Although they were of very modest means, his mother believed that creativity would help him recover. She gave him coloring books, comic books, paper doll cutouts, and movie magazines while his brother Paul gave him a camera and taught him art techniques. As an adult, Warhol's paintings

had black outlines and swatches of color like coloring books; he made images of movie stars and comic book characters; the camera became central to his work, and he used paper doll cutouts in his early graphic design.

At age 18, Frida Kahlo (Mexican, 1907–54) was severely injured in a traffic accident. Incapacitated for months, her mother had a carpenter build an easel for her to use in bed and her father, a photographer and amateur artist, gave her his oil paints. Kahlo had been a premed student until she began making art during her convalescence. "Instead of studying to become a doctor," she stated "And without paying much attention, I began to paint." Kahlo had a prior transforming illness at age seven when she contracted polio and began to draw. Her father encouraged her talent and also taught her how to use a camera. Even though Kahlo sketched constantly and took art lessons, she planned on a career in medicine until the traffic accident altered her life.

Mobility problems early in life also turned Henri de Toulouse-Lautrec (French, 1864–1901) to a career in art. Research suggests he had pycnodysostosis, an inherited condition producing brittle bones that heal poorly, problems with walking, and dwarfism. Unable to be athletic like his relatives, Lautrec was instead a periodic invalid throughout his early years. Then his condition worsened as a result of two falls he sustained as a teenager that broke his leg bones. Lautrec's uncle, an amateur artist, had given him art lessons since early childhood and during his convalescence from the accidents, he focused on creativity. Acknowledging the role of illness in his life, Lautrec insisted, "One thing is certain, if my legs had been a bit longer I would never have become a painter."

Parental Pressure, Illness, and Careers in Art

For some individuals, whose families wanted them to follow more secure and established professions, it was an illness in childhood and young adulthood that halted parental pressure and allowed them to become artists. The desire to see a sick child recover was paramount to the caregivers, even if it meant that the young person would choose a less secure vocation. When Lawrence Alma-Tadema (English born in Holland, 1836–1912) developed tuberculosis as a boy, his family believed he wouldn't live much longer. In response they allowed him to stop preparing for a career in law and take art lessons. Alma-Tadema's health recovered and he became a professional painter. George Tooker (American, b. 1920), who had suffered from ulcerative colitis and a chronically inflamed appendix since childhood, acceded to family pressure to have a career in finance although he wanted to be an artist. When Tooker's intestinal problems became extremely severe in his early twenties, his parents relented and he began a career in art.

As a teenager, Henry Ossawa Tanner (American 1859–1937) knew he wanted to be an artist but his family pressured him to be a businessman. He had been a sickly child and the stress of painting at home while going to work severely compromised his health. Tanner's parents, fearing he might die, gave in and permitted him to become an artist. Tanner had a second transforming illness in his early twenties. As a young artist painting in Paris, he contracted typhoid fever and went home to Philadelphia to recuperate. It was on this trip home that Tanner reconnected with his African-American heritage and celebrated his

ethnicity in the best-known paintings of his career. Although all of these men were very sickly as children, they found art to be healing and all three of them lived long lives.

Eye Problems in Childhood and Their Influence on Art

It may appear paradoxical that an individual with poor eyesight would decide upon a career as a visual artist, yet this has happened repeatedly and with a variety of visual impairments. When the visual condition occurs in childhood, then as with other early illnesses, it is important to have an encouraging and nurturing caregiver, one who focuses on the young person's desire for creativity rather than on the presence of a visual disorder. Albert Pinkham Ryder (American, 1847–1917) had the good fortune to have such a caretaker in his father. When Ryder developed a severe inflammation of both eyes in response to a childhood vaccination, his father, knowing that his son liked to draw, gave him art supplies. The gift changed Ryder's life. He said, "When my father placed a box of colors and brushes in my hands and I stood before my easel with its square of stretched canvas, I realized that I had in my possession the wherewith to create a masterpiece that would live throughout the coming ages." Ryder's eyesight remained problematic throughout his life. Unable to see fine lines, he used broad areas of color and painted from his imagination. Ryder's poor vision created strength in his art.

When Matthew Brady (American, c. 1823–96) was a teenager, he also had a severe eye inflammation and turned to art. While making a trip to find medical care, Brady met the painter William Page, who encouraged the boy and gave him art lessons. Later, in his twenties, Brady changed from painting to photography. With diminished sight, he needed assistance to focus the camera and adjust the dials but it was he, who arranged the poses, composition, and lighting. Although Brady is well known for his portraits of Abraham Lincoln, his most famous photographs are of the Civil War. While both Ryder and Brady had lifelong vision difficulties, sometimes an eyesight correction can turn a child to art.

Nell Blaine (American 1922–96) said two things influenced her to become a painter, "One was making art when I was a sick child in bed and the other was the improvement in my eyesight from glasses and operations." When Blaine was finally able to see well, the world looked so beautiful to her that it became the subject of her art for the rest of her life. Sometimes eyeglasses can only give a partial correction as they do with Raymond Hu (American, b. 1977), who works with his eyes just inches away from the paper. Yet with parental encouragement, art lessons, and supplies, Hu started making art as a teenager and continues working today. Despite the poor fine motor control that is associated with his condition of Down syndrome, Hu perseveres and forged a new watercolor technique combining Asian and Western elements.

Learning Difficulties: Dyslexia, Attention Deficit Disorder, and Prosopagnosia

Learning disorders have also turned individuals to art. They are widespread, affecting about 10–30% of the population with

dyslexia being the most prevalent. Dyslexia, which is usually inherited, is noted by problems with reading, spelling, and writing. Now a recognized learning problem, people with dyslexia in the past were often considered to be less intelligent even though some of them like Leonardo da Vinci (Italian, 1452–1519) were geniuses. People with dyslexia often have difficulty learning a foreign language and Leonardo, who appears to have had a type of dyslexia known as surface dysgraphia, could never master Latin. As a result, he could not be a professional notary like his father nor attend university where classes were given in Latin. Instead, Leonardo decided he would become a "disciple of experience" and do his own empirical research rather than quoting the work of others. Focusing his keen mind on the natural world, he recorded notebooks filled with scientific observations. Leonardo also became an artist, a profession where education was not written in Latin but given orally in Italian.

Leonardo also appears to have a mixed form of attention deficit disorder that contains both daydreaming and restlessness as well as the ability to hyperfocus, which is the capacity to concentrate for an extended period of time. While Leonardo's restlessness often prevented him from finishing long-term projects, it helped him create short-term works such as drawings. By the end of his life, Leonardo made over four thousand drawings, a number four times greater than any other individual of his time. Leonardo employed his ability to hyperfocus during the long hours he is recorded as working on his art. He used his propensity to daydream to create inventions such as his machines. When assembled over 500 years later from Leonardo's original drawings, these machines worked perfectly.

The sculptor Auguste Rodin (French, 1840–1917) also had dyslexia. His parents wanted Rodin to have a career in the professions or civil service. Although Rodin eventually learned to read, he was unable to master Latin, spelling, or mathematics. Realizing this, his parents allowed him to study art. Both Rosa Bonheur (French, 1822–99) and Pablo Picasso (Spanish, lived in France, 1881–1973) had dyslexia. Yet Bonheur and Picasso may have become artists even without learning disorders because their fathers were professional painters who gave them art lessons from an early age.

Dyslexia has also affected the career choices of contemporary artists. Greystone Elizabeth Abbott (American, b. 1959) became a ceramic artist in response to an academic impediment in college. Yet the dyslexia that spurred her career change brought out a connection to her Native American heritage that had lain dormant until she began decorating her ceramics with tribal imagery. Chuck Close (American, b. 1940), who has attention deficit disorder and dyslexia, received art lessons in childhood and insists, "Art saved my life." In response to being considered an unintelligent, inattentive, and lazy student at school, Chuck Close worked long hours teaching himself to read. The discipline he developed as a child shapes his disciplined work habits as a professional artist. Close also has prosopagnosia, which is an inability to recognize faces. People with prosopagnosia, also called face blindness, cannot see a face in its entirety but instead comprehend the face as comprised of many separate bits of information, which when combined create their perception of a face. Close's work is completely comprised of faces created from separate small bits of information that the viewer combines into a whole image, thus seeing a face prosopagnosically, as does Chuck Close.

Adult Onset of Illness

When physical illness occurs in adulthood, either acute or chronic, it can change an established artist's way of working and may also bring benefits from what may have initially appeared to be a disaster. During the winter of 1894–95, Odilon Redon (French, 1840–1916) became ill and described his condition as “being struck by exhaustion like a thunderbolt.” Prior to that time Redon had focused on black and white work but by the middle 1890s he had begun to use color. After 1895, color work became his dominant form of expression, and Redon stated, “I am leaving black behind me.” Consuelo Gonzalez Amezcua (American born in Mexico, 1903–75) also had a transforming illness in adulthood. Amezcua was a sculptor who worked in limestone but inhaling the rock dust as she carved left her with breathing problems. Forced to change mediums, Amezcua started drawing and found she had a gift for color.

The ceramic artist David Drake (American, 1800–c.1870) was also a poet. Known as “Dave,” he had a transforming illness while a slave in South Carolina. A master potter who created large clay vessels that were used to store food before refrigeration, Dave was the first African American ceramic artist to sign his vessels and also the first to write poems on them. Sometime before 1857, Dave lost a leg, making it impossible for him to stand and kick the potter's wheel he used to shape his clay. Determined to keep working, Dave had Harry Simkins, a slave whose arms were disabled, kick the wheel for him. By 1859, Dave Drake was making the largest ceramic works of his life.

When the kimono designer Itchiku Kubota (Japanese, b. 1917) was having a second exhibition of his art at age 60, he contracted acute hepatitis. While in the hospital Kubota thought about his work and decided to develop a new style of kimono design combining ancient Japanese techniques with French Impressionism and scenes of nature. Kubota, who became very successful, spoke about the influence of having hepatitis saying, “This was the time of deepest import in my life as an artist.” Pierre-Auguste Renoir (French, 1841–1919) started to develop rheumatoid arthritis at age 56 and despite his efforts at exercise, the illness progressed. Sitting in a wheelchair with swollen immobile fingers, Renoir continued to work. With small gauze pouches to hold his brushes, the artist moved his arms rather than his wrists to make art. His son Jean Renoir admired his father's determination and said, “The more intolerable his suffering became, the more he painted.”

Creativity in Response to Cancer

One of the most prevalent illnesses in adulthood is cancer. Currently it is estimated that about one out of every three women and one out of every two men will develop this illness during their lifetime. Like the general population, artists get a variety of cancers but for the following individuals, the illness becomes a challenge that they face with creativity in a variety of ways. Some artists change their way of working or use the work specifically to address their emotional response to illness, while others like Vincent Desiderio (American, b. 1955) find that having been sick has strengthened them emotionally.

Desiderio, who had an aggressive type of nasal pharyngeal cancer, said that the ordeal of illness and treatment with chemotherapy and radiation was grueling but it changed him. He stated he now lives in the present moment and has developed greater internal strength because he no longer requires ‘validation from outside.’

Although they had different types of cancer, Darcy Lynn, Dan Savage, and Nancy Fried used art to depict their psychological response to illness and treatment as a way to manage the stress. The images they produced were often graphic depictions of medical procedures, shunts, vomiting, and breast removal that also showed their emotional anguish. After they recovered, all three individuals who remain well today used the art they created during illness as a way to give hope to others who were sick. In 1991 when Darcy Lynn (American, b. 1956) was diagnosed with Stage IV immunoblastic lymphoma, a non-Hodgkin lymphoma, she documented her entire treatment through a series of paintings and drawings. After her recovery Lynn gave lectures on the role of creativity in healing to medical personnel saying, “I fought illness with the best weapon I had – my art.”

Dan Savage (English, b. 1982), who was 20 years old when he was diagnosed with an aggressive form of testicular cancer, also depicted his treatment. Creating daily images of medical procedures and his response to them, Savage said, “I accepted it and used it for inspiration.” After his recovery, Savage became a public speaker to emphasize the necessity of early detection and treatment: “I show there is life after cancer.” Nancy Fried (American, b. 1949) had cancer four times during the years 1986–90. She had three separate types of breast cancer and also cancer of the appendix. In response, she began making sculptures of her ordeal. She showed herself with one breast after a mastectomy, having severe burns from radiation, and depicted her agony about being sick. Her sculptures became widely known. Fried, who did not have breast reconstruction and refuses to wear a breast prosthesis, openly presents herself as a one-breasted woman saying, “By making something private public, you find you aren't the only one.”

Artists with AIDS

AIDS (acquired immunodeficiency syndrome) is a pandemic but nowhere is it more prevalent than in Africa. Thirteen South African women, members of the Bambanani Women's Group, contracted AIDS and made art in response to their illness. Their names are Babalwa Cekiso, Thobani, Nomawethu, Victoria, Nloyiso, Nondumiso Hlwele, Thozama, Bongwiwe, Bulelwa Nokwe, Ntombizodwa Somlayi, Ncedeka, Maria, and Nomonde. Their creativity was part of the Memory Box Project from the University of Cape Town. It was originally intended to be expressive arts therapy for dying individuals to help alleviate stress and build a legacy to leave their children. Then with the introduction of ARVs (antiretroviral medication), the women started to recover. Despite the sometimes violent prejudice against people who are HIV positive, the women used their art as a political statement to highlight the importance of extending medical care to other low-income individuals with AIDS. They also want to encourage those living with HIV: “We want to teach people living with HIV how to live

with HIV. We want people outside to know that it is not the end of the world.” Keith Haring (American, 1958–1990) also made a political statement about having AIDS. A very successful artist with a strong interest in human rights, Haring created posters about AIDS awareness and established a foundation to continue his work. It is the Keith Haring Foundation that carries on his commitment to assist both AIDS organizations and children. John Dugdale (American, b. 1960) was a commercial photographer who used AIDS to change careers and do the fine art photography he always wanted to do. Despite the multiple opportunistic infections associated with AIDS that caused him to lose half of his hearing and most of his eyesight, Dugdale, who says he views the world as if peering through six Baggies, has achieved success as a fine art photographer and insists that, “In illness there is an unbelievable opportunity for freedom and change.”

Color Vision Deficiency and Its Influence on Art

One of the most common visual impairments is color vision deficiency, also known as color blindness. Usually an inherited condition, it affects one in ten men and one in two hundred women. The degree of impairment can range from a slight inability to see colors to a profound lack of color discrimination. Although people with color vision deficiency have problems perceiving color, they have an enhanced ability to distinguish gradations of light and dark along with an acute perception of textures and patterns. Color vision deficient artists use this acuity in the gradations of light and dark that empower their work.

One of the most famous artists in Western culture, Rembrandt Harmenszoon van Rijn (Dutch, 1603–69), is believed to be color vision deficient. A. Hyatt Mayor, a curator at the Metropolitan Museum of Art, who was the first to recognize this in Rembrandt’s work, also noted that Rembrandt’s difficulty in perceiving colors gave him an increased sensitivity to tones of light and dark (see Figure 2). He said of Rembrandt that “seeing the world more or less in browns freed him to calibrate luminosity with a delicacy as expressive as any palette of colors.” Color vision deficiency also helped Rembrandt with his etchings, which was a black and white medium in the seventeenth century.

Although it is unusual to find a female artist with color vision deficiency, Kaethe Kollwitz (German, 1867–1945) appeared to have this condition. Kollwitz, who showed talent at an early age and wanted to be a painter, realized in art school that her color perception was flawed. She said, “In the painting class I made no progress. Color was my stumbling block.” In response, Kollwitz stopped making oil paintings and focused on black and white or brown and white imagery in etchings, drawings, and lithographs. She also turned to sculpture, another medium without color in which she could excel. Paul Manship (American, 1885–1966) also had color vision deficiency and changed to sculpture after difficulties with color in his paintings. Charles Meryon (French, 1821–68) was another artist with color vision deficiency who stopped painting and achieved success with his black and white etchings.

Lack of color in an artist’s work cannot be used as the sole criteria to assess a person’s level of color vision. Odilon Redon and Chuck Close worked almost exclusively in black



Figure 2 Rembrandt Harmensz van Rijn (1606–69) *Belshazzar's Feast*, about 1636–8. Oil on canvas, 167.6 x 209.2 cm. Bought with a contribution from The Art Fund, 1964. (NG6350). Location: National Gallery, London, Great Britain. Photo Credit: © National Gallery, London/Art Resource, NY. Image Reference: ART373904.

and white for the first half of their careers before going on to become major colorists. Caravaggio (Italian, 1573–1610), born Michelangelo Merisi, showed an excellent sense of color in his early work but preferred a reduced palette emphasizing light and dark in his later paintings.

Artists with Macular Degeneration

Macular degeneration, which is a disease of the retina, is one of the most common causes of vision loss in older adults. In this illness, the macula, which is the central part of the retina, becomes damaged leaving the affected individual with only peripheral vision. Although this illness usually found in individuals aged over 55, Edgar Degas (French 1834–1917) had his first symptom at age 36. The condition, which began in his right eye, eventually affected his left eye as well. Even without central vision, Degas was determined to work. Unable to stand the glare of the sun, Degas painted indoors, creating interior scenes, portraits, and images of ballet dancers. When his eyesight deteriorated so that he could no longer see the fine lines his brush made with oil paint, Degas changed to pastels where the thick chalk lines were easier to see. These pastels are his most popular works. As his vision worsened and Degas could no longer see the chalk lines, he turned to sculpture, using his hands to help in his determination to remain creative.

For most of her life, Georgia O’Keeffe (American, 1887–1986) had excellent vision but in her later years, she developed wet macular degeneration in both eyes along with a rupture of capillaries in the retina of her left eye. Faced with diminishing vision, O’Keeffe started to simplify her forms. She also worked from photographs and from her memory saying, “You paint from your subject, not what you see.” For a while, O’Keeffe, like Degas, turned to sculpture, but she returned to painting, stating that it was central to her life.

Deafness and Art

Deafness, which is a widespread condition, can be an early influence toward a career in art. It may happen when deaf children use art as a means of communication with their hearing parents as it did with John Lewis Clarke, Ann Silver, and Harry R. Williams. When John Lewis Clarke (American, 1881–1970) was three, he became deaf from scarlet fever. As a boy who was unable to speak, he used clay from the Montana riverbanks near his home to sculpt animals as a way of telling his parents what he had seen that day. Clarke, who became a sculptor specializing in animals, eventually learned to sign in two languages, his Native American Blackfoot sign language and the ASL (American Sign Language) that he learned in schools for the deaf. Ann Silver (American, b. 1949), who was born deaf, also used art in childhood as a way of communicating with her hearing family. A professional artist, Silver still uses art as communication but now it is to promote deaf culture. Harry R. Williams (American, 1948–91) was eighteen months old when he lost his hearing after a reaction to the antibiotic streptomycin. At age four Williams started to draw in an effort to communicate with his hearing parents and as an adult, he became famous in the deaf community for his exquisitely drawn symbolist paintings.

Perhaps the best-known artist with a hearing problem is Francisco Goya (Spanish, 1746–1828, also known as Francisco de Goya y Lucientes). In 1792, Goya lost his hearing after a severe illness that kept him incapacitated for months. Goya's precise diagnosis is unknown but after becoming deaf his art transformed and his production increased. Goya began his career as a painter of colorful canvases with scenes of pleasant pastimes but after losing his hearing his work became darker, more structured, and filled with political and psychological content. After his illness, Goya turned into a romantic painter and is considered a precursor of modern art.

Accidents and Their Legacy in Art

Creativity that starts during convalescence from serious accidents may begin a career in art as it did for David Cox and Frank Day. David Cox (English, 1783–1859) was a blacksmith who broke a leg and started drawing during his recovery. Unable to return to the forge Cox studied painting. He became very successful, exhibiting at the Royal Academy and writing books on art. Frank Leverall Day (American, 1902–76) was a migrant agricultural worker when a farm accident in 1959 broke both of his knees. Day, who began to make art in the hospital rehabilitation program, continued for the next sixteen years until his death. As a Konkow Maidu from California, Day created over two hundred paintings of Native American customs, ceremonies, and legends. Art became a way of preserving his culture for Day, who said, "If I do not do this, all things will be forgotten."

Traffic accidents, a leading cause of disability and death, can inflict severe injury whether people are drivers of cars like Ginny Ruffner or passengers like Howardena Pindell. In 1979 Pindell, an art professor, was riding to work at her university with two colleagues when a woman, who had been given pain medication, swerved across the meridian and hit their car.

Pindell was trapped in the back seat, her hips misaligned and unconscious from a concussion. In response to the trauma, Pindell said, "My work changed drastically." She went from abstract painting to autobiographical imagery featuring a slave ship to acknowledge her African-American heritage. While the hip injury healed, Pindell still has neurological problems. Although she cannot see all the objects in her visual field, Pindell says she now has the ability to focus intensely on repetitive tasks and uses this ability to create intricate patterns in her paintings.

Ginny Ruffner (American, b. 1952) described her near fatal auto accident in 1991 as "five weeks in a coma, five months in the hospital, and five years in a wheelchair." Trying to avoid another car that had cut across both lanes Ruffner lost control of her vehicle, crossed the median, and spun into ongoing traffic where she had a head-on collision with a first car and then was hit by a second one. In addition to great physical damage, Ruffner suffered a shearing brain injury; her doctors did not think she would live. Yet despite paralysis of her left side that included her drawing hand, double vision, spasms, and a seeming total loss of memory, Ruffner survived. When friends and family brought images of her work, Ruffner began to retrieve memories of her art and started to draw with her right hand. She said, "I knew I would make art again" that making art "was what brought me back." Ruffner now creates by making drawings and supervising assistants who build the finished sculpture. In addition to her previous medium of glass, Ruffner has expanded her work to include metal and book design.

Working with Quadriplegia

Auto accidents can also result in quadriplegia as they did for Ernie Pepion and John Callahan. Yet after being injured both men changed their lifestyles, went to college, and became artists. Ernie Pepion (Eewokso, American, 1943–2005), who worked from a motorized wheelchair with a hand and forearm brace to support his right hand, said, "I am an artist, Blackfeet Indian, and am physically disabled." Pepion used his paintings as political/psychological statements to counteract prejudice against quadriplegia and people of color. John Callahan (American, b. 1951), now one of America's leading cartoonists, is also an author, filmmaker, and a role model for other disabled people. Callahan draws by sitting in a motorized wheelchair with a tablet on his lap using his left hand to brace his right.

Sports accidents are another cause of quadriplegia. Cindy Bernhardt (American, b. 1963) was a freshman in college when she was injured in a gymnastics accident and Trevor Wells (English, b. 1956) was an apprentice carpenter age 21 when he was injured playing rugby. Completely unable to use their hands, both of them started making art in hospital rehabilitation programs and went on to have success as painters by holding brushes in their mouths.

When a blood clot lodged in his spine at age 47, Chuck Close (American, b. 1940) became quadriplegic. With very limited movement in his arms and legs, Close paints while sitting in a wheelchair with braces on his legs and a Velcro brush holder attached to his wrist. Two years before the illness Close, who had painted in black and white, began

experimenting with color. After the incident, his palette expanded and he has become a colorist. A disciplined worker who paints steadily, Close stated that "Every day when I roll out of my studio and look over my shoulder, I say 'That's what I did today.'"

Multiple Transforming Illnesses

While Frida Kahlo, Henry Ossawa Tanner, Nell Blaine, Itchiku Kubota, Chuck Close, Lawrence Alma-Tadema, and Odilon Redon all had more than transforming illness, few individuals have had their lives and art as affected by incidents of poor health as Henri Matisse (French, 1869–1954). He had five transforming illnesses. Matisse's first transforming illness came at age 20 when intestinal problems he had since childhood flared into an acute attack. Forced to recuperate for months, and hoping that creativity might help his boredom, Matisse asked for art supplies. Upon receiving them from his mother he said, "The moment I had this box of colors in my hands, I had the feeling that my life was there." When Matisse was in his late forties, bronchitis, his second transforming illness, forced him to move to the south of France. The beautiful colors of the Mediterranean brightened his palette and he became a great colorist (see Figure 3).

Intestinal cancer at age 70 was Matisse's third transforming illness. After an operation that went poorly, Matisse became an invalid for the rest of his life. Unwilling to stop working, he started drawing from his bed and then cut out pieces of colored paper while working in a wheelchair. Compositions made of colorful cut paper became a main form of expression for Matisse and include some of his best work. His fourth



Figure 3 Henri Matisse (1869–1954) *The King's Sadness* (La Tristesse du roi). 1952. Cutout. Inv. AM 3279 P. Photo: Philippe Migeat. © Succession H. Matisse, Paris/ARS, NY. Location: Musée National d'Art Moderne, Centre Georges Pompidou, Paris, France. Photo Credit: CNAC/MNAM/Dist. Réunion des Musées Nationaux/Art Resource, NY Image Reference: ART186826.

transforming illness was a gallbladder condition that came soon after the intestinal surgery. Refusing another operation, Matisse sublimated his pain by making book illustrations. The fifth transforming illness came in 1942 when Matisse's poor health required a nurse. The young woman who was his nurse later became a nun and in 1947 she asked him to design a church. Matisse was 84 when he finished the *Chapel of the Rosary* and said, "I consider it to be my masterpiece."

The courage and determination of Matisse and other artists to face hardship with creativity indicates the transforming illness is a widespread phenomenon and fundamental to the human condition. Yet the transformation of trauma into creativity is not limited to the visual arts but is found throughout the life histories of accomplished people in all domains (Goertzel and Goertzel, 1962; Sandblom, 1996). Like the steel in the blade of a samurai's sword that repeatedly meets the flames and the hammer, these individuals who endure adversities emerge stronger and more resilient – and they continue to be creative.

See also: Aging; Art, Artists, and Arts Audiences: Their Implications for the Psychology of Creativity; Mary Cassatt 1844–1926; Everyday Creativity; Flow and Optimal Experience; Frida Kahlo 1907–1954; Pablo Picasso 1881–1973.

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Unconscious

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Glossary

Cortical arousal Level of brain activation, measured physiological through brain waves, ranging from quiet and unfocused dreaminess to intense and sharp concentration.

Incubation A stage in the creative thinking process in which preliminary problems gestate for an unspecified period of time without conscious attention to their resolution.

Insight Often referred to as illumination or the ‘aha’ experience, a stage in the creative thinking process, following incubation, in which previously unconscious connections become revealed to the conscious mind.

Intuition A vague and anticipatory feeling of an implicit solution to a creative problem that is based on a hunch supported by extensive knowledge and experience in a given domain.

Preconscious A level of arousal that lies between the conscious and the unconscious in which playful, analogical,

and combinatory mechanisms function to aid creative thinking.

Primary process A tendency, according to psychoanalytic theory, to satisfy sexual and aggressive tensions indirectly through imaginative, emotional, and irrational means.

Progression in the service of the ego A cognitive style process employed by creative thinkers to facilitate the conscious organization and communication of valued ideas.

Regression in the service of the ego A cognitive style process employed by creative thinkers to delve into the unconscious and interrupt rational constraints on new ideas.

Secondary process A tendency, according to psychoanalytic theory, to resolve instinctual tensions through the use of logical, realistic, and conscious mechanisms.

Sublimation In psychoanalytic theory, the unconscious displacement or redirection of sexual and aggressive drives into socially acceptable and creative activities.

Anecdotal Background

At least as far back as Archimedes in the bathtub, the emergence of a creative solution to a problem, with less than fully conscious attention, has been the subject of both conjecture and awe. How was the ancient Greek scientist, by engaging in a very ordinary activity, able to determine the method for measuring the amount of gold in the king’s crown through the displacement of water? Inspiration deriving from unconscious sources is presumed to be a primary factor in achieving poetic success, creating an artistic legacy, producing musical compositions, and other inventive or creative accomplishments, as well as in resolving scientific conundrums. The unconscious well-springs of creative activity are imbued with mystery, reverence, and even fear for their potential disappearance. Creators whose work may depend upon a fragile coalition of characteristics and circumstances are wary that the muse may depart, that the guiding spirit or the divine inspiration will leave them barren. There is concern that what may not be readily grasped – the essence of their creative powers – which may not be obvious to conscious exploration, could be easily and inexplicably lost. Perhaps, the creative unconscious represents to both creators,

and to those who study them, simply a summary of what is still beyond our grasp: a more complete analysis of what it means to be creative and how to best actualize the potential for producing creative work.

Accounting for how the unconscious contributes to creative achievements in various fields does not depend exclusively upon stories dating back several millennia. Many examples range from the mathematician Poincaré’s demonstration of Fuchsian functions, to the chemist Kekulé’s discovery of the benzene ring, to Coleridge’s poem about Kubla Khan, to Darwin’s theory of evolution, to Mozart’s musical melodies, and to Gutenberg’s invention of the printing press. In fact, the classic collection of first-hand reports published by Brewster Ghiselin in 1952 has been one of the most widely cited publications in the creativity literature. These and other descriptions often reveal a strong belief on the part of the creator that subconscious processes are quite involved in the path from dimly perceived to fully thought out creative ideas.

The apparent automaticity in creative activity noted by Ghiselin, however, is not to be interpreted as antithetical to conscious processes, but instead as a balancing factor that aids in loosening the normal constraints of reality:

(A)utomatic invention, far from being a sign of diminished, imperfectly functioning consciousness, is a healthy activity supplementary to conscious invention and in no way inconsistent with it. The automatic functioning in invention is, rather than an inferior or suspect substitute (or an exalted one), an extension of activity beyond the limited scope of that which is shaped by insight, the conscious activity, which is an observant adjustment of exactly appreciated means to known ends. Something beyond that fully observable conscious construction takes place, to the advantage of consciousness, or of the consciousness able to make use of it. (p. 17)

Examples of the interplay between conscious and unconscious factors from the reports of the creators in Ghiselin's volume include the musician Roger Sessions who claimed that the composer "is not so much conscious of his ideas as possessed by them (and) often is unaware of his exact processes of thought till he is through with them" (p. 49), the sculptor Henri Moore who stated that for the artist "the nonlogical, instinctive, subconscious part of the mind must play its part in his work, (but) he also has a conscious mind which is not inactive" (p. 73), and the poet Amy Lowell who defined the need for "an extraordinarily sensitive and active subconscious personality, fed by, and feeding, a nonresistant consciousness" (p. 110).

The challenge for researchers in the realm of creativity in the twenty-first century is to effectively demonstrate how processes of thinking that a person is not aware of can lead to significant creative achievements. Beliefs from ancient times have carried over into the social and biological sciences of the past century. It is difficult to ignore the persistence of creators from a variety of domains that unconscious influences are critical components in the development of their work. While the lack of concrete evidence to support claims about unconscious processing may not be sufficient to give up this notion, building a case that fully explains how this is accomplished is likely to be several decades away. However, understanding the potential foundations for interweaving the conscious and the unconscious aspects of creative thinking is a worthy beginning.

Freudian Roots

Comprehensive psychological elaboration of the relationship of creative thinking to unconscious processing was first explored in the work of Sigmund Freud. Based on his few retrospective studies of the lives of creators such as Leonardo da Vinci and Dostoevski, Freud attempted to explain creativity as motivated by the desire to maximize personal gratification. The essential concept that pertains to creativity from a psychoanalytic perspective suggests that the sublimation of tensions resulting from unconscious instinctual drives is responsible for all human progress. Furthermore, sexual and aggressive needs are expressed indirectly through a mechanism which Freud labeled as primary process thinking. In contrast to the more rational, logical, realistic, mature, and clearly conscious secondary process thinking, the primary process is imaginative, irrational, emotional, childlike, and uncontrolled. It is presumed that the creative individual is somehow able to employ primary process thinking to effectively thwart anxieties while engaging in culturally sanctioned behaviors (e.g., writing a song, producing a play, constructing a theory, or inventing a new machine).

Psychoanalytic theory cast a long and dominating shadow over twentieth-century efforts to explain the nature of creative thought, particularly in the artistic and literary milieu where the residue of emotional conflict seems to be played out more directly in the works of fiction, composition, and painting. Personality qualities associated with the development of parent-child relationships, disguised by the defensive alterations of the unconscious or in the context of regressive and spontaneous activity, possibly interwoven with elements of neurotic or even psychotic behavior, served as a rich mine to be explored for creative ores. Freud was surely not alone in his approach to untangling the threads of creative motivation; however, his views had serious limitations which led Albert Rothenberg to conclude, in his 1990 treatise entitled 'Creativity and Madness,' that Freud merely replaced "the Platonic idea of possession by an external factor . . . to a factor that is external to awareness" [the unconscious] p. 50.

Although Rothenberg does not dismiss the value of unconscious influences on creative activity, he and others have pointed out that Freud's definition of the unconscious as a kind of repository for creative ideas contradicts the *sine qua non* of creativity – originality. Is it really possible to create something truly unique if the elements of the achievement already reside in the past, locked away in the unconscious until stimulated by anxiety or insanity? In addition, Rothenberg also questioned how the motivational power of the unconscious to direct creative behavior is commensurate with its distorting functions to alter thought so that it cannot be easily recognized by the conscious. Whatever benefits might be obtained by immersion into the emotional themes and flexible play with material in the unconscious, creative accomplishments ultimately require the unity, organization, and control that must be accessible to awareness.

The key legacy of psychoanalysis is that the distinguishing feature of all creative individuals is their mastery of the ability to utilize the primary process to the degree that ideas can be transformed into meaningful and communicable symbols. Freud himself acknowledged that he did not understand how this actually worked. Standard criticisms of psychoanalytic theory may illuminate why Freud was never able to complete his explication of the creative process. For example, retrospective accounts of creativity do not permit the researcher to actively examine the thoughts or behaviors of the creator. Second, the limited sampling and lack of empirical methodology makes generalization extremely difficult. Finally, the heavy emphasis on sexual and aggressive instincts appears to reduce the scope of application from creativity in diverse realms of human achievement. One of Freud's most important colleagues, Carl Jung, provided another variation on early psychoanalytic theories of the role of the unconscious in creativity.

Neoanalytic Concepts

Movement away from the orthodox psychoanalytic view, emphasizing creative acts as a result of instinctual drives and the sublimation of anxieties, was fostered by the neoanalytic theorists who stressed the control of primary process thought and its adaptive connections with the secondary processes of

the ego. In contrast to describing creativity as a defense mechanism or in terms of coping with frustration, the modifications of Freud's doctrine were to effectively reverse the transcendence of the id over the ego and to allow creative activity to attain a higher priority than sexual or aggressive instincts. The most significant conception forwarded by the neoanalytic tradition was regression in the service of the ego, detailed in 1952 by Ernst Kris. This process consisted of an oscillation between two phases, usually over a lengthy period of time. An inspiration phase involved the breakdown of rational barriers to allow the influence of external, varied ideas and images within the mind. Counterbalancing this process, Kris also postulated an elaboration phase in which the constraints of reality are meaningfully imposed to select and synthesize the critical themes of a problem.

In the introduction to his 1973 volume on theories of creativity, Morton Bloomberg further outlined the process:

During controlled regression, the ego, or rational element, maintains the power to regain command over any large-scale invasion by unconscious material which threatens with selfish and forbidden pleasures. Hence the id, or instinctual impulses, neither overthrows the ego nor is it sealed off from consciousness. The ego uses chaotic, irrational, bizarre thinking to play a constructive role in problem solving and directs the individual away from self-destructive action. (p. 3)

Therefore, the neoanalytic position engendered a shift from an essentially irrational, unconscious eruption of material controlling the creative process to a somewhat more cognitive approach in which creativity is shaped by reason and critical evaluation.

Lawrence Kubie, another psychoanalyst, suggested in his 1958 book that preconscious processes must mediate between the primary or unconscious level and the secondary or conscious level of thought. He stressed the adaptive and healthy aspect of creative thinking and believed that the playful, analogical, and combinatory mechanisms of the preconscious should not be "anchored either to the pedestrian realities of our conscious symbolic processes or to the rigid symbolic relations of the unconscious" (p. 141). Both Kubie and Kris share with Freud a basic tenet of the psychoanalytic perspective; that is, the source of creative inspiration is not readily accessible to awareness. Whether the emphasis is on the preconscious, a regression to the unconscious, or to the unconscious itself, neoanalytic theorists relegate creative drive to the nonconscious or subconscious realm. The question remains whether this psychoanalytic structural division of consciousness, including the conflict between primary and secondary processes, adequately accounts for the nature of creativity activity.

One example of the type of early neoanalytic research that promoted the value of unconscious mechanisms as a healthy approach to creative accomplishment was to employ projective techniques, such as the Rorschach inkblot or Thematic Apperception Tests (ambiguous drawings), in order to assess the process of adaptive regression. Robert Holt's method for scoring the Rorschach has the advantage of allowing researchers to measure both the use of primary processes as well as the extent that they are adaptively controlled by secondary processes. While the validity of projective techniques has been a controversial topic, particularly with respect

to clinical diagnosis, their contribution to understanding the notion of adaptive regression has potential pending further investigation. In his extensive 1980 review of primary process thinking and creativity, John Suler concluded that the majority of "projective test studies provide evidence that the *integrative control* of primary process is an important aspect of creative thinking" (p. 153).

In his 1993 analysis of the myths associated with creative thinking, Robert Weisberg has suggested that there is little evidence to support any version of psychoanalytic theory. He discounts both primary process thinking and the role of the unconscious as at all significant to creativity. Instead, he argued that creative production is the result of ordinary thought processes, augmented by particular abilities, specific areas of training, and high levels of motivation. Weisberg acknowledged that the neoanalytic approach involves a blend of primary and secondary process thought, but that the "emotionally laden, unconscious associations based on unsatisfied childhood needs are still assumed to be limited to primary process thinking" (p. 31). Thus, the legacy of Freud and his neoanalytic followers was an unfinished portrait of the relationship between affective and cognitive processes in creativity.

Incubation, Insight, and Intuition

The history of the unconscious in creative thinking is apparently linked to a variety of similar terms that all imply the lack of conscious attention as part of the process in which the creator is able to follow through a sequence from the germ of an idea to its more complete resolution. Three examples of this type of concept include incubation, insight, and intuition, all of which have been discussed widely as representative of the nonconscious components of creativity. Complicating the analysis of such terminology are related words – for instance, insight may often be referred to as illumination. While Weisberg and other researchers continue to insist that all creative thinking is based on logical, ordinary, problem-solving processes, and that incubation, insight, and intuition are old myths, many contemporary theorists maintain support for these nonconscious contributions. In her 1996 chapter on affect and cognition, Sandra Russ presented a model that incorporates several elements of primary process thinking, such as adaptive regression and insight abilities, as facilitating factors in creative thought.

Perhaps the earliest well-developed conception of the notion of incubation in the understanding of creative thinking was postulated in 1926 by Graham Wallas. He articulated four stages – preparation, incubation, illumination, and verification – in what was described as a linear process of thought. During the incubation stage, the preliminary ideas of the preparation stage are allowed to gestate for an unspecified period of time while the problem is not pursued consciously. The culmination of the incubation process is the explosive stage of illumination, which is to be followed by the final, and more prosaic, verification stage. Although Wallas did not really discuss how the process of incubation worked, nor did he recognize the nonlinear possibilities of these stages, later metacognitive theorists, Bonnie Armbruster for example,

in reviewing the self-analysis of several creative thinkers, concluded in 1989 that “during the incubation stage the interconnected network of flexibly organized knowledge . . . is being restructured into new schemata” and, that unconsciously, “(c)reative individuals may have a superior metacognitive ability to separate the wheat from the chaff” (p. 179).

Illumination, or insight (the ‘Aha!’ experience), is the moment when the previously unconscious connections become revealed to the conscious mind. Armbruster again stated that illumination is the “recognition of a mental representation that fulfills, or has the potential of fulfilling, the goal of the creative enterprise” (p. 180). The presumed spontaneity of insightful experiences in creative thinking is undoubtedly exaggerated, embellished by selective memory, frequently divorced from the context of the lengthy preparation leading up to it, and probably far rarer than popular reports would suggest. Nevertheless, the transitions from preparation to incubation to illumination in the creative process do reflect the notion of unconscious, and as of yet not fully identified factors, in the accomplishment of many extraordinary human creations. The concept of insight in problem-solving dates back very clearly to the 1930s work of the Gestalt psychologists on resolving mental blocks and avoiding the pitfalls of repetitive and routine mental pathways. Yet Robert Sternberg and Janet Davidson have edited in 1995 a large volume entitled *The Nature of Insight* which suggests that interest in this area has resurfaced.

Caught between the subconscious wanderings of the incubation stage, and the momentary flash of insight or illumination, is the sense of creative intuition. In her 1995 review of the intuition concept, Emma Policastro defined it as an implicit form of information processing in which vague and anticipatory perceptions orient and constrain the direction of a creative search. Intuition can be viewed as the unconscious bridge from incubation to insight. The research team of neurobiologist Antonio Damasio provided evidence in 1997 that the intuitive hunches of people are nonconscious signals that “act as covert biases on the circuits that support processes of cognitive evaluation and reasoning” (p. 1294). Similarly, in his 1988 chance-configuration theory of creative thinking, Dean Simonton suggested that the intuitive genius is characterized by “numerous infraconscious but behaviorally and emotionally active associations” (p. 46) that provides the opportunity for combining appropriate elements in new ways. It is evident that intuition is based on extensive experience and knowledge within a particular domain, somehow connected at a nonconscious level, and yet the explanation of this phenomenon still leaves many unanswered questions.

Brain Physiology

Creative thinking is, of course, ultimately dependent on the functioning of the human brain, conscious or otherwise. Damasio was not the only neurobiologist to speculate about the unconscious as a legitimate realm for conducting scientific research, but he has very clearly postulated a brain mechanism that assists in the solving of problems through a covert examination and preselection of options of which only a few are presented for conscious evaluation. In his 1994 analysis of

the fallacy of Cartesian dualism, Damasio cited the views of creative scientists who support the interconnection of reason and emotion. Although the goal of his work is not to discuss creativity per se, the reality of the unconscious is stressed: “It is as if we are possessed by a passion for reason, a drive that originates in the brain core, permeates other levels of the nervous system, and emerges as either feelings or nonconscious biases to guide decision making” (p. 245). It is important to recognize that Damasio is not maintaining that the unconscious is the source of problem solutions, merely that those decisions are facilitated by the activation of multiple regions of the brain.

One of the more persistent beliefs in recent decades has been that creative thinking is predominantly a function of the right hemisphere of the brain. In contrast to the logical and conscious processing of the left hemisphere, the right brain is purported to specialize in the emotional and symbolic processing necessary for creativity. However, a number of empirical investigators, such as Ingegerd Carlsson in 1992 and Klaus Hoppe and Neville Kyle in 1990, have concluded that cooperation between both right and left hemispheres is characteristic of the brains of creative thinkers. There is little evidence to conclude that either the unconscious or the primary process would be attributed to right hemisphere functioning while conscious and secondary process thinking would be relegated to the left hemisphere. As R. E. Ochse pointed out in 1990, there is a common tendency to misconstrue levels of consciousness as particular regions of the brain rather than as a continuum of arousal. Referring to the unconscious as a particular brain structure reflects the nineteenth-century biology that served as the basis for psychoanalytic theory.

Reformulation of the role of the primary process in creative thought was summarized by Colin Martindale in 1989 as a state of defocused attention occurring during a period of relatively low cortical arousal. He believed that connections among different ideas, represented by interneuronal associations, are at the heart of creativity. In states of low cortical arousal, the creator is able to shift easily his or her focus from one node (cluster of neurons) to another. The simultaneous activation of many nodes increases the probability that relationships among them will emerge. In higher states of cortical arousal, more intense focus is placed on a fairly limited number of nodes, decreasing the likelihood that connections will be achieved. Several studies by Martindale and his colleagues have provided support for these differences in levels of arousal, particularly during the inspiration stage of the creative process. In addition, he suggested that creative individuals are “more variable in their level of arousal than are uncreative people; that is, they may show more extreme fluctuations” (p. 219), perhaps a physiological rewording of the concept of regression in the service of the ego.

While Ochse also recognized the merit of low levels of arousal in dissipating attention so that new combinations of elements might form, she further suggested that creators will use these ordinary mechanisms more effectively because they “engage persistently and independently in activities relating to their field of work, and thereby acquire a potentially valuable store of automatic routines” (p. 247). Low levels of arousal, whether in dreams, drug-induced states, or everyday reveries,

do not necessarily lead to creative achievements with any greater certainty than do the primary process or regression mechanisms forwarded within the psychoanalytic perspective. Therefore, it is neither the amount nor the process of unconscious thought that distinguishes the creative person, but the depth of content related to their field that may better permit 'automatic' integration of different ideas. Unconscious automaticity is apt to occur in any individual with respect to relatively trivial insights, whereas the most creative breakthroughs depend upon a large repertoire of experience and knowledge that have been established through an extensive network of neuronal interconnections.

Cognitive Models

Parallel to the developments in understanding brain physiology in recent decades has been the explosion of knowledge from cognitive and information processing researchers. It is no surprise that contemporary theorists have attempted to integrate the introspective reports and psychoanalytic processes presumed to be operable in the creative unconscious with the cognitive models that have typically addressed more logical and conscious elements of thought. Probably the earliest effort in this direction was the 'blind-variation and selective-retention' model advocated by Donald Campbell in 1960. He drew an analogy between the evolutionary process of genetic mutation and the almost random combination of ideas that might fuse in the mind of the creative thinker. Dean Simonton elaborated extensively on this approach in 1988 when he proposed his 'chance-configuration' theory in which original work is dependent upon a rich but flexible set of associative connections that provide the context for chance variations. He stated that:

In chance permutations, mental elements evoke other elements by such rare routes that any configuration so generated must be considered an essentially random confluence of psychological events. The appearance of unpredictability is reinforced by the fact that so many of the associative linkages operate at the infraconscious level, making it difficult to reconstruct cognitively the origin of chance configurations. (p. 48)

Previous dismissal of Freudian theory, including references to unobservable phenomena such as the unconscious, has led to isolation and rejection of neoanalytic theorists, resulting in the lack of cooperation in exploring complex notions like creativity. The resurgence of interest in revised perspectives on the unconscious is exemplified by a collection of eight articles on the topic in a 1992 issue of the *American Psychologist*. In the lead article, Elizabeth Loftus and Mark Klinger concluded that there is no longer any question about the existence of unconscious processes in human thought, but consensus about how such mechanisms operate has yet to be achieved. Although the current literature on unconscious cognition is much too voluminous to be reviewed here, much of the empirical support for this concept has been produced by Anthony Greenwald and his associates. One conclusion that he reported in 1995 was that his evidence is consistent with a view of the unconscious that can be supported by the newer parallel distributed network interpretation of the traditional serial information

processing approach. In sum, there appears to be no inherent contradiction between contemporary cognitive research and a significant role for the unconscious in creative thinking.

Excellent illustrations of the renewal of interest by cognitive theorists in the unconscious are the books and edited works of Steven Smith, Thomas Ward, Ronald Finke, and colleagues. In their 1997 collection, entitled 'Creative Thought,' they defined the field of creative cognition as a "relatively new area of investigation that attempts to characterize creativity in terms of fundamental cognitive processes acting on previously stored knowledge" (p. 4). Chapters in their 1995 book, *The Creative Cognition Approach*, included George Mandler's discussion of the unconscious influences on creativity (particularly the 'mind popping' that follows an incubation period), Kenneth Bowers and associates' analysis of the interplay of conscious and unconscious processes in the conceptualization of intuition, and Jonathan Schooler and Joseph Melcher's research which indicates how the conscious verbalization of thoughts may inhibit the achievement of creative insights. In their other 1995 book, *Creativity and the Mind*, Ward, Finke, and Smith described incubation, intuition, and insight all in terms of the unconscious activation of a network of associations.

A somewhat different angle was suggested by Lloyd Noppe in 1996, drawing on the psychological differentiation theories of Heinz Werner and Herman Witkin, as well as the neo-Piagetian constructive-operators model of Juan Pascual-Leone. This model incorporates the cognitive styles of fixity-mobility and field-dependence-independence in an affective-cognitive blending of the primary and secondary processes of regression and 'progression' in the service of the ego. The strategies of creative thinkers are flexible enough to adapt to the demands of complex problems because they effectively balance the combination of executive processing skills with a rich collection of relevant experiences. Creators are systematic and analytic thinkers, but they are also amenable to a relaxed formation of impressions based, at first, on varied elements that may be disconnected and not fully formulated. Regression to unconscious levels of awareness, including sensitivity to the knowledge and issues of one's specific field of creativity, must be coupled with a corresponding progression through a rational and organized set of strategies for communicating the breakthrough.

Mihaly Csikszentmihalyi's 1996 analysis of his interviews with 91 creative individuals provided fresh documentation of the value of the unconscious. While again the methodological ambiguities of introspective self-reports of the creative process still apply, he found frequent reference by these creators to the notions of insight, intuition, and incubation. Csikszentmihalyi distinguished between the psychoanalytic concept of the unconscious, driven by the motivation to achieve resolution of hidden tensions, from cognitive accounts, which posit no predetermined direction, only the potential for attaining useful connections. He further points out that irrelevant connections would eventually dissipate whereas the useful ones would emerge into consciousness. In focusing on the relationship between the conscious and the unconscious, Csikszentmihalyi describes a difficult contradiction: "not to miss the message whispered by the unconscious and at the same time force it into a suitable form. The first requires openness, the second critical judgement" (pp. 263-264).

Contemporary Controversy

At the present time, Weisberg continues to maintain that experimental evidence for the existence of unconscious processes in creativity is required, but not yet demonstrated. He dismisses anecdotal reports as unscientific and minimizes the contributions of previous laboratory studies as inconclusive. Weisberg, however, does acknowledge the necessity of explaining apparently unconscious mechanisms such as incubation, illumination, and primary process thought, given the frequency and certainty with which so many creative persons report such phenomena. The ordinary thought processes he purports to be responsible for creative thinking do not yet account for the unconscious inspiration that appears to motivate many creators.

In his impassioned analysis of the conscious and unconscious aspects of the mind, Guy Claxton has reviewed historical and cultural traditions of trust in thought that is not largely logical and rational. He describes the Western ideal of scientific thinking as limited and exclusive of alternative ways of knowing and understanding the world. It is important to recognize that he does not reject conscious processing as valuable to the creative process, but he does call for the rediscovery of how the unconscious equally contributes to creativity. Citing such diverse sources as Shakespeare's plays, Einstein's theories, and Buddhist philosophy, Claxton maintains that our society needs to balance our obsession with analytical science by greater acceptance of ambiguous, paradoxical, and patient reflection about creative issues. He believes that the "voices of philosophy, poetry and imagery are relatively weak in a world that largely assumes that only science and reason speak with authority. Thus, paradoxically, it is only science itself that can bring credible tidings of unscientific ways of knowing" (p. 226).

During the last decade, experimental research has, in fact, been conducted that is highly suggestive of the value and the veracity of unconscious elements in creative thinking. Sophie Ellwood, Gerry Pallier, Allan Snyder, and Jason Gallate, for example, recruited a sample of Australian college students to participate in a study of the incubation process in solving convergent thinking tasks. Taking a break and doing something totally different was found to be more effective at enhancing problem solving than either working continuously or working on related types of activities. The researchers concluded that their results were strongly supportive of an incubation effect.

A series of studies involving college students in Amsterdam were designed to investigate the unconscious-thought theory (UTT) of social psychologist Ap Dijksterhuis and his colleagues that was originally proposed in 2006. There are a number of

important components in the theory, but they include the relevance of processes such as incubation, the complementarity of the conscious and the unconscious, and the significance of the unconscious for dealing with complexity in promoting creative thinking. The results of the experimental research were interpreted by the Dijksterhuis team as particularly indicative that previous investigators have underestimated the fundamental role of unconscious processing in creative thought.

Similarly, there is empirical literature that supports the role of intuition in attaining creative insights. Janice Langan-Fox and Debbie Shirley have reviewed issues in the nature and measurement of intuition as well as offering a demonstration of how this process might be defined. They are also optimistic that people can be trained to improve their intuitive abilities. As evidence for the reality of unconscious processing seems to mount, researchers may begin to give up their skepticism about unscientific suppositions. If we are not cautious about spilling the water from the bathtub, we may end up throwing out Archimedes with it. Creativity does not seem to flourish without submission to the unconscious components of the mind.

See also: Incubation; Insight; Intuition; Jungian Theory.

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Underachievement

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Glossary

Attention deficit hyperactivity disorder

(ADHD) Symptoms include heightened activity, inattentiveness, and impulsivity.

Convergent thinking Generating one 'correct' answer for a given problem.

Cortical activation Brain activity during any given task.

Creativity A product or an idea that is novel and useful.

Divergent thinking Generating multiple answers for a given problem.

Giftedness Above average intellectual ability.

Underachievement Student's actual performance below his/her ability level.

What Is Underachievement?

Underachievement refers to a level performance that is below an individual's actual ability level. In contrast, overachievement refers to a level of performance that appears to be higher than one would expect given the individual's ability level (although some question whether it is logically possible to achieve above one's potential). Gifted underachievers typically have average or above average academic achievement, yet many do not perform on a par with their abilities. Thus, underachievement can, and should be, differentiated from low achievement. Defining underachievement requires that we are able to measure ability. The most common yardstick for measuring ability is IQ, an easy and widely employed index and significant predictor of future academic performance.

Who Underachieves and Why?

The causes of underachievement can be divided into internal factors such as personality, motivation, gender, ethnicity, and language, and external factors such as family, peer group, teacher, school, and social environment, and culture. Both kinds of causes can lead to underachievement due to low self-confidence, a low ability to persevere, lack of goals, and feelings of inferiority.

Internal Factors

Personality

In 1992, L. J. Emerick showed that gifted underachievers exhibit independence of thought and judgment, willingness to take risks, perseverance, above average ability, creative ability, and an intense love for what they like doing. Gifted students tend to be sensitive to teachers who are critical, rigid, officious, and unsympathetic, as well as to negative social feedback, which can all contribute to emotional conflict and the development of underachievement, as studied by J. R. Whitmore in 1980. Gifted underachievers with emotional problems have relationship problems with teachers, such as demanding behavior, excessive attention seeking, hostility, and rebelliousness, and relationship problems with peers,

including being either intensely competitive or fearful of competition.

Personality inventories of male high ability students show that male high ability dropouts are more assertive, independent, rebellious, cheerful, expressive, frank, and talkative than male high ability nondropouts. S. P. Lajcie and B. M. Shore discussed in 1981 that this might indicate that school pressures for conformity, rather than a lack of interest in school, create potential dropouts. Further, such characteristics can prevent the students from being selected for gifted programs, even if they have superior ability and other talents.

Motivation

Motivation plays an important role in underachievement. Two types of motivation can be distinguished: mastery goals and performance goals motivations. Mastery goals motivation leads to pursuing competency in a chosen field. Students who adopt such goals are self-efficient, persist in the face of difficulty, and are high achievers. Performance goals motivation, on the other hand, leads to hiding of existing ability and being afraid to make mistakes, seeing them as a sign of weakness. Students who adopt these goals tend to be low achievers.

Gender

Boys are more likely to underachieve than girls, with 50% of gifted boys performing below their level of ability. In addition, boys are more likely to drop out of school. However, there is evidence suggesting that there is an equal representation of males and females among underachieving students (e.g., Preckel et al. 2006). The cause for this inconsistency in findings may be that girls' problems and needs are more difficult to identify, and therefore their underachievement is easier to overlook.

Language and ethnicity

English proficiency tends to be associated with greater academic achievement for students whose first language is not English. However, maintenance of their first language is also associated with greater academic achievement because balanced bilingual students tend to perform better academically than monolingual students. Value systems within different communities and cultures have a high impact on academic achievement. For Asian

American and Hispanic American students, strong ethnic, culture, and language retention is associated with successful academic achievement. These students incorporate both cultures into their life experience, and draw resources available to them from either their own or American culture. However, African American students experience the opposite in that ethnic and culture retention tends to be associated with less successful academic achievement. It is more difficult for these students to achieve success if they retain their own cultural norms, in which academic achievement can be considered as "acting white."

External Factors of Underachievement

Poor family relationships and inconsistent standards, peer group, teacher, school, and social environment and culture are external factors that can lead to underachievement.

Parent, peer group, teacher, school, and social environment and culture

In 2001, of the Ph.D.s awarded in the Sciences, 80% were white, 9% were Asian, 4% were African American, 4% were Hispanic, and less than 0.5% were Native American. One of the likely reasons for the persistent underachievement of African American (and some other minority) students is the disproportionate numbers who live in poverty, which often include inadequate learning materials, under-qualified teachers, high administrator and teacher turnover, and overcrowded schools. Other factors include low teacher expectations, lack of access to more rigorous courses, and disproportionate referral to special education. Kozol showed in 2005 that African American students in gifted programs may disengage psychologically because of the lack of diversity in gifted education programs. African American students, and gifted students in particular, do not know that their school counselors or their interactions with counselors are ineffective.

However, African American students attending middle-class schools still do not perform at the level of their white and Asian counterparts. One of the contributing factors is attributed to parents' involvement in their children's education. African American parents tend to have lower academic expectations for their children compared to white parents. For African American students, peer pressure plays a significant role in their underachievement as well.

Comparative studies of ethnic differences in academic achievement tend to label whole groups of African American students as 'underachievers.' Such labeling can damage the way educators perceive African American students' intellectual capabilities and can reinforce the ecological fallacy. Majority and minority students have different reasons for academic achievement and retention in school. Inadequate preparation has been widely assumed to be the cause of most poor academic performance. However, programs that target such causes are not universally successful. Such programs improve academic achievement of majority students, but minority students can still lag behind. Other factors tend to influence minority students' academic performance. Minority students lack minority role models and advisors, who are available to support and advise them and this may be the reason for this disparity.

Teachers' lack of cultural awareness also explains minority students' underachievement, and thus schools need to provide

additional training and educational support to meet the needs of such teachers.

Creativity and Underachievement

Role of Creativity in Underachievement

Creativity is critical for the highest levels of academic achievement. It is a better predictor of outstanding adult accomplishments than measures of intelligence or school grades. In social sciences, for example, creativity explains more variability in performance than reasoning capacity, speed, or memory. In addition, creative thinking is more related to final dissertation marks than to exams or continuous assessment performance.

Neuropsychology of Creativity and Underachievement

Some studies have argued that neural efficiency explains differences in human intelligence – that is, brains may function more efficiently in highly intelligent individuals. (Staudt and Neubauer, 2006)

Highly intelligent individuals use less mental activity (i.e., higher alpha power) than average intelligent ones to perform the same kinds of tasks. Further, there are differences on the neurophysiological level between highly creative individuals compared to less creative ones. Highly creative individuals show less mental activity (i.e., low cortical arousal) than average creative ones while working on open-ended problems. Similarly, highly creative individuals show lower levels of cortical arousal than less creative ones during an inspirational (i.e., thinking of a story) phase but not during an elaboration (i.e., writing down the story) phase (From Staudt and Neubauer in 2006). In 1980, Whitmore showed that underachievers are highly imaginative as well as creative and perform better on holistic or divergent tasks than on analytic or convergent problems. They show a different cortical activation pattern, with greater neural efficiency in frontal cortical areas, compared to achieving students. Differences between achievement and underachievement groups (i.e., underachievers' lower activation) are found in that brain regions which are prominent for creative and divergent problem solving – the anteriorfrontal/frontal cortex. Defocused attention with a lower level of frontal lobe activation and low arousal is important for producing creative ideas. Creative problem solving is generally accompanied by lower levels of cortical arousal. Thus, underachievers might be more creative than achievers because of their lower level of cortical activation in the anteriorfrontal/frontal brain regions (from Staudt and Neubauer in 2006).

Creativity in classroom and at home

See the detailed discussion by K. H. Kim in 2008.

Characteristics of a Creative Student

Creativity can be a gift. However, it is just as true that creativity can be a curse for some students in traditional school environments, where it can lead to underachievement. It has been well documented that highly creative students experience difficulty in traditional school environments. For example, 60% of 400 eminent creative individuals had serious school problems.

Despite strong support for the importance of creativity, classrooms generally do not appear to be creativity-fostering places, primarily due to the biases of teachers and traditional classroom organization, lack of meaningful curriculum differentiation, and lack of originality in classroom-based enhancement efforts.

When highly creative students are forced into traditional school environments, they may become troublesome to teachers and disruptive in the classroom. They may resent the constraining structure of the classroom, excessive rules and regulations, and the press for the conformity. They avoid unpleasant academic tasks and interactions with teachers or peers and can become troublemakers, which can in turn negatively affect the classroom environment for others. Eventually, these creative individuals can develop into underachievers.

Not surprisingly, teachers prefer students who are achievers and teacher-pleasers, rather than disruptive or unconventional creative students. Teachers frequently perceive creative student behaviors as 'misbehaviors.' Creative students often display characteristics disliked by teachers such as hyperactivity, argumentativeness, selfishness, stubbornness, and independence. Many of the traits associated with attention deficit hyperactivity disorder (ADHD) also seem to be present in children who have been identified as gifted, talented, or creative. For example, compared with students who can focus attention easily, students with ADHD gather and use more diverse, non-verbal, and poorly focused information, and show higher figural creativity. In fact, teachers may mistake a highly creative student who is energetic and unconventional as having ADHD. This disconnection between teacher's preferences and highly creative students may lead to a discrepancy between classroom expectations and a creative student's educational needs. Therefore, educators are encouraged to be mindful of the creative talent in young people by recognizing and nurturing it to reduce underachievement, the school dropout rate, and other negative spin-offs.

Teachers' Preferences and Perceptions

Teachers tend to prefer students who conform to their requests, and exhibit socially acceptable behaviors. When questioned about the characteristics of their ideal student, teachers list easily manageable behavior and logical thinking as some of the most desirable traits. G. A. Davis and S. B. Rimm discussed in 1994 that teachers tend to prefer students with a high IQ rather than students who are both highly creative and highly intelligent. Some teachers see creative children as a source of interference and disruption. In fact, teachers' judgment of their favorite students is negatively related with creativity.

Although teachers agree with the abstract goal of fostering and encouraging creativity in children, their in-class demeanor and nonverbal behaviors appears to be antithetical to such a goal. For example, teachers report that they value qualities such as curiosity and independent thinking in their students, but students report that their teachers' behavior suggests that they value obedience and devalue asking questions and self-sufficiency. In fact, the work on teachers' views of the creative personality generally has been interpreted by Davis and Rimm as indicating that creative children in the classroom will be ignored or even punished.

Many teachers perceive highly creative students as nonconformists, easily distracted, and experiencing obstacles in fulfilling their academic obligations. E. P. Torrance and H. T. Safter discussed in 1999 that most teachers show a general lack of understanding about the nature of creativity and the characteristics of creative students. They most often associate creativity with artistic ability. Teachers often confuse characteristics of gifted high achievers with creative characteristics. When teachers are asked to think of a creative student, they frequently describe high achievers who possess some creative traits. However, intelligent people produce high quality products, but not necessarily novel ones. Therefore, if traits of creativity are confused with traits of high intelligence, a large majority of creative students will be overlooked.

Funding limitations may lead to situations where teachers are overloaded by class sizes. Naturally teachers seem to gravitate to students that are easier to handle, respectful, not disruptive, follow along in class, and accept their teaching unquestioningly. This may lead to rigid classrooms, which discourage new and unique ideas and demand obedience, rote memorization, and conformity. Ultimately, this combination can stifle creativity and lead to underachievement of highly creativity students.

Structure and Conformity

Teachers who prefer conformity are frustrated by many characteristics of highly creative students. Highly creative children, especially highly creative boys, have a reputation for having wild or silly ideas. After a child gains a reputation for being silly, it is difficult for teachers and classmates to see good ideas as anything but silly. This is exemplified by a third-grade teacher who had emphasized conformity to behavioral norms so much that she could not recognize the achievements of a certain highly creative student, even though this student had learned more than any of her other students (from E. P. Torrance in 2000).

As gifted students move forward in school, their desire to conform, fit in, and be accepted by teachers and peers causes many of them to disavow their uniqueness (as discussed by Torrance and Safter). A teacher's desire for conformity can also drive students to nonconformity. Nonconformity can become a drive in highly creative individuals with exceptional mental abilities, whose natural thought processes can lead to exploring concepts and methods that diverge greatly from the norm, especially when they are faced with pressure to conform.

Parental Influences

Parental attitudes can impact a child's creativity in a similar manner to teachers' attitudes. Parents of highly intelligent and highly creative children emphasize different characteristics when asked to describe their children. Parents of intelligent children tend to describe their children as polite and studious. Parents of creative children, on the other hand, tend to describe their children as enthusiastic, open to experience, and having a lot of interests. There is a strong relationship between preschool children's creativity test scores and their mothers' chaotic or rigid family style.

Parents may feel threatened when their highly creative children express their creativity. Some of the questioning, experimenting, and wild ideas can be annoying. Creative behavior may be interpreted as aggressive or even hostile, and it becomes just that if ideas and questions are rejected. Children who show creative activity consciously ask annoying questions and challenge the *status quo*. In response, parents may react by punishing this exploration of alternatives and discouraging their child's abilities.

Creativity and Society

Sensitivity, Risk-Taking and Socialization

Highly creative students face social difficulties due to their unique personality characteristics and needs which may not be experienced by other students. What distinguishes creative adolescents from their less creative counterparts is their greater independence and rebelliousness, deeper feelings and fuller range of emotional expression. Creative people are highly sensitive and are easily disturbed. They integrate feminine and masculine characteristics more fully, and demonstrate higher originality, imagination, and divergent thinking. In addition, compared to students with high IQ, highly creative students exhibit much higher degrees of humor. They enjoy taking risks and being in unusual situations. Torrance showed in 2000 that if a student asks an unusual question or advances a new idea, the student runs a risk of ridicule by classmates and by the teacher. This risk of ridicule may tend to discourage risk-taking, which is important in the acquisition of skills and knowledge.

Evidence of the anti-creativity effects of childhood socialization can be described by a 'fourth grade slump,' which is a drop in creativity test scores after the third grade. The observed drop may be caused by peer pressure and demands for conformity in the classroom. In addition to creativity, curiosity declines by fourth grade among gifted students.

Gender Roles

Gender role expectations may have an impact on underachievement and creativity. Creative individuals seem to diverge from sex norms because both sensitivity, which is traditionally a feminine virtue, and independence, which is considered to be a masculine virtue, are essential for creativity. Torrance indicated in 2004 that some students may sacrifice their creativity in order to maintain their masculinity or their femininity, which can lead to emotional issues and other problems for highly creative students. Teachers who are sensitive to gender issues among their students are in a position to soften the negative impact of sex-role stereotyping.

Suppression of Creativity and Emotional Problems

An entirely different problem may manifest when highly creative children suppress their creativity and become overly conforming and obedient. They are likely to grow up with a lack of confidence in their own thinking and be overly dependent upon others in making decisions. They fail to develop because

they have not been provided situations in which it is safe to practice without negative evaluation. The psychological dangers are severe if creative needs are strong and suppression is severe or prolonged. Torrance showed that in such cases, tension is likely to be overwhelming and psychosis can result. Creative people derive meaning from expressing their creativity, and denying them the opportunity to express their creativity can lead to numerous problems. Students may succumb to peer pressure and conformity, which can lead to the denial and inhibition of their creative ability. It may create personal tension, feelings of social stress, estrangement, and eventually may even cause a breakdown. Ultimately, such stifling of creativity affects creative students' quality of life.

Loneliness is a serious problem for highly creative students, especially if they do not have anybody who can listen to their original ideas without criticism. However, this is often the reality for creative children – they find themselves isolated from, and even teased by, peers and sometimes go through school unnoticed. Because creativity involves independence of mind, nonconformity to group pressures, or breaking out of the mold, highly creative students can experience problems of adjustment. They must either repress their creativity or learn to cope with the tensions that arise from being different. Repression of creative needs can lead to personality breakdown, while expression of those needs leads to loneliness, conflicts, and other problems of adjustment (see Torrance in 1994).

Unrecognized Creativity

Many unrecognized, creatively gifted, students are somewhat shy or nonassertive in the classroom. Some are children who teachers report to be in frequent conflict with classmates. The disruptive child usually consumes a lot of teacher attention, but does not show exceptional academic achievement or potential. Some students become highly creative when they enter special programs for the gifted, but most of them have learned to suppress creative impulses or had not yet discovered them. This means that such students may only become aware of their potential for creative productivity and the intrinsic rewards derived from the act of creating, once they are placed in an environment that encourages creativity.

Students' creativity can contribute to their underachievement as indicated by the real world measure of grades. It appears that some classroom interactions discriminate against creative ability such that students who try to use this ability achieve less well. Students with only high IQ, for example, achieve more than students with only high creativity scores, and students with combined high intellectual and creative skills do equally well on achievement measures, but have significantly lower school grades. In addition, those students who use their creative ability in the classrooms achieve less well than those who use their intellectual skills.

Creativity and Behavior Problems

Students with behavioral problems obtain statistically significantly higher scores on flexibility and originality measures. For example, youth delinquents from a Juvenile Justice System showed that approximately 18% of those screened turned out

to be gifted in some way. It is possible that these students' creative personality played a role in their problems.

Discrimination against creativity may go as far as to force creative students to drop out of high school or college. In fact, dropouts outperform nondropouts on creativity tests. Similarly, high school underachievers are found to be more creative compared with a group of normal achievers. Evidence suggests that creativity is related to school offenses. Popularity and misbehavior appear to be most predicted by creativity scores, whereas fluency and elaboration contribute more than other creativity subtests to the misbehavior correlation.

What Can We Do About It?

The characteristics of gifted underachievers are similar to the characteristics of highly creative underachievers. The same models and procedures can be used for mentoring and fostering highly creative and gifted underachieving students. Once creative students are in an environment that meets their needs, they perform much better, although reversing the underachievement may take a long time and be difficult.

Students' different weaknesses or difficulties and strengths can be hidden behind similar academic achievements, regardless of underachievement or overachievement. Thus, before educators make a diagnosis to design suitable and differentiated instruction for each student, identifying strengths and explicitly building on them is as important as carefully identifying each student's difficulties or weaknesses.

Less Restrictive and Less Evaluative Environments

Creative children's underachievement is minimized when school settings are least restrictive. The best learning environment for creative students allows them to move around and be physically active as much as possible, rather than being confined to their seats. Creative students also seem to thrive in challenging environments because without challenges creative students become frustrated and may lose interest in an activity. One of the primary problems is the failure of the school to give creative students challenging tasks in a less restrictive setting. Torrance showed in 2000 that misbehavior can often be seen as a reaction to the unchallenging, boring, and reproductive tasks given to highly creative students in restrictive school settings.

Further, students' creativity is fostered when teachers minimize the use of assessments in making social comparisons. When students focus on self-improvement, they are more likely to take risks, seek out challenges, and persevere in the face of difficulty. For students to be willing to express their creativity, they must feel that their ideas, especially those who are unconventional, are welcome in the classroom.

Play and Fun

Abundant play facilitates maturation of the frontal lobe inhibitory skills that gradually come to regulate children's impulsive primary-process emotional urges. Many parents and school systems neglect play needs, assuming that treating children like little adults facilitates the construction of well-conducted

citizens. However, human socialization occurs when children's brains are allowed to learn and develop in culturally rich, mind-supporting environments, including those that support a variety of self-generated social activities encompassed by the concept of 'natural play.'

If creatively gifted children are engaged in an academic activity that is fun and playful, they will become more motivated to learn and grow to fulfill their potential. Therefore, teachers and parents must continuously bring fun as the most important attribute to creative children's learning. Teachers need to incorporate play and fun fully into gifted education. Highly creative students should be encouraged to have pride in their own work instead of making external rewards a goal. Intrinsic motivation should be modeled by intrinsically motivated adults. Children should be shown the value of being creative for creativity sake, rather than for competing with their peers. Creative students should be given a choice of which activities to pursue, and on how they follow such activities. And again, play, fun, and imagination should be emphasized as much as possible. Teachers, parents, and families can help creatively gifted students by allowing them to pursue topics of strong interest. Allowing students to explore a variety of topics and skills and then giving them the time to pursue some in depth is a way of reversing underachievement. Creative students seek more challenge than average students. They prefer tasks they are intensely interested in, and would rather work independently than within a group. Creative students value freedom of choice: They become more motivated and engaged if given freedom to choose activities rather than receiving direction on specific pursuits. The freedom to pursue topics of strong interest often results in high levels of achievement.

Creative Teachers

Teachers who foster creativity allow choice of topics, welcome unorthodox views, interact with their students outside of class, and conduct classes in a more informal manner. In addition, teachers who make a difference help students fall in love with a subject so intensely that it becomes the center of the student's future career image. This future-image and passion is the best predictor of future creative achievement (see the 1994 book by Torrance).

Adult mentorship and understanding can have a strong impact because creative students are natural outsiders who often flounder in attempts at meeting seemingly contradictory needs. Teachers and counselors must help creative students learn to tolerate and understand their separateness, and they must help them find someone with whom they can communicate. Creative students need to develop and maintain self-confidence in their abilities to go beyond the limits of the known and familiar, and to endure in the face of risking failure to truly excel. Adults play an essential role in supporting creative students in their pursuits.

Highly creative teachers tend to have overachieving creative students, whereas less creative teachers have more underachieving creative students. The goal of guidance is not to promote individuality and creativity, but to encourage a healthy balance of individuality, creativity, and conformity. If students achieve a balance between creativity and conformity, they can enhance one another.

Teacher Training

Teacher training in creativity and nonconformity is one highly recommended change. Teacher training has an impact on teachers' conformist attitudes and interactions with students. Training in creativity influences teacher attitudes toward highly creative gifted students and training reduces sex role stereotyping. Teachers who have a gifted education background respond differently to gifted students when compared to preservice teachers or teachers without a gifted education background. Unfortunately, many elementary school teachers tend to be politically conservative and conforming. These teachers have a difficult time with students who are nonconforming and speak their mind. Rather, they prefer students who are submissive and conform to teacher's rules. Thus, it is important that teachers are trained on what types of behaviors are associated with creativity and giftedness, and do not ignore or punish such behaviors. If teachers are exposed to a sufficient range of information about individual gifted, talented, or creative students, they will be sensitive to the students' multiple intelligences and will also be less likely to respond to students' gender, social class, and racial information.

Voice and Choice

All students, but creative students in particular, have a strong need for voice and choice. Creative students need the option of voice to express their creative ideas, and choice to pursue those ideas. Stifling creative students' voice may cause them to withdraw or to rebel. Conversely, they will explore their own possibilities and strengths, and develop their own learning style when voice is given to them. Classroom meetings empower students, giving them some control over their environment and a chance to voice and process diverging viewpoints. Teachers who provide some open-ended assignments or open-ended components find success in bringing out the creative

potential in their students. Finally, concentration on meaning rather than rote memorization will benefit a highly creative student.

See also: Climate for Creativity; Conformity; Crime and Creativity; Deviance; Eccentricity; Education and Creativity; Giftedness and Creativity.

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Vincent van Gogh 1853–1890

Artist/painter

Painted *Starry Night*

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VINCENT VAN GOGH was an artist for 10 years, from 1880 to 1890. As a mature artist, he is known for his distinctive style of undulating lines and bold colors. During his mature phase he was capable of executing works in a rapid fashion, sometimes up to three a day spending less than an hour on each. He spent 9 years of deliberate repetition to evolve his competencies to a level where he could execute rapidly and automatically. In spite of his diverse ways of behaving, van Gogh possessed a remarkable unity of mind and spirit, as can be seen in the many letters—more than 700 of them—that he wrote over a period of 20 years.



Vincent van Gogh, self-portrait. Used with permission from Girandon /Art Resource, NY.

Childhood (1853–1876)

On March 30, 1852, Anna Cornelia Carbentus van Gogh, 33 years old, gave birth to her first child. It was stillborn. Christened Vincent Wilem van Gogh was buried in the graveyard of the local church. Exactly one year later, on March 30, 1853, she gave birth to a healthy male, and he too was named Vincent. As a schoolchild, the young Vincent walked past the local cemetery in which a gravestone bore his name and birthday. Vincent's father, Theodorus van Gogh, was a Protestant pastor at the village of Groot Zundert in North Brabant in the south of Holland, near the Belgian border. Vincent van Gogh was the firstborn to Anna and Theodorus. They had five more children: Anna Cornelia, Theodorus, Elizabeth Huberta, Cornelis Vincent, and Wilhelmiën Jacoba. During his adult years, Vincent would remain close to Wilhelmiën, his youngest sister, and extremely close to his younger brother and staunch supporter, Theo. The collaboration between Theo and Vincent remains one of the most remarkable interactions in the history of art, and it is difficult to imagine Vincent's creativity without

the support of, and feedback from, his younger brother. Van Gogh came from a relatively unremarkable background. His ancestors had been art dealers, consuls, goldsmiths, preachers, and there had been a sculptor. Other than art dealership, Vincent's family showed no propensity for the type of creativity demonstrated in his work.

Johanna Bonger, Vincent van Gogh's sister-in-law, reported that, as a child, van Gogh had a difficult temper, was often troublesome, and was strongly self-willed. She noted he had a great love for animals and flowers and delighted in collecting things. There was, however, during his childhood, no indication that young Vincent was precocious nor had an unusual talent for art. On August 1, 1866, van Gogh was apprenticed to a branch of the prominent Paris art dealers Goupil & Cie at The Hague. He was exposed to various works of art and, under the supervision of H. G. Tersteeg, assisted in the sale of paintings, photographs, engravings, lithographs, and reproductions. Van Gogh worked at this apprenticeship until he was fired in 1876 for conducting himself in a manner antithetical to the firm's interests; for one, he would commonly and inappropriately discuss the merits of the works of art with customers, and he frequently talked them out of sales.

Searching (1876–1880)

From 1876 until 1880, when van Gogh was 23 to 27 years old, he engaged in multiple activities in the pursuit of a meaningful career. He was variously a teacher, a book dealer, and a minister.

Vincent van Gogh, at the age of 23, four years prior to his decision to become an artist, was an intelligent, enthusiastic book dealer working in Dordrecht, Holland. A fellow lodger wrote of him:

He was a singular man with a singular appearance into the bargain. He was well made, and had reddish hair which stood up on end; his face was homely and covered with freckles, but changes and brightened wonderfully when he warmed into enthusiasm, which happened often enough. Van Gogh proved laughter repeatedly by his attitude and behavior—for everything he did and thought and felt, and his way of living, was different from that of others of his age.

In May 1877 van Gogh left Dordrecht and his job as a book vendor and went north within Holland to Amsterdam. There he refined his idea of working. Sensing that he was impulsive, he recognized that he needed to exercise patience and discipline and wrote to his brother:

I have a lot of work to do and it is not very easy, but patience will help me through. I hope to remember the ivy "which stealth on

though he wears no wings"; as the ivy creeps along the walls, so the pen must crawl over the paper.

He was referring to the writing he was required to do for his theological studies—he was preparing for an exam he needed to pass for entrance into a university. Van Gogh outlined his intention to proceed with his theological studies in an ongoing, logical manner and expressed his belief that there were certain commonalities between studying religion and painting: "[C]oing on step by step . . . must lead to a good result. . . . But it takes time. . . . A great deal of study is needed for the work of men like father [a pastor] . . . just as for painting."

Van Gogh started as an artist late. During 1878 to 1880, while he had his job as a lay minister in Belgium, he sketched the miners who made up his congregation. At this time he wrote:

I still can find no better definition of the word art than this, . . . art is man added to nature . . . — nature, reality, truth, but with a significance, a conception, a character, which the artist brings out in it, and to which he gives expression . . . which he disentangles, sets free and interprets.

He recognized in June 1879 that artistic development involves the conscious quest for novelty, and in this regard wrote, "the artist has put things in a new light . . . all things have become new."

In 1879, van Gogh secured a position as a lay minister with miners in Belgium. As was his custom, he threw himself into this job, giving away his belongings, living on bread and water, and taking sick miners into his own home. His church superiors reprimanded him for his excessive zeal and ultimately he was dismissed.

While a minister, he sketched the miners, and it was after his dismissal that he went through a period of existential crisis during which he questioned the direction of his life's work. After several months of soul searching, the answer emerged clearly, and in June 1879 he noted in a letter to his brother Theo that an artist's vocation was a sublime, admirable one. Further, he wrote passionately of his intention to engage in a quest for a distinct style and his belief that a concept for a work precedes the execution of a work. Van Gogh worked as a lay minister with miners. They provided an image for him regarding positive character traits and productive ways of working: "[T]hey are intelligent and quick at their difficult work," he wrote in 1879, "brave and frank." (New York Graphic Society, Letter 129, originally April 1879). He saw his work proceeding by quick actions and slow progress, like the miners with whom he so obviously identified:

[T]hey are short but square-shouldered, with melancholy deep-set eyes. They are skillful at many things, and work terribly hard. They have a nervous temperament — I do not mean weak, but very sensitive. They have an innate, deep-rooted hatred and a strong mistrust of anyone who is domineering. With miners one must have a miner's character and temperament, and no pretentious pride or mastery, or one will never get along with them or gain their confidence.

It was during July 1880, at the age of 27, after being fired from his position as minister, that he wrote to Theo of his intention to become an artist. This begins a collaboration between Vincent and his brother that will last for 10 years

until Vincent's death. Theo agreed to send Vincent a monthly allowance in exchange for his artworks.

Getting Started (1879–1882)

During the summer of 1880, van Gogh experienced a philosophical and spiritual crisis, and after a period of intense rumination he decided to devote his life to being an artist. At the beginning of his tenure as an artist, he outlined his idea of art:

[A]rt is man added to nature . . . nature, reality, truth, but with a significance, a conception, a character, which the artist brings out in it, and to which he gives expression . . . which he disentangles, sets free and interprets.

In October of 1880 Vincent moved to Brussels to begin art studies; he read books on art and perspective and studied copies from prints, especially Millet. His decision to become an artist was preceded by certain ideas about work: that effective results require commitment and hard work, that to do something with fluency and ease one must spend a great amount of time in preparation, that the miner served as a metaphor for the quick execution of one's actions. Earlier, van Gogh tried executing his sketches in a quick manner. "I am sending you a hasty sketch," he wrote to his brother, "but I . . . need to study the . . . masters."

His interest in hard work persisted, and on September 24, 1880, he wrote to Theo that "I am in a rage of work, though for the moment it does not produce very brilliant results." In the same letter he noted the best work is "conscientiously done, with the evident intention of portraying the truth without any straining after effect."

In September 1880, van Gogh wrote of a metaphor that was to guide his work over the succeeding several months: a weaver at a loom. The effective artist and weaver, according to van Gogh, both learned their craft so that the work could be executed unconsciously, with ease and at a cautious, steady, deliberate pace. He wrote, "with his dreamy air, somewhat absent-minded, almost a somnambulist—that is the weaver." During this time, van Gogh rendered more than 36 pictures of weavers at looms. He varied the positions and the lighting, each time seeking the best arrangement of forms.

During his seminal attempts at art in July 1880, van Gogh acknowledged the need to construct and reconstruct a product by first beginning with an initial sketch or rough draft, developing it into a more refined sketch, and again reforming it into a completed work. He wrote, "as the rough draft becomes a sketch, and the sketch becomes a picture—little by little, by working seriously on it, by pondering over the idea, vague at first, over the thought that was fleeting and passing till it gets fixed."

In 1881 he returned to his parents' home in Etten to join Theo and an artist friend Van Rappard. After a brief stay at Etten, he moved to The Hague in 1881 to study with his well-known artist cousin Anton Mauve. He set up his own studio at The Hague, and he met and lived with a reformed prostitute named Clasina Hoornik, nicknamed Sien by him, and her two children. During August of 1881, after concentrating for several months on drawing and multiple media (e.g., charcoal and watercolor), he tried his hand at oil painting for the first time.

After some seminal attempts, he decided that his skills were too poorly developed for this demanding medium and returned to the basics, which meant drawing and related media.

During August 1882, he made a second attempt at oil painting after a year of drawing. Again he decided that he was not yet ready for the demands of painting, and he returned to drawing.

Van Gogh's early experimentations with oil painting led to a tube-squeezing insight—the realization that squeezing the paint directly from the tubes opened up possibilities for new effects. It happened when he was painting out-of-doors. He wrote to Theo:

It struck me how sturdily those little stems were rooted in the ground. I began painting them with a brush, but the surface was so heavily covered, a brush stroke was lost in it—then I squeezed the roots and trunks in from the tube, and molded it a little with the brush. Yes—now they stand there rising from the ground, strongly rooted to it.

As important as the tube-squeezing insight is to van Gogh's mature style, he elected to shelve it, along with all efforts at oil painting, and focused his efforts on drawing and related media, such as pencil drawing and lithography. He believed that oil painting was the most demanding of all media, and to do justice to its demands he believed that he needed to develop his skills for other tasks, such as drawing. "Drawing is the backbone of painting" he was fond of saying. He realized the tube-squeezing insight was valuable. But he had no overall mental structure for style to which it could be adapted. Put aside temporarily, he reactivated it when other mental structures evolved to more complex levels that were able to accommodate the innovative tubesqueezing insight. The tube-squeezing insight foremost demonstrates that van Gogh's creativity was a combination of long periods of planful work along with spontaneous play and chance events.

Van Gogh went to The Hague, Holland, in December 1881 and left in September 1883. During this 20-month period he wrote approximately one-quarter of his total letters, he redefined his ideas about models, he clarified his notions of love through his romance with Clasina Hoornik, and he rendered a total of 357 existing works, done in multiple media, including pencil, charcoal, chalk, ink, lithography, watercolor, and oil; only 7% of this output was oil painting.

Drawing dominated van Gogh's activities during the first two years of his tenure as an artist. In August 1882 he wrote, "But I have attached great value to drawing and will continue to, because it is the backbone of painting, the skeleton that supports all the rest." He did not address painting seriously until his third and fourth years as an artist; he was very planful to ensure that his drawing skills were acceptable to him before he undertook his adventures at oil painting. He mentioned that "before I began to paint, I had been drawing so much and studied perspective in order to build up the composition of the thing I saw."

When van Gogh began his activities as an artist in 1880, he brought to that experience a wide range of knowledge from previous enterprises, such as knowledge of literature, religion, and teaching. Once firmly committed to art, he subdivided that enterprise into various tasks and purposes, a notion he addressed in the following passage written during October 1884:

I have bought a very beautiful book on anatomy, *Anatomy for Artists* by John Marshall. . . . I have also what they use at l'Ecole des Beaux-Arts, and what they use in Antwerp. . . . The key to many things is the thorough knowledge of the human body. . . . Besides, I am quite sure that color, that chiaroscuro, that perspective, that tone and that drawing, in short, everything has fixed laws which one must and can study, like chemistry or algebra. This is far from being the easiest view of things, and one who says, "Oh, one must know it all instinctively," takes it very easy indeed. If that were enough! But it isn't enough, for even if one knows ever so much by instinct, that is just reason to try so hard to pass from instinct to reason.

Van Gogh was addressing multiple issues and multiple activities. Not all of the ideas expressed, such as approaching art like an algebraic equation, were used by him later in the form found here. But leading himself down certain pathways, from which he may retreated or abandoned completely, served a constructive function of having a pattern to reconstruct in his own manner. An initial pattern for reconstruction was provided during this early phase of development by his adoption of classical placements and poses of models resulting from academic influences, from the Holland experiences, and art instruction books.

After 20 months at The Hague, van Gogh decided to move to Drenthe, north within Holland. He left The Hague with vastly improved skills and greatly refined ideas about his working and during his last summer there he noted, "Last year I repeatedly tried to paint figure studies, but the way they turned out made me desperate. . . . [N]ow there is nothing that keeps me from carrying it out, because drawing comes so much more easily to me than last year."

He left The Hague a much better and more confident artist, but still recognized that he had a long way to go to develop an individualized style. "I know that I'll have to make many studies," he told his brother Theo, "therefore a great deal of painting must be done this year, and then there will come more light."

Van Gogh The Painter (1883–1888)

Experimenting with the interaction between oil and various media was an early preoccupation for van Gogh because he wanted to test the waters. His plan was to eventually tackle and conquer the demanding medium of oil painting on canvas and toward this end he wanted to develop a finely tuned skill for understanding the properties and attributes of oil interacting with other substances. This strategy as part of his overall plan did not go wasted.

Ever looking for the unusual interaction of materials and media, during the spring of 1883, van Gogh rendered a group of drawings that involved the experimentation of the interaction between printer's ink and various media. In regard to this he wrote:

But now about the drawings. I have done a few with printer's ink, and this week I made some experiments in mixing that printer's ink with white. I found out that it can be mixed in two ways—that is, with the white from the tubes of oil paint and, probably even better, with the ordinary powder zinc with white which can be obtained at any drugstore; it must be diluted with turpentine, which doesn't soak into this paper or cause spots on the black like oil does, because it dries

quickly and disappears. One gets much stronger effects working with printer's ink than ordinary ink.

Some of van Gogh's ideas regarding experimentation came from other artists. During May 1882 he wrote, "One can do great things with charcoal soaked in oil, I have seen Weissenbruch do it; the oil fixes the charcoal and at the same time the black becomes warmer and deeper."

In September 1883 van Gogh decided to leave The Hague and go to Drenthe, in northern Holland, for a new "field of action," in his words. He and Sien decided to break up. She returned to prostitution and several years later committed suicide. The breakup caused van Gogh considerable pain, and at Drenthe he wrote, "I often think with melancholy of the woman." Although his best-known works are paintings, van Gogh proclaimed in June 1883 his early experimentation with charcoal and ink: "[M]y dislike for working with charcoal is disappearing more every day. One reason for this is that I have found a way to fix the charcoal and then work it, for instance, with printer's ink."

Van Gogh engaged in a process of associating and consolidating previously unrelated elements and synthesizing them into a broad, purposeful plan. Van Gogh's broad plan throughout his production was to construct an effective artistic style, based on a notion of action and undulation. He wrote, "I tried to put sentiment into the landscape, and to convey the convulsive, passionate clinging . . . yet . . . half torn quality of the tree, to capture the struggle for life, to faithful to nature."

Van Gogh very strongly believed that a skill for drawing must be established before advancing to painting. Further, while drawing, he kept in mind the use of drawing as a springboard for skilled painting. In the same letter he wrote, "Though *The Roots* is only a pencil drawing, I have brushed it in with lead pencil and scrapped it off again, as would if I were painting." Scraping a pencil drawing functioned as a cognitive strategy to bridge the skills of drawing and painting. Scraping an oil painting is a method of revision; the artist removes parts that are unsatisfactorily rendered. One method of revision employed by van Gogh was scraping-and-repainting. In the following passage he describes how he scraped off areas of paint when he was dissatisfied with an effect. He would then repaint the area and, if still not satisfied, scrape and repaint until his intention as achieved. Over time, van Gogh became extremely competent at examining, analyzing, criticizing, and revising his efforts; this is the type of thinking we can call "self-regulation." He established a finely tuned sense of which efforts were poor and which were excellent.

If I have now painted so many studies in a short time, it is because I work hard, literally working all day, scarcely taking time even to eat or drink. There are little figures in several of the studies. I also worked on a large one and have scraped it off twice, which you perhaps have thought too rash if you had seen the effect; but it was not impatience, it was because I feel I can do better by grinding and trying, and I absolutely want to succeed in doing better, however much time, however much trouble it may cost.

Revision was important to the van Gogh's creative process. He utilized other types of revision in addition to painting-scraping-repainting. Not only would he alter an individual work in an effort to improve its structure, but he would

revise a concept by rendering a series of works. His group of sunflower paintings provides an example. He began by painting solitary flowers; then, work by work, introduced two, then three, and so on, until he worked his way toward the magnificent bouquets well known to the public. Revision, thus, is an important aspect of creativity. Effective creators are adept at generating seminal ideas and evolving them into coherent systems.

Van Gogh's use of his studio was an important aspect of his working. He would sketch his subject matter on location, making note of the source of lighting. He wrote, "I enclose a little sketch which I made in the soup kitchen. They sell the soup in a large passage where the light falls from above, through a door to the right."

He would take his initial sketch and use it as a guide to set up the same scene in his studio, positioning models and, by a careful manipulation of the light coming in through the windows (covering some of the windows with curtains), re-create the original scene that was recalled from the sketch. Sketching on location has its advantages and disadvantages. One disadvantage is that the scene is fleeting; people are moving about, and, for the artist, getting accurate details is difficult. A re-creation of the scene in his studio, based on the initial sketch, allowed van Gogh the luxury of attention to details and to careful drawing that was difficult to achieve on location. Further, as can be seen in the following passage, van Gogh drew a backdrop to his models in the studio based on his on-location sketch. He set up the scene in his studio much like a stage manager would arrange the props and actors for a play. He wrote:

Now I tried to find that same effect in the studio. In the background I put a white screen, and on that I drew the hatch, according to its real position and measurements; I closed the farthest window at the bottom, so that the light falls from P, exactly as in the place itself.

The *P* he refers to is a spot from which the light fell on his models in the studio, replicating the source of light in the original scene. His studio was a transitional arena for him to mediate the source of inspiration and the final work. He added, "You see, when I have the models posing there, I get exactly the same effect as in the real soup kitchen."

Van Gogh consistently made a distinction between *sketches* and *drawings*. A sketch was spontaneous, incomplete, the starting point for further work; a drawing was a finished product. Recreating scenes in his studio allowed him the opportunity to evolve an initial sketch from an ill-defined, seminal idea to a completed drawing. He wrote to Theo, "[T]omorrow I'll have the house filled of people . . . from the neighborhood, and . . . these persons . . . will pose for the drawing of which this is the first rough sketch."

Typical of his attitude toward working with multiple media and executing rapidly during his period at The Hague is the ideas expressed in the following passage, written to his brother Theo during February 1883:

But I shall have to put up with many more failures, for I believe that in water color much depends on a great dexterity and quickness of touch. One must work in it before it is dry to get harmony, and one hasn't much time for reflection then. So the principal thing is not finishing each one separately, no, one must put down those twenty or thirty heads rapidly, one after the other. Here follow a few curious

sayings about water colors: "L'aquarelle est quelque chose de diabolique"; and the other is by Whistler, who said, "Yes, I did that in two hours, but I studied for years to be able to accomplish this in two hours."

This passage highlights several characteristics about van Gogh's ideas for working at that time, 1883. First, he was heavily influenced by James Abbott McNeil Whistler's notion that rapid execution required years of preparation: "Yes, I did that in two hours, but I studied for years to be able to accomplish this in two hours."

Whistler, in the mid 1800s, took the well-known art critic John Ruskin to court. Ruskin had accused Whistler of "flinging a pot of paint into the public's face," meaning that the artist had quickly dashed off his works and was trying to pass them off as serious works of art. Whistler, on the stand, pointed out to the court that although he executed the works in a spontaneous, quickly brushed manner, he spent a long time in pre-execution training. Van Gogh was very impressed by Whistler's notion that the appearance of spontaneity in art requires arduous preparation. Second, van Gogh was unafraid of failure and of taking risks—and actually thought that failure was necessary as a source of growth. Van Gogh felt that in order to learn, one fails, and then he exclaimed, "Forward—and what the devil do I care if I fail—if I fail, then I'll try again." Third, van Gogh expressed the belief that reflection is most effective when it precedes and follows a work. An artist needs to consider what is going to be done, but also needs to consider what *has* been done so he can decide what to do next. For van Gogh, each work in a group (such as the 36 weavers) provided inspiration and correction for the next. Fourth, van Gogh believed that a rapidly executed work (based on careful preparation) was aesthetically more expressive and pleasing than one that was not.

Vincent van Gogh loved experimentation. In his quest for a novel artistic style, for example, he used lithographic crayon to do drawings, a use that this type of greasy crayon was not specifically designed for, and he included bread crumbs into the drawings to experiment with various values of tone. As he related to his brother:

I wrote to Rappard about the crayon yesterday, because I had to write him about various things concerning lithography; and as I wanted to send him a few sketches done with it, I used it for some drawings of our baby, in different positions, and I found it is very well suited to sketching, too. One can bring in demitones by means of bread crumbs.

Van Gogh left The Hague in September 1883 and arrived in Paris 2½ years later. In between he stayed at Drenthe (September to November 1883), Nuenen (December 1883 to November 1885), and Antwerp (November 1885 to February 1886).

During this time he continued working by the principles and ideas established at The Hague, and the culminating work of this period was his monumental *Potato Eaters*, the depiction of peasants sitting about a table having dinner, for which he executed more than 150 studies of heads before rendering the final painting.

Van Gogh moved to Paris to live with his brother Theo in March 1886. Since he was living with his brother, he had no need to write, hence, there is little correspondence during this 2-year period.

Maturity As An Artist (1888–1890)

Van Gogh decided in 1888 to leave Paris and go to Arles, a small, picturesque town in the south of France, to discover, in his words, "a new light." During his stay at Arles, from February 1888 to May 1889, van Gogh achieved full maturity as an artist and established his own individualized style. He also spent a 2-month period sharing housing and collaborating with Paul Gauguin. During this time, he had the first of seven "attacks" of mental illness during which he severed an artery in his ear; he did not cut off his ear as some people have incorrectly described the famous incident.

More than ever he accelerated his efforts and intentions to work quickly, execute rapidly, and at the same time render effective figures. Van Gogh was ever the one to isolate problems of execution and then work on them tirelessly until he arrived at a solution. He wrote:

Oh! someday I must manage to do a figure in a few strokes. That will keep me busy all winter. Once I can do that, I shall be able to do people strolling on the boulevards, in the street, and heaps of new subjects. While I have been writing this letter I have drawn about a dozen. I am on the track of it, but it is very complicated because what I am after is that in a few strokes the figure of a man, a woman, a child, a horse, a dog, shall have a head, a body, legs, all in the right proportion.

By 1888 van Gogh had progressed to the point that he would execute a painting in one sitting. "More than once," he wrote, "I have done a size 30 canvas in one day, but then I did not stir from the spot from morning till sunset except to eat a morsel."

Van Gogh worked rapidly, and when his efforts did not please him he would scrape off and repaint sections. In addition, he would add finishing touches, when appropriate, after a painting would dry. Van Gogh worked rapidly and revised by scraping and adding details after drying. A close look at *Starry Night* (at The Museum of Modern Art in New York City) reveals that some of the stars in the sky were painted as part of the original conception and that some were added after the painting had dried. Similarly, if you examine *Pipe with Chair* (executed at Arles), it is evident that the pipe and other details were added after the painting dried.

During September 1888, at Arles, France, van Gogh was faced with a specific problem in regard to painting at night. He was inspired by the contrasting colors, the quality of light, and the overhanging sky with its many glistening stars of a nearby outdoor cafe. Although the subject was well lit and easy to see, the canvas on which he wished to paint was not, and he had difficulty mixing paints and seeing his palette. He overcame the problem by experimenting with a wide-brimmed hat that had candles secured on it in various positions. What a sight he must have made to the residents of the small town of Arles! Surely, they thought him eccentric at best, and when in December of 1888 he had the first of several epileptic seizures and mutilated his ear, the candle-donning behavior could have added to their notion that he was insane and may have led to their subsequent efforts to encourage him to leave the town.

Among their reactions to him after the infamous ear-slicing incident were a petition circulated requesting that he leave and sporadic incidents of the local children taunting him at his window.

Van Gogh closed out the final 14 months of his life at two towns in France, St. Remy (in a mental institution being treated for seizures) and Auvers-sur-Oise. During periods of mental dysfunction, he did not create. In between attacks, he continued developing the ideas about creating he had previously set in motion. In this regard he wrote:

My work is going very well, I am finding the thing that I have sought in vain for years, and feeling this, I am always thinking of that saying of Delacroix's that you know, namely that he discovered painting when he no longer had any breath or teeth left.

At this point, his powers of rapid execution were refined so that he could quickly execute a rendition of a work by Delacroix in his own individualized style. He wrote, "[I]f you could see me working, my brain so clear and my fingers so sure that I have drawn that *Pieta* by Delacroix without taking a single measurement." The miner had been, and remained, a stabilizing metaphor for his working style, and he saw himself "like a miner who is always in danger makes haste in what he does."

Van Gogh continued to work purposefully, valiantly between epileptic attacks. In May of 1889, shortly after a psychotic episode, he wrote, "At present all goes well, the whole horrible attack has disappeared like a thunderstorm." He added his observation that his ability to render art firmly and quickly was improving: "I am working to give a last stroke of the brush here with calm and steady enthusiasm."

If there is any doubt that van Gogh was purposeful regarding his art can be dispelled, I would suggest by his description of his paintings of flowers, writing during May 1889:

I am doing a canvas of roses with a light green background and two canvases representing big bunches of violet irises, one lot against a pink background in which the effect is soft and harmonious because of the combination of greens, pinks, violets. On the other hand, the other violet bunch (ranging from carmine to pure Prussian blue) stands out against a startling citron background, with other yellow tones in the vase and the stand on which it rests, so it is an effect of tremendously disparate complementaries, which strengthen each other by their juxtaposition.

Van Gogh continued to paint right up until the end. "I have painted . . . vast fields of wheat under troubled skies," he wrote in the summer of 1890, "and I did not need to go out of my way to express sadness and extreme loneliness." "Well," he stated in his last letter, found unfinished on his person when he shot himself, "the truth is, we can only make our pictures speak." And speak they did and do to countless people of all nations and languages. Van Gogh never wavered from his intention to establish a new visual vocabulary for the expression of universal emotions.

During his adult years, van Gogh wrote copious letters. Most were to his brother Theo, who retained the great majority of them. Conversely, and unfortunately, Vincent did *not* retain the letters sent to him by Theo, so we have essentially a one-way correspondence. One of the reasons van Gogh's letters are powerful is that they are pure "thinking aloud" materials. He carried paper with him and jotted down his thoughts while he was creating. His writings are not distorted by the passage of time and the haziness of memory that attends it.

Van Gogh wrote many letters to his brother Theo, and to other friends and collaborators. The letters give a firm picture of van Gogh's thinking during critical phases of creativity. They also supply us with a profile of the shifting quality of his moods and of the quality of his emotions toward significant persons, places, and activities. Quotes from his letters were utilized in this work to demonstrate the rich world of emotional and cognitive states he experienced and to show that his ideas provided the basis to produce art. In his letters, van Gogh reveals the gentleness, love of humanity, and clarity of thought about his art that he maintained throughout his creative process—properties of his personality that are not so apparent in the sensationalistically magnified actions of his brief psychotic behavior.

Van Gogh Chronology

- 1853–1870: Childhood in Holland; firstborn of six children.
- 1870–1880: Various jobs, including art dealer, lay minister, schoolteacher, book seller.
- 1880: Makes decision to devote his life to becoming an artist.
- 1880–1883: Early development as an artist, devotes this period solely to drawing; lives at The Hague and learns from his teacher Anton Mauve.
- 1883–1886: Moves back with parents at Nuenen; culmination of Dutch period.
- 1886–1888: Goes to Paris; encounters the Impressionists and palette enlivens; lives rest of his life in France.
- 1888–1889: Lives at Arles in south of France; collaborates with Gauguin; first attack of mental disturbance (the infamous ear-slicing episode in December 1888).
- 1889–1890: Voluntarily stays at St. Remy, a mental hospital.
- 1890: Stays at Auvers; treated by Dr. Gachet; suicide.

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Lev Semenovich Vygotsky 1896–1934

Psychologist

Author of *Cultural-Historical Theory of Human Development*

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LEV SEMENOVICH VYGOTSKY has become famous in the scientific world as the creator of the cultural historical theory of psychology. Born at the end of last century into a Jewish family living in one of the provincial towns of the Russian empire, he is thought by many to be one of the major figures in 20th century psychology. Among L. Vygotsky's major works available in English are Thinking and Speech (published in 1934; published first in the United States in 1962 as Thought and Language), Tools and Symbols in Child Development (written in 1930, published first in English in 1978, and in Russia at the end of the 1980s), and The History of the Development of Higher Psychological Functions (published in the 1960s). He also wrote a series of articles dealing separately with the development of creativity in childhood and adolescence.



Lev Semenovich Vygotsky.

Background

Lev Semenovich Vygotsky was born in the town of Orsha, Vytebskaya oblast' (former Mogilev guberniya) in Byelorussia on November 5, 1896 (old calendar style). In 1897 his family moved to the city of Gomel, where Lev Vygotsky spent his childhood and his school years. Orsha and Gomel were towns inside of the Pale, a few provinces where Jews were allowed to stay permanently in the Russian Empire. Lev returned to Gomel after finishing his university education in Moscow in 1917 and stayed there until January 1924.

Vygotsky's early interest in humanities and art was influenced by his family, one of the best educated in town. His father, Semen L'vovich Vygotsky (1869–1931), had graduated

from the Commerce Institute in Kharkiv and worked as a banker. A very respected man in the Gomel community, he devoted a lot of time organizing activities in different service organizations, including an educational association that created one of the best public libraries in the city. Family history, recorded by Lev Vygotsky's daughter, Gita Vygodskaya, stresses that the personality of Lev's father was not easy to deal with—he was often stern, but this did not prevent him from being a loving father.

The heart and soul of the family was Cecilia, Lev's mother. At home she upheld an atmosphere of love and care. She was well educated and, like her husband, fluent in several languages. By training, she was a teacher, but she never got a chance to work in school; her whole life was dedicated to raising her eight children and running the household. Lev was the second child in the family.

Lev received his elementary education at home, studying independently and having a tutor for consultation. He passed an exam for the first 5 years of elementary school and entered into a private all-boys secondary school. Lev was a very good student in all subjects, and teachers often commented on his gifted abilities. His favorite subjects were literature and philosophy, both objects of his youthful fascination and involvement. In 1913 Lev graduated with a gold medal from the gymnasium, a secondary school in prerevolutionary Russia that prepared students for the university.

With his honored diploma he could have been accepted by any university to study philology, his favorite subject, but for a Jew in prerevolutionary Russia such a course of study would not have been very practical: philology graduates became, in most cases, teachers in public schools, a position not available for Jews. Lev's parents advised him to become a doctor because this would allow him to live outside of the Pale.

Lev was admitted to medical school at Moscow University, but a month later he realized how distant medicine was from his true interests, and he transferred to the law school at the same university. This school opened the way for a career as a lawyer, which would have allowed him to live outside the boundaries of the Jewish settlements. But his deep interest in the problems of literature, art criticism, philosophy, and the philosophical analyses of art led him, in 1914, without interrupting his education at the law school, to enroll in the Historical-Philosophical Department of Shanyavsky's University. Soon after, however, he became interested in psychology, and he combined his training in law, literature, and history with psychology.

Vygotsky's first publications, written during his student years and recently discovered by his daughter, were devoted to the problems of literary criticism. His student graduation paper

“The Tragedy of Hamlet, Prince of Dutch, W. Shakespeare” had an unusual history. It was published 52 years after he wrote it and gained a reputation nationally and internationally as one of the most original and unique analyses of *Hamlet*. Few student graduation papers receive serious attention from the international academic community more than 50 years after they were written.

In 1917, after graduating from both universities, Lev Vygotsky returned to his family in Gomel. According to his daughter and biographer, Gita Vygotskaya, the seven years that Lev Vygotsky spent in Gomel before moving to Moscow were important in his professional and personal development. The time after the Great October Socialist Revolution (1917) and the civil war that followed were very difficult for Lev Semenovich’s family, which suffered diseases and the death of two of Vygotsky’s brothers. Nevertheless, during this time, Vygotsky was active in teaching in the pedagogical college, managing a theater, and publishing his own journal of literary criticism. Most important, he conducted scientific studies of the psychology of art and the psychology of education, which resulted in his first famous books *The Psychology of Art*, which was written in 1925 but first published in 1965, and *Pedagogical Psychology*, which was published in 1926 then “arrested” (withdrawn from libraries and destroyed) and forbidden for more than 60 years. This book was republished only at the end of the 1980s. After a very impressive presentation at the Second Psychoneurological Congress in Leningrad in 1924, Lev Vygotsky received an invitation to join the Moscow Institute of Psychology. He accepted the invitation. During the next 10 years of Lev Vygotsky’s career, he built a new psychology, a new approach to the study of human development, and a powerful school of thought.

He did all this as a Russian intellectual who was actively involved in building *Soviet psychology*, an effort to revise and reform psychology along Marxist lines and to build a new, objective materialistic psychology. The new Soviet psychology was challenged to address the practical needs of a new regime to form new educational, clinical, and academic systems.

Vygotsky together with his closest friends and colleagues, Alexander Romanovich Luria and Aleksei Nikolaevich Leont’ev, started this enterprise at the time when nobody knew how to build a “new psychology.” Vygotsky began by analyzing what he believed to be a “crisis of contemporary psychology.” He was very ill and in hospital at the time he wrote a book *The Historical Meaning of the Crisis in Psychology* (this book was finished in 1927 but was not published until 1982). At that time, psychology was divided into different scientific schools. While analyzing the theoretical differences of these schools, Vygotsky concluded that, in reality, two camps existed in psychology. One camp was *objective* psychology, built on the principles of natural sciences. I. M. Sechenov and Ivan Pavlov, and their studies of reflexes, were among the most famous representatives of this camp. The second camp was phenomenological, idealistic, *subjective* psychology. Vygotsky’s attempts to unite the contradictory objective and subjective fields resulted in the creation of the cultural historical theory of human development. From 1924 to 1934 Vygotsky had more than 270 published articles, monographs, and books.

Ironically and tragically, the rise of Stalin’s political regime resulted in closer, potentially dangerous scrutiny of Lev

Vygotsky and his colleagues as they worked enthusiastically to build a new Marxist psychology. They tried to save their activities by moving from Moscow to Kharkiv (Ukraine), where their situation was not so politicized. Vygotsky spent much of his last 7 years in trains traveling from Moscow to Kharkiv to Leningrad. During this time he worked intensively, knowing that he was terminally ill with tuberculosis. Vygotsky died prematurely in 1934 at the age of 37. His death spared him from the suffering inflicted on other leading intellectuals by the Stalin regime. His likely fate, if he had lived longer, is indicated by the treatment of his research. His work was banned in the Soviet Union and was preserved only as oral history by his family, colleagues, and friends until it was rehabilitated in 1956.

Despite Stalin’s effort to obliterate his research and ideas, and his short, difficult life, Vygotsky is now viewed by many as one of the most influential figures of 20th century psychology and pedagogy. Remarkably, the books and articles he wrote more than 65 years ago continue to inspire and excite new researchers and research, and to influence practitioners.

Vygotsky Psychology

The efforts of Vygotsky and his colleagues to build a new Soviet psychology led them into diverse areas of investigation. All of these areas were linked to the same core ideas of his theory and were drawn from and tested with empirical studies, many performed with innovative techniques. Because Vygotsky’s work on creativity flows from and is closely related to his cultural historical theory of psychology, it is important to introduce key elements of that theory before discussing how they relate to creativity.

According to Luria, Vygotsky liked to call his approach “instrumental,” “cultural” and “historical” psychology. Each term reflected a different feature of a new approach to psychology that Vygotsky proposed to explain the development of higher psychological functions. The term *instrumental* reflected the fundamental idea of the mediated nature of higher psychological functions. Unlike basic reflexes, which could be analyzed as a simple stimuli-response situation, complex psychological functions incorporate in their structure new elements— internal and external tools—that transform the whole structure of mental functioning. The analysis of tools, which individuals actively use as instruments to modify and master their own behaviors, became a necessary part of Vygotsky’s new approach.

The term *cultural* emphasized that aspect of Vygotsky theory that views cultural development as a unique direction in the development of the child, reflecting socially constructed ways in which society organizes the various types of tasks faced by a growing child and the physical and mental tools that society provides to the young child to master those tasks. The *historical* aspect of Vygotsky’s theory is closely connected to the *cultural* aspect. The set of tools provided by a given culture were invented and developed during the long course of human history. Thus, tools like language, arithmetic or algebraic systems, maps, and signs have a long history of development and accumulation of their social influence before they become available as special instruments for a child’s individual development. Because the invention and

development of cultural tools continues, *historical* also means not only something from the past, but also contemporary aspects of life that are in process of change, linking the past and the future.

The historical method of psychological analysis differs greatly from the traditional methods used in the West. Vygotsky wrote that the concept of historically based psychology is misunderstood by most researchers. For them to study something historically means, by definition, to study some past event, and hence they naively imagine an insurmountable barrier between historic study and the study of the present-day behavioral forms. In Vygotsky’s view, to study something historically means to study it in the process of change. That is why he argued that the historical study of behavior is not an auxiliary aspect of theoretical study, but rather forms its very base. In fact, studying something in the process of change is the basic demand of the dialectic method, which is an essential element of Vygotsky’s theory.

The *dialectical method*, incorporated by Vygotsky in his work owes much to Hegel’s dialectic concept, which was later used by Marx and Engels. The Hegelian dialectic concept views things as in constant change and movement. It is concerned with interrelations and interactions. The sources for constant movement and development, the driving force of change, are conflicts and tensions between the contradictory aspects of things. As a result of these conflicts and tensions, development was viewed as constant transformation: nothing can be stable, everything is in a constant process of becoming.

Vygotsky viewed the very essence of psychic development as lying in the change of the *interfunctional structure of consciousness*. He criticized the atomistic and functional models of analysis, which treat psychological processes in isolation while ignoring their interdependence and their organization in the structure of consciousness as a whole. Rejecting methods of research perfected to study separate functions, Vygotsky suggested that psychology’s main problem for investigation should be the changing relationships between psychological functions and their developmental changes. The basic characteristics of Vygotsky’s theory are summarized in Table I. As this framework shows, Vygotsky separated higher psychological functions (like creativity) from natural psychological functions, then compared them based on their origins, structure, functioning, and complexity.

As Table I shows, natural psychological functions are genetically inherited (their origin), they are unmediated (their structure), they are involuntary (their way of functioning), and they are isolated from each other (their relation to other mental functions). In contrast, higher mental functions are socially acquired, “instrumental,” mediated by social means, voluntarily coconstructed and controlled, and exist as a part of a broad system of functions rather than as separate elements (see Table I).

Vygotsky On Creativity

The starting point for understanding Vygotsky’s view of creativity is that he believed that creativity is a higher psychological function. It is one of the complex and multidimensional human characteristics that distinguishes us from animals. Creative imagination is linked to the free processing of elements of our experience, creating their free combinations. It requires an inner freedom of thinking, activity, and cognition that is possible only for “cultural man.” Vygotsky stresses that it is freedom of creativity that distinguishes us from animals even more than intellect does.

He characterized creativity as the ability of humans to deal not just with the past or react to the present, but the ability to deal with change and with the future. Such an ability is lacking in animals, children of early age, and primitive humans. They all are unable to act creatively, to reach beyond the concrete situation and free themselves from a total dependency on the present. Vygotsky viewed imagination and creativity as equal parts of all aspects of cultural life, including artistic, scientific, and technical creativity. In this sense, all that is the work of the human hand, the whole world of culture, was distinguished in his view from the natural world because it is a product of human imagination and creativity based on imagination.

To explore Vygotsky’s views on creativity, the framework in Table I is used to structure the remainder of this section. We discuss these key points: (a) creativity has social origins and is culturally and historically determined; (b) creativity has a mediated structure; and (c) creativity exists not as a separate function but as a part of a more complex system, and changes during developmental stages.

Social Origins of Creativity

Vygotsky believed that the origins of individual creativity can be found only in the individual’s social relationships with the world. Creativity, like all other higher psychological functions, begins in the social environment and then through the process of *internalization* moves from the “outside” into the “inside.” His view was the opposite to the Piaget’s, who believed that intelligence is started and matured from inside the individual and then is directed from the inside to the outside. Internalization, according to Vygotsky, is a dialectical process that occurs during a child’s interaction with others: children watch other people speak, think, or behave in certain ways and thus can learn how to speak, think, or behave this way themselves. A child can learn how to think creatively only by first trying to do it together with other people. After that, the child can then internalize and model what has been done socially at first.

Once the process is internalized, it becomes a property of the inner psyche, even though Vygotsky never drew a real line between the inner and outside because the dialectic nature of internalization is a mechanism of human development. Vygotsky described this basic idea in his theory, which he called the *general law of cultural development*, as follows: Each higher psychological function in child development appears on the stage twice. It is seen first as a social collective activity, an interpsychological function. At the first stage of

TABLE I
Main Criteria of Differences between Natural and Higher Psychological Functions

Psychological functions	Origin	Structure	Functioning	Complexity, integration
Natural psychological functions	Mainly inherited	Unmediated direct	Involuntary	Relatively isolated
Higher psychological functions	Social origins, culturally acquired	“Instrumental,” mediated by cultural tools (verbal and external), which transforms the structure of mental functioning	Activity, voluntarily co-constructed and controlled	Systemic, always arise as part of complex integrated functional systems

development, adults are viewed as external agents mediating the contacts that children have with the world.

Second it is seen as an individual activity, which is the inner manner of a child's thinking, an intrapsychological function. At the second stage, the tasks that the child initially shared with an adult could be performed alone, they are internalized. As a higher psychological function, creativity follows this pattern in development. Because Vygotsky believed that a child can acquire abilities for creative thinking through the interaction with adults, there was no doubt for him that creativity, creative thinking, could be enhanced through appropriate teaching. Vygotsky believed that good teaching can lead to the development of a child's creativity if it is based on the principles of the *zone of proximal development*.

The concept of the zone of proximal development is a very influential Vygotskian idea. It is defined as the distance between (a) the actual development level of a child, as determined by independent problem solving and (b) the level of the child's potential development, as determined by problem solving carried out under adult guidance or in collaboration with more capable peers.

Creativity has Mediated Structure

As noted earlier, Vygotsky described the cultural development of higher psychological functions as a dialectical process that goes beyond incrementally improving the elementary functions to stimulate fundamental changes in the direction of development. Thus higher psychological functions like creativity are not built *on* (on the top of) the elementary functions, but are separate, new psychological systems. This radical transformation of the structure and the functioning of higher psychological processes is based on the use of signs, words, symbols, and other cultural tools, which become psychological tools for organizing behavior. The structure of higher psychological processes become mediated and, in some cases, could be flexible, depending on the nature of tools that are used.

According to Vygotsky, creativity as a mediated activity means that creativity as a higher psychological process could have a very different structure, depending on what cultural tools are available at a given moment and which kind of cultural tools a person uses for its mediation. The direction of creativity depends on the tools that are supplied to a given individual, which is determined by the culture and history of the society in which the person lives. Vygotsky argued that it would be a miracle if the imagination could create something from nothing, or if it had another source of creation besides previous experience. He stressed that the creative activity of imagination is found to depend primarily on rich and varied previous experiences. The richer the person's experience, the more material his imagination has at its disposal. Accordingly a child has less imagination than the adult because he or she has less rich and diverse experiences.

Vygotsky wrote that any inventor, even a genius, is always a plant growing at a certain time and in a certain environment. His creativity issues from needs, which are given to him. He operates with the possibilities that exist around him. Because of this, we can trace the historical development of technical areas and the sciences. He stresses that no inventions of

scientific discoveries can occur before the materials and psychological conditions necessary for their creation are at hand.

So, Vygotsky viewed creativity as a mediated activity and he attempted the scientific analysis of different types of mediation. He specifically studied symbolic mediation, which is originated during the interaction in child play as a visual, perceptual mediation and then transformed during adolescence into the verbal, symbolic mediation.

The Development of Creativity

Rejecting the model of development as the linear, gradual accumulation of small changes, Vygotsky described development as a dialectical transformation that includes both evolutionary and revolutionary changes. He applied this approach to analyze creativity and noted that even though creativity usually appears to be a "catastrophic act," it is actually the result of a very lengthy internal maturation. For Vygotsky, evolutionary changes (maturation) and revolutionary shifts (catastrophic act) in creative behavior were not opposite forms, as could be viewed from the "commonsense" point of view. Instead, he viewed them as mutually dependent forms of the dialectical process of the development of creativity.

Vygotsky argued that creativity, as one of the higher psychological functions, cannot be studied separately without taking into account its relationships with other psychological functions in different stages of the development of the individual. For Vygotsky, the dialectic of the relationships among memory, perception, abstract thinking, and motivation play a major role in the systematic analysis of creativity and imagination and its development.

Vygotsky wrote that creativity as a higher psychological function does not appear suddenly; instead it develops slowly and gradually from more elementary and simple forms to more complex forms at each age level of childhood, which has its own form of creativity. It does not appear by itself in the behavior of the child as a separate psychological function, but it emerges in direct dependence on other forms of activity and other psychological functions.

Vygotsky found that creativity in childhood differs from the creative abilities of adults. The imagination of children is poorer than the imagination of adults. In the process of child development, the imagination also develops, reaching maturity when the child become an adult. He describes child play as the first activity during which creative imagination appears, mediated mainly by perception, memory, and visual thinking. During the same period, a child first becomes aware of differences between reality and imagination and develops the ability to undertake symbolic play. [See PLAY.]

In the adolescent stage of development, creativity begins a revolutionary shift that is caused by the appearance of new powerful mediators, inner speech and abstract thinking. At this stage of development, creativity changes due to complex interfunctional connections between imagination and abstract thinking. In Vygotsky words, creativity "is intellectualized." It enters into a system of intellectual activity and begins to play a completely new function in the structure of adolescent personality. From the developmental point of view, argues Vygotsky, imagination in the adolescent is the successor of children's play.

Vygotsky argued that imagination of the adolescent is more creative than a child's fantasy, but it is not productive in comparison with the fantasy of an adult. Only in adulthood does creative imagination and creative thinking reach maturity in the form of artistic, scientific, and technological creativity. [See IMAGINATION.]

Conclusion

Drawing on his cultural-historical theory of psychology, Vygotsky attempted to analyze creativity from inside of culture and history. He regarded individual creativity as a higher, mediated psychological process, whose origins could be found only in the individual's social relationships with the world. Vygotsky view of creativity is optimistic: He sees that humans have the ability to develop creativity and to formulate the fundamental laws of its development.

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W

War

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Glossary

Aggregate units Units of analysis that tabulate cases across time or space. Examples include counting creative geniuses in consecutive generations or the number of Nobel laureates in different nations.

Content analysis A systematic method of extracting useful information from documents, artifacts, or products.

Generational time-series analysis A statistical method in which a transhistorical sample of eminent personalities are assigned to consecutive 20-year periods and then subjected to various statistical analyses.

Integrative complexity A measure of the extent to which an individual can differentiate alternative perspectives and then integrate those perspectives into a coherent viewpoint.

International war Enduring and organized military conflict between two or more sovereign or independent states. Sometimes referred to as balance-of-power wars.

Intranational war Enduring and organized military conflict within a single sovereign or independent state. Can include civil wars, rebellions, and revolts.

Power motivation The need to influence on or exert dominance over other individuals, whether aggressive, sexual, or social; the desire for prestige and respect.

Time-lagged relations Associations between two variables that occur after some time delay, the length of the lag being dependent on the time needed for the causal variable to have an impact on the effect variable.

Time-series analysis A series of measurements on the same case spread over consecutive periods of time; most often the assessments are equally spaced.

Introduction

Is personal and societal creativity positively associated with peace and prosperity? How does warfare affect the creative output of a given individual or nation? Does war determine both quantity and quality of cultural and intellectual activity?

A superficial glance at history might lead us to suspect that war features positive relation with creativity. At the individual level we might cite the example of Ludwig van Beethoven: many of his masterworks seem to have appeared during the height of the Napoleonic Wars. Indeed, he had originally planned to dedicate his Third 'Eroica' Symphony to Napoleon himself. At the societal level we might mention the Golden Age of Greece, a period of high cultural achievement framed by the Persian and Peloponnesian Wars. The Italian Renaissance provides another apparent example. Did not Leonardo da Vinci devote part of his creativity to designing weapons? And did not Michelangelo help design fortifications? Of course, it is also possible to come up with counterexamples. On the one hand, the famed Pax Romana – a period of relative peace during the Roman Empire – also was associated with a great cultural florescence, such as the so-called 'Silver Age' of Latin literature. On the other hand, it would seem that World War II had a devastating impact on creativity in Europe and Asia.

Rather than continue to pit one anecdote against another, it is possible to address this question in a more objective and

quantitative manner. In particular, the optimal approach is to apply historiometric methods to biographical and historical data. Fortunately, a large number of diverse studies have been conducted on this issue. The vast majority of these investigations focus on how war might influence creativity, so that research will be discussed first. But a smaller number have looked at how creativity might be involved in war, a possibility examined toward the end.

Effects of War on Creativity

In general, war can affect creativity in two ways: quantitative and qualitative. The first concerns the actual output, such as the number of creative products produced in a given year. Does warfare help or hinder the odds that creativity will appear? The second concerns the nature of the output, such as its thematic content or stylistic characteristics. Does peacetime creativity look different than wartime creativity?

Quantitative Effects

How does war affect creativity? It turns out that this question is much more complex than first meets the eye. Research cannot begin to provide an answer until the investigator first responds to three subsidiary questions.

First, what exactly is meant by war? At the very least two different kinds of war can be distinguished. On the one hand are the wars between sovereign states, such as World War I among several European nations. This type of conflict is sometimes referred to as an international war. On the other hand are the wars that take place within a given sovereign state, such as the English Civil War of the mid-seventeenth century. This type of conflict is sometimes called an intranational war. However, these two labels do not exhaust all of the possibilities. For instance, another kind of war is the imperialistic or colonial war where one modern nation-state subjugates foreign peoples, especially those who have a tribal rather than national political structure. Needless to say, different varieties of war need not have the same impact on creativity. Complicating the situation all the more is the issue of how to assess the state of war. Is it merely a matter of counting the number of nations that have declared war? Or should the number of pitched battles or war casualties be taken into consideration? What about the war's economic costs?

Second, what exactly is meant by creativity? It has become customary to distinguish between two levels of creativity, 'little-c' or everyday creativity and 'Big-C' or genius-level creativity. War might not exert the same influence on both. In addition, it is obvious that creativity appears in many different disciplines. At the very minimum, scientific creativity must be separated from artistic creativity. Yet it may be necessary to make finer distinctions as well. Certainly more expensive art forms like architecture might suffer more from military conflict than less expensive forms like poetry. In the case of the sciences, applied disciplines like medicine and technology may receive a boost at the expense of pure disciplines like botany and mathematics.

Third and last, what is the unit of analysis? This turns out to be a very complex issue. To begin with, the investigator must decide whether the units are going to be individual or aggregate. Individual units concentrate on samples of creators or their creative products. Such units are designed for asking whether people are less creative if they grow up in wartime conditions. In contrast, aggregate units concern samples of individuals organized into larger entities, such as nations or civilizations. Such units are best for addressing whether societies that more often engage in war are more likely to have fewer creative geniuses. Another issue is whether the units are to be cross-sectional or longitudinal. Cross-sectional units could entail samples of individual creators or independent nation states. Longitudinal units, in contrast, would examine one or more units across time, where those units may be either individual or aggregate. For example, a researcher might examine how war affects the annual output of creators or nations. Most often the units are arranged into time series and thus subjected to some kind of time-series analysis. Whenever time series are used, the investigator must decide on the size of the longitudinal unit. The most common choices are years, decades, or generations, where the latter is taken as somewhere between 20 and 25 years in length. Shorter time-series units are optimal for studying the momentary effects of war whereas longer units are optimal for studying the more enduring consequences of war.

The answer to these three questions largely determines the empirical results. Indeed, the one secure conclusion that can be drawn from the literature is that the relation between war and creativity depends on the definitions of war, creativity, and the

units of analysis. To appreciate this dependence, below I report the key findings under two headings, aggregate units and individual units.

Aggregate units

Some researchers have counted the number of creative geniuses appearing in consecutive generations in the history of an entire civilization, where the creativity could come from any major domain in the arts and sciences. The fluctuations in these counts were then compared with the occurrence of international wars (sometimes weighted by the number of casualties). The same findings have appeared for both Western and Eastern civilizations: military conflicts among independent states have no relation, positive or negative, with societal creativity. This null result explains why it is so easy to find examples of creativity under wartime conditions and creativity under peacetime conditions. Both possibilities occur with roughly equal likelihood.

Even so, by various changes in the methodological design, it becomes possible to observe some variety of war-creativity connection. For example, one investigation scrutinized the relation in Western civilization since the Renaissance, but introduced the following changes: (a) the unit of analysis was the year rather than the generation; (b) creativity was restricted to science and technology; (c) the creativity measure entailed an annual count of discoveries and inventions rather than individual scientists and inventors; and (d) war was split into four different categories, namely balance-of-power (or international) wars, civil (or intranational) wars, imperial (or colonial) wars, and defensive wars (when Western civilization was under attack by a non-Western civilization, such as the Ottoman Empire). In this case, negative effects were observed for balance-of-power and defensive wars. Over all, the following balance-of-power wars had the most destructive effect on discovery and invention in modern Western civilization: the Thirty Years' War, the Napoleonic Wars, and the two World Wars. Other inquiries have replicated this finding, particularly in the case of World Wars I and II. The latter even had an adverse effect on creative contributions in psychology.

The preceding studies concentrated on the concurrent or contemporaneous relation between societal creativity and war. The amount of war in a given year was directly compared with the number of discoveries and inventions in the same year. Yet it is also possible that the causal relation between the two variables is time lagged. That is, the impact is not immediate but rather manifests itself after a decade or more. This possibility has been tested using generational time-series analysis. In this technique historic creators and political events are tabulated into consecutive 20-periods called generations. The number of creators in generation g can then be correlated with the event counts in generation $g - 1$, or 20 years earlier. Because creators are assigned to the time-series units according to their peak productive period (most often taken as age 40), creators in generation g would be in their developmental phase in generation $g - 1$. Hence, this time-lagged function can assess whether certain political events, including war, exerts an effect on creative development.

Although the allowance for time-lagged generational does not alter the picture for international war, the provision does change conclusions for various kinds of intranational war.

Most prominently, revolts and rebellions directed against the hegemony of imperial states tend to increase the level of creative activity in a civilization. It seems that large empires tend to enforce a degree of cultural homogeneity that is antithetical to creative development. Interestingly, another kind of internal violence, namely, political instability, can have the opposite effect after a generation delay: 20 years after military revolts, coups d'état, and political assassinations a civilization tends to witness a decline in the number of creative geniuses.

One peculiarity deserves special mention: the impact of the diverse varieties of warfare depends on the domain of creativity under scrutiny. Most notably, creativity in the arts tends to be less affected than creativity in the sciences. Scientific creativity may require more ideal conditions than artistic creativity.

Individual units

The empirical findings reported in the previous section all depended on data aggregated across large numbers of creative individuals. Indeed, many of the investigations tabulated thousands of geniuses into 20-year generational time series. It is conceivable that such aggregation obscures the relation between war and creativity. Especially in a large civilization area, some creators will be more directly affected by war than others. While World War I was quite injurious to creativity in Europe, its consequences for creativity in the Americas was minimal. Thus, it might be better to investigate how war affects creativity at the individual rather than aggregate level.

Unfortunately, far fewer researchers have taken this alternative approach. One study examined creative output in ten top classical composers and still found that international war had no influence one way or another. Another study, using a very similar design, showed that the creative output of ten top psychologists declined during times of international war. Both of these investigations counted output in five year periods across each creator's career. Potentially even this degree of aggregation may mask the more transient effects of war. An alternative is to use an even finer unit of analysis, namely individual creative products. For instance, a study of 1935 compositions in the classical repertoire found that the most frequently performed works are less likely to be created during times of international war. So this particular form of artistic creativity may be encouraged by peacetime conditions.

Qualitative Effects

Even though certain types of war appear to have quantitative effects on specific kinds of creative activity, these effects are weak. Seldom is a military conflict so extensive that it shuts down creativity altogether. Because some creators will reside sufficiently far from the war zone, creative products will still appear, even if at a reduced rate. Consequently, it becomes possible to ask whether the works that appear in times of war differ from those that emerge in times of peace.

Various historiometric studies have addressed this question using an even more diverse set of methodological approaches. Probably the most important difference is the domain of creativity that is under investigation. Clearly, the thematic and stylistic parameters of creative products are contingent on the domain of creativity. For instance, a musical composition cannot be assessed by the same criteria as a scientific journal

article. Accordingly, it is optimal to organize this section according to creative domain. More specifically, the discussion here will separately cover music, literature, and philosophy, and science. The visual arts appear to be missing from this survey, but there appear to be no published studies of how war might affect the style or content of paintings, sculpture, and architecture. Perhaps this omission reflects the difficulty of analyzing the visual arts for this purpose.

Music

One approach to assessing the qualitative effects of war is to apply content analysis to creative products that are generated under either wartime or peacetime conditions. The content analysis may take two major forms: subjective and objective. Subjective content analysis requires trained human judges to apply well-defined coding schemes to a given document or artifact. In contrast, objective content analysis requires that a computer program apply the coding schemes without the intervention of a human being. Both of these approaches have been applied to compositions that make up the classical repertoire. The empirical research using these methods has shown that music is often responsive to the stresses and strains occurring in a composer's personal life. And it is hard to imagine war having any less of an effect. In point of fact, investigations have indicated that concurrent warfare has a major impact on the stylistic content of compositions. For example, compositions penned during wartime exhibit much greater variation in melodic originality; extremely predictable and extremely unpredictable themes being found in the same work. It is almost as if highly stressful contemporary events polarize the creator's emotional reactions, inspiring vast mood swings between resignation and despair, hope and fear. Furthermore, the stylistic impact of war appears to intensify to the extent that the composer resides close to the actual war zone. Shostakovitch's Leningrad Symphony, written during World War II, may provide a graphic auditory example of the magnitude of this polarization of trite and profound in melodic material.

Given that classical music constitutes a relatively abstract form of artistic creativity – where style seems more crucial than content – it might seem surprising that compositions are so responsive to external conditions like war. In the next domain of artistic creativity such a connection would be more likely expected.

Literature

Ben Jonson said that William Shakespeare "was not of an age, but for all time." Nevertheless, it is evident from the empirical literature that he definitely wrote his plays for his own age and time. The thematic material often reflected current events, particularly the most dramatic of these events. And it is difficult to imagine an event more striking than military conflict. So, in line with expectation, Shakespeare's thematic content tended to be responsive to wartime circumstances. In the first place, whenever his native land, England, was attacked by a foreign power, his plays had a tendency to discuss political expansion, empire, and conquest as the goals of war. In addition, various revolts and rebellions would stimulate discussion of life's conflicts. Even conspiracies against the monarch left an imprint on the Bard's plays. Nor was Shakespeare unique in his responsiveness to international and intranational war. Comparable

results appear to hold for the ancient Athenian playwrights Aeschylus, Sophocles, Euripides, and Aristophanes.

Content analytical studies have found that international war affects the content of poetry as well. Poems written during wartime are noticeably different from those written in peacetime. For instance, one investigation scrutinized how concomitant war casualties related to the content of French and English poetry. When wartime deaths and injured intensified, poets were more likely to treat moral imperatives (more often using such words as should, right, and virtue in their poems) but were less likely to invoke the theme of chaos (less often using such words as wild, crowd, and ruin). Just as intriguing, war intensity was positively associated with content indicative of rationality, restraint, and control. All in all, wartime poems place more emphasis on maintaining the moral order in the face of evil and chaos.

Finally, it is worth mentioning a curious relation between war and a very specialized literary theme – that of Don Juan. Although Don Juan legend originated in Spain, he proved to be such a popular character that various versions appear in other national literatures as well. In any given literary tradition, the frequency of Don Juan versions correlates positively with how much that nation was engaged in warfare. What makes this association most interesting is that the Don Juan theme can be linked with the need for power. The character's sexual conquests are indicative of interpersonal dominance, just as war is an instrument of international dominance. Because war itself is also connected with power motivation, enhanced interest in the Don Juan reflects a national shift toward the need for power. Significantly, this literary theme peaks about a decade after the peak in warfare.

Philosophy

Philosophers are apparently no more immune from war's influence than are the composers and writers. This impact was demonstrated in an extensive generational time-series analysis of over two thousand thinkers from the ancient Greeks to modern Western civilization. A team of experts first rated the thinkers on the stances on several key intellectual issues. These issues included the fundamental nature of reality (ontology), the basis for human knowledge (epistemology), and the criteria for good and evil (ethics). These thinkers were then tabulated into separate generational time series for each philosophical position, yielding a measure of fluctuations in major intellectual ideas. Because war was hypothesized to function as a developmental influence, a time-lagged analysis was used. That is, the number of philosophers in generation g was related to the amount of war in generation $g - 1$, or 20 years earlier. Significant relations were found for both intranational and international war.

1. Intranational war, and especially substantial civil disturbances, has a polarizing impact on intellectual debate, again after a one generation delay. To be specific, 20 years after such collective violence philosophers tend to advocate (a) empiricism (all knowledge comes through the senses), rationalism (all knowledge comes through reason), and mysticism (all knowledge comes through revelation); (b) materialism (matter is the fundamental basis of reality) and idealism (spirit or mind is the fundamental basis);

(c) eternalism (reality is unchanging) and temporalism (reality is in constant flux); (d) realism (abstract ideas really exist) and nominalism (abstract ideas are but names in our language); (e) singularism (the individual is of primary importance) and universalism (the society is primary); (f) determinism (everything is caused) and indeterminism (humans have free will); and (g) the ethics of happiness (good and evil based on pleasure), the ethics of principles (good and evil decided by universal rules), and the ethnics of love (good and evil guided by compassion). It is as if the political polarization that causes intranational war in generation $g - 1$ induces ideological polarization in generation g .

2. In contrast, international war has a far more selective effect, and a negative one, discouraging the emergence of certain beliefs. In particular, one generation after major international warfare philosophers are less likely to advocate empiricism, temporalism, nominalism, singularism, and the ethics of happiness. In other words, thinkers are less prone to argue that knowledge comes through the senses, that reality is constantly changing, that abstract ideas are but names, that individuals have priority over society, and that moral decisions should be based on what causes pleasure and pain. Evidently, these particular stances are not favored during wartime conditions, perhaps because these beliefs might be antithetical to the extreme patriotism and self-sacrifice required for the war effort. So, future philosophers who grow up under such circumstances are less likely to espouse these beliefs as adults.

As will be shown later in this article, sometimes the causal relations can be reversed, certain ideologies increasing war after a generational delay.

Science

It was shown earlier that international war has an immediate impact on the annual output of discoveries and inventions. In the previous section, however, it was seen that war can exert a long-term influence on philosophical creativity. Given that scientific creativity is partially dependent on the prevailing philosophy of a given age, the latter result implies that war might have enduring consequences for science as well. For instance, it seems reasonable to infer that scientific ideas might become less empirical and materialistic in line with similar changes in philosophy. Regrettably, no research has investigated this possibility. Even so, one empirical study has indicated a possible immediate connection between war and science in psychology. Peter Suedfeld content analyzed the presidential addresses delivered by 85 Presidents of the American Psychological Association. The speeches were specifically scored for integrative complexity, a measure of how many distinct perspectives a person considers and the extent to which these perspectives are successfully integrated. Some of these presidential addresses were delivered during peacetime, whereas others were delivered during the Spanish-American War, one of the two World Wars, the Korean War, or the Vietnam War. Cognition was much more complex in those addresses given during times of peace. What makes this correlation even more interesting is that the distinguished psychologists who score high on integrative complexity tended to

practice a different kind of psychology than those who score low. The former are more prone to view psychology as a human science, and thus be more humanistic or clinical in their orientation, whereas the latter are more likely to see psychology as a natural science, and therefore be more behavioristic or experimental in orientation. By implication, the presence or absence of war seems associative with qualitative differences in psychological science.

Effects of Creativity on War

It has been assumed so far that creativity is somewhat at the mercy of politics. War either lowers the amount of creativity or else modifies the nature of the creativity that does appear. Despite that assumption, sometimes researchers have found evidence for influences going in the opposite direction. These consequences operate at two levels, the aggregate and the individual.

At the aggregate level, there is some tentative evidence that certain ideologies tend to encourage the development of the militaristic ideas that lead to war. This evidence came from a generational time-series analysis that compared the relation between prevailing philosophical beliefs at generation g and the level of international war at generation $g + 1$. When civilization becomes dominated by sceptical and materialistic ideologies, then warfare was likely to increase about 20 years later. This time-lagged relation held from the ancient Greeks to the beginning of the twentieth century. Because scepticism and materialism may undermine ethical values, and even lead to a high degree of political cynicism, the youth exposed to these ideas may be more disposed to become adults who are far more willing to see war as a viable means to attain a desired end. This possibility may bring to mind the ideal leader according to *The Prince* written in 1513 by Niccolò Machiavelli: the end justifies the means.

At the individual level, it becomes useful to return to the concept of integrative complexity. As noted earlier, integrative complexity tends to decline during wartime, and it tends to be associated with the type of psychology displayed by a President of the American Psychological Association. But the variable's connections with both war and creativity are even more complicated than so far discussed. To start with, integrative complexity is positively correlated with creative problem solving. Creative people are able to look at a problem from multiple perspectives and, when necessary, discover a solution that integrates those alternative points of view. Thus, Albert Einstein examined a problem in physics from the standpoint of both Newtonian mechanics and Maxwellian equations, saw the contradiction between the two, and resolved the conflict by deriving his special theory of relativity. By the same token, high integrative complexity is associated with effective leadership, especially in the area of decision making and problem solving. For instance, the more successful US presidents score higher in integrative complexity than do the less successful. In the case of war, integrative complexity is involved in two ways.

First, research has shown that international crises are more likely to result in international war when the political leaders facing crisis score low in integrative complexity. If the goal is to resolve the conflict, then leaders must be able to examine the

issues from multiple perspectives, and then find a satisfactory integration of those perspectives. The various parties to the crisis can then identify a resolution that allows the tensions to be reduced peacefully. If the leaders score low in integrative complexity, they can only see the crisis from one point of view (their own), and reconciliation becomes impossible. War then becomes the only answer. In a sense, when a crisis results in war, it is a sign that the world's leaders failed to exhibit sufficient creativity.

Second, once war breaks out, military leadership becomes more critical than political leadership. To a very large extent, the nations with the superior commanders will have an edge over their opponents in the conflict. Research indicates that those military leaders who score highest in integrative complexity are most likely to emerge victorious in battle. To be effective, a commander must be able to view the military situation not only from his point of view but also from that of the enemy commander. By inspecting the situation from all possible perspectives, the commander can determine the most probable consequence of a given tactical decision. In short, the leader can 'second guess' his opponent. Of course, integrative complexity is probably an asset with respect to strategy, and not just tactics. Hence, it enhances the national capacity to win the war, not just the battles making up the war. In short, military success demands a certain amount of creativity.

These two points taken together point to an ironic conclusion: It may take some amount of creativity to avoid war, and also a certain amount of creativity to win a war once it has begun.

Conclusion

Creativity is an enormously important phenomenon. Modern culture is largely the accumulation of creative acts since the beginning of civilization. War is also a tremendously significant phenomenon. Few political events affect so many people so dramatically, and often permanently. The history of humanity is very much a narrative of its major wars, battles, and conquests. Putting these two obvious facts together might lead to the conclusion that the relation between creativity and war would be a frequent subject of research. Yet that is far from the case. Direct empirical studies of their association are actually quite rare. To be sure, this article has reviewed a rich inventory of empirical results. However, close examination of the literature shows that the diverse findings are scattered and disconnected. Too often one investigator will approach the topic in ignorance of past research already published on the subject. As a consequence, frequently researchers end up duplicating results rather than building on the prior results of their predecessors.

Another liability has to do with the lack of a strong theoretical foundation for almost all published inquiries. The typical investigation tends to be exploratory, war constituting just one of numerous situational factors thrown into a set of independent variables. Complicating the problem all the more, investigators do not always define war in the same way, thereby obtaining divergent results. Furthermore, as mentioned earlier, researchers have often employed rather diverse methodological approaches, such as contrary units of analyses. Such contrasts can also affect the outcomes.

In light of these unfortunate limitations in the research, it is hoped that future investigators will adopt a more systematic approach to this crucial question. In particular, subsequent investigations should adopt a stronger theoretical framework that more firmly guides the critical methodological choices. Until then, those curious about the relation between creativity and war must be contented with a heterogeneous collection of piecemeal observations.

See also: Ludwig van Beethoven 1770–1827; Everyday Creativity; Historiometry.

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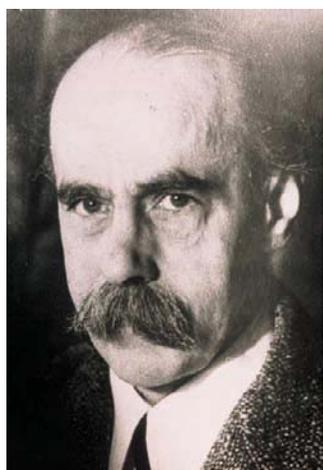
Max Wertheimer 1880–1943

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Introduction

Max Wertheimer was the creator of Gestalt psychology. The Gestalt 'school' arose in opposition to the four elementaristic, atomistic systems of psychology that were dominant early in the twentieth century, structuralism, functionalism, behaviorism, and psychoanalysis. Wertheimer demonstrated in analyses of music, creative thinking, perception, and many other areas of psychology that conceptualizing psychological processes and events in terms of the combination of 'elements' such as sensations, complexes, associations, or reflexes does violence to these processes and events; rather than psychological wholes being merely the sum total of their constituent elements, or the sum total plus some added element, wholes are entirely different from a sum of their elemental constituents. The nature of the whole determines the place, role, and function of each of the parts that make up the whole. The power of this kind of conception was concretely demonstrated in the many examples of dynamic thought published in his posthumous work, *Productive Thinking*. While the Gestalt movement waned somewhat during the second half of the twentieth century, its validity and applicability in a wide range of areas was once again recognized late in the century and early in the twenty-first in domains as diverse as cognitive science, visual neuroscience, art, social psychology, and the psychology of personality.



Max Wertheimer

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Background

Wertheimer was born 15, April 1880, into a prominent family in the Jewish community in Prague, then a major city in western Austria-Hungary, and later the capital of Czechoslovakia.

His father Wilhelm, the son of a prosperous businessman, pursued a career in accounting, agricultural commodities, and banking, and founded and directed a successful business school in Prague; his mother Rosa had a rich classical education in music, politics, and the arts. In keeping with the social stratification at the time, the language used at home was German; Czech was used only on the street and with shopkeepers.

Max's older brother Walter became a teacher in Wilhelm's business school, but died when he was in his late twenties. While Max was raised in the Jewish tradition, he did not carry on these practices into his adulthood. His parents sent him to a Catholic Gymnasium (or secondary school), because of the high quality of its reputation as assuring an excellent broad scholarly background for students aspiring to a university education. But doubtless the holistic perspective of the Jewish tradition at home played a role in Wertheimer's intellectual development. Holism has been a part of western philosophy for millennia; it can be traced back to classical Greek antiquity. And a resurgence of holism was a major trend among the late nineteenth-century Central European intelligentsia; a favorite topic of discussion, for example, was the skill of a good symphony orchestra conductor: the result of an accomplished conductor's skill is an experience for the listener of a profound, unified work that transcends just the concatenated sum total of the sounds made by the individual musicians.

Wertheimer's early independence of thought, as evidenced in his brother Walter's diary, was already clear when, as an adolescent, Max defied his parents at the dinner table by asserting that memorizing various items in the Bible has nothing to do with truly understanding religion or the Bible; this distinction between sheer blind memorization and true understanding or insight was to become a prominent feature in his later adult analyses of productive thinking and of education.

Early Adulthood

Wertheimer entered Charles University in Prague in 1898 and, following his father's wish, began to study law. But his exposure to philosophy and psychology, as well as to the humanities – and especially his repugnance toward the idea that a lawyer's duty is to the welfare of the client rather than to the establishment of truth and justice – persuaded him to pursue graduate work in philosophy and psychology instead. After five semesters studying law and then three concentrating on philosophy and psychology at Charles University, he transferred for graduate studies to the University of Berlin, at the time the most prestigious university in the German-speaking world.

Wertheimer was profoundly stimulated not only by the superb university, but also by the artistic, architectural, musical, political and intellectual ferment in Berlin at that time. He became close friends with the family of the highly successful graphic artist Käthe Kollwitz, and indeed lived with her sister's

family for several years. His dissatisfaction with what he considered the dull, pedantic elementaristic perspectives that dominated the psychology of the time led him to consider switching to the University of Würzburg, where the predominant views concerning psychology had a distinctly holistic cast. In Berlin, he performed experiments with a fellow student in 1902 that concerned the determination of guilt (in a legal sense), and these experiments were very similar to work already going on at the time in Würzburg.

Thus in the summer of 1904, probably with the blessings of his mentors in Berlin who themselves had distinct leanings toward holism, Wertheimer enrolled at the University of Würzburg. When he went there, graduate students were working on such issues as the qualitative characteristics of mental associations, the 'imageless' nature of many thought processes, the 'directedness' of thinking, and how the laws of logic are not really identical to the laws of actual thought. Würzburg was a major world center for creative experimental work on the psychology of thinking. By the close of that same year, 1904, Wertheimer successfully defended his doctoral dissertation on lie detection, a direct outgrowth of the work he had begun in Berlin on the determination of legal guilt. His Ph.D. was conferred on him with highest honors (*summa cum laude*).

Wertheimer's strategy in the lie-detection experiments was ingenious. He would tell a vivid story about a crime to some subjects in the experiments, but control subjects would be told a different story. Then a word-association test was administered to both sets of subjects. Some of the words would refer to items that only the experimental subjects would know had something to do with the crime, and indeed it turned out to be possible without exception to determine from the subjects' responses – their reaction time, their flustering, their emotional demeanor – which ones had been exposed to the crime story. If, for example, the story concerned the theft of a valuable gold chalice with the monogram FH embossed on it, that had been kept on a shelf in a special oak glass-enclosed bookcase, the critical subjects, but not the control subjects, would react in a telltale way to such word-association stimuli as 'FH,' 'gold chalice,' or 'oak bookcase.' Wertheimer's reasoning was that actual perpetrators of a crime would know about various details of the crime that innocent suspects had no way of knowing, and that their emotional reaction to these details would unerringly give them away. An emotional response to such ambiguous questions as "did you steal x?" could be expected from innocent suspects as readily as from guilty ones, but a discriminative response to critical features of a crime that could be known only to the actual perpetrator is an infallible indicator of true guilt. This technique of lie detection (finding that suspects who deny they committed the crime are in fact guilty) was to become one of the (few) methods of lie detection that would be acceptable in courts of law.

Beginnings of Gestalt Theory

Wertheimer stayed mostly in Berlin during the next few years, enjoying the stimulating intellectual and artistic opportunities in that exciting city. He performed and published further studies related to the lie-detection theme of his doctoral dissertation. He also worked on aphasia (a kind of word-blindness)

and brain injury, other neurological and physiological projects, and the psychology of music at research centers in Prague, Frankfurt, and Würzburg as well as Berlin. His work with brain-injured patients, trying to determine experimentally the exact nature of the patients' cognitive psychopathology, and his forays into sociocultural aspects of music – and also a preoccupation with philosophical issues of epistemology and logic, soon resulted in the coalescence of a holistic perspective that eventually culminated in the formal recognition that natural wholes not only in psychology but also throughout the physical world as well are not merely the sum total of their constituent associated elements, not even the sum total of such parts plus some added emergent element, but fundamentally different from a mere sum of such isolated components. Indeed the whole is prior to its parts, not a product of their combination. And the nature of the whole determines the nature of its parts, rather than vice versa. The precise formulation of this perspective was still several years away, but its beginnings are already clearly discernible in several papers Wertheimer published early in the second decade of the twentieth century.

The first one was a 1910 paper on the music of the Vedda, a tribe in Ceylon (now Sri Lanka) that was considered among the most primitive cultures then still extant. Wertheimer had spent some time during his years at the University of Berlin at a major phonogram archive there of music recorded in many parts of the world, including the songs of the Vedda. In contrast with an earlier analysis of this music, claiming that it is irregular, primitive, and 'undeveloped,' at least in comparison with modern European music, Wertheimer's analysis was much less ethnocentric. He clearly admired the songs, even if they were composed of only two or three different tones, as displaying a sophisticated internal structure, with specific 'laws' that govern their rhythm and internal articulation. His comments on this admittedly primitive music can be seen as perhaps the first specifically Gestalt analysis of a specific phenomenon; his approach, like in many later publications on Gestalt psychology, sought to discover how characteristics of a whole (in this case an entire melody) determine the nature of its individual parts (in this case the notes and their rhythmic and pitch characteristics and relationships).

A second early paper, in 1912, also on an ethnopsychological theme, concerned the thinking processes of aboriginal peoples about numerical problems and structures. Here again his admiration of the cognitive processes of so-called primitive people was evident. The numerical concepts and structures that people around the world use for particular purposes are often elegantly appropriate for the particular task at hand. The article is riddled with dozens of examples of how particular numerical usages are appropriate for their intended purposes; the usages typically are structurally far more elegant than simply applying the abstract, piecemeal, abstruse, content-less western additive system to all numerical problems. It makes no sense, for instance, to count the number of grains of rice for a meal; their overall bulk is what is crucial. And if I add two horses and two people, I may not have four – but two riders. In many contexts it is more appropriate to use such terms as 'a few' or 'many' rather than specific numerals. Or if I happen to break a spear in half, I don't now have two items as such, but a broken spear – a piece of a shaft and another one that has what might be a reusable tip. If a chain of eight links is cut in half I have two chains of four

links each; if I divide each of these, I have four batches of double links – and if the division continues the same way, I no longer have even a semblance of chain but a collection of links (and not even links any more if I divide each of them once again). Adding one to a small group is very different from adding one to a large group; and there are many other instance in which the rigid application of the western fixed, rigid system of counting in integers is by no means always more appropriate, more sophisticated, or more advanced. The article makes clear that to do justice to how people think about quantitative issues it is inappropriate to ask which numbers and operations of the European mathematical system they happen to be using; rather, the issue is what kinds of thought processes they use in dealing with particular concrete problems; what do their thought processes actually achieve? Wertheimer discusses ‘natural groups,’ ‘sensible operations,’ ‘variability,’ ‘approximate quantities,’ ‘arrangements, counting processes, value, and many other issues related to quantitative thinking. Many numerical structures that occur in various cultures permit a variety of conceptions of groups and quantities that are more true to the material being represented.

Another paper that Wertheimer published in 1912 is generally considered to be the article that launched the ‘Gestalt school of psychology.’ It concerned the perception of apparent motion when what is presented to an observer is in fact a succession of static visual stimuli. If, for example, on a white ground two short vertical black lines equidistant on either side from a visual fixation point, separated from each other by a small horizontal distance, are successively exposed with an appropriate very brief time interval between the exposures, the observer may see not a succession of two stationary vertical lines, but one vertical line moving back and forth. If the time interval between exposure of the two lines is too short, the observer sees two simultaneous stationary lines, and if it is too long two successive stationary lines are seen – but with the appropriate time interval between the offset of the first line and the onset of the second, the emergent phenomenon of a single line moving from one location to another (and back again, if the exposures are repeated) is unmistakable. Such stroboscopic motion, which is of course the fundamental process in motion pictures, was already well known in cinema; Wertheimer designated the phenomenon of the perceived apparent motion the phi phenomenon, using the Greek letter phi that is the first unit in the Greek root of that word. In general, what happens when motion is perceived in a pattern of successive exposures of stimuli that are actually stationary? The then-predominant view that complex perceptual experiences are the sum total of their constituent sensations cannot account for the emergence of the perceived motion. The motion cannot be derived simply by theoretically adding together the sensations of the stationary lines. Nor can the perceived motion be due to eye movements of the observer, since it is easy to generate motion in opposite directions at the same time with a stimulus pattern such as a horizontal motion from left to right between two lines exposed just above a fixation point and a simultaneous horizontal motion from right to left between two lines exposed just below the fixation point.

The stimulus arrangements and the temporal relationships of their exposures constitute a striking experience, a Gestalt with certain specific requirements if the observer is to see motion, a Gestalt that cannot simply be decomposed into a

concatenation of associated sensations. Indeed, Wertheimer argued, a pattern of stimulation is required in which certain conditions must be met in the processes in the brain that correspond with the perceptual experience. The brain traces of the two lines must functionally be physically close enough together spatially and temporally that a kind of ‘short circuit’ can occur between the electrochemical field of excitation produced in the visual cortex by the exposure of the first line and the excitation produced by exposure of the second.

Wertheimer’s ground-breaking experiments on the phi phenomenon were performed in the winter of 1911–12 at the University of Frankfurt, where two other young psychologists, Wolfgang Köhler and Kurt Koffka, were his main experimental observers. The three, Wertheimer, Köhler, and Koffka, were to become the recognized leaders in the Gestalt movement in psychology during the following decades.

Gestalt Theory Matures

Wertheimer’s work earned him a faculty position at the University of Frankfurt, where he remained until a call to the University of Berlin in 1916. Then in 1929 he obtained a full professorship back at the University of Frankfurt. Meantime Köhler, first on Tenerife in the Canary Islands and then at the University of Berlin, published extensively on applications of Gestalt theory to perception, to thinking and memory, to problem solving by chimpanzees, and to physical and physiological configurations, and developed major systematic theoretical statements on Gestalt theory. Koffka did many experiments on perception at the University of Giessen and then moved to the United States; he introduced Gestalt theory to the English-speaking world in an influential 1922 paper on perception that summarized much of the Gestalt perception work of the preceding decade, and in 1936 published a lengthy textbook that not only discussed the large corpus of experimental work that had been performed by that time in the Gestalt mode but also developed detailed Gestalt perspectives on social psychology and personality. By the fourth decade of the twentieth century Gestalt theory had become one of the dominant ‘schools’ of European and American psychology and had been adopted by many ‘second-generation’ Gestalt theorists such as Kurt Lewin, Rudolf Arnheim, Karl Duncker, Wolfgang Metzger, and Mary Henle.

Although Wertheimer published relatively little during this period, he continued to have a profound influence on many students and colleagues. Among his few major articles of the 1920s one, on the principles of organization of perception published in 1923, was to have a significant and lasting impact; its principles became part of the discussion of perception in almost all introductory psychology texts down to the present.

How is it, Wertheimer asked, that we perceive a world of meaningful objects in space when all that the brain has to work with is impulses in individual neurons that have been excited by stimulation of our sensory organs? In vision, light rays entering the eye stimulate various elemental cells in the retina to a greater or lesser extent; these cells in turn send all-or-none messages through the neural apparatus via midbrain structures to the occipital lobes of the brain. How does the complex of

differential excitation of the occipital cells get turned into the rich world of visual experience – in which one sees, for example, not a series of 150 dots of a certain brightness and hue, 200 of another kind, and so on, in a disorganized patchwork, but instead a house, and trees, and the sky? What are the principles of perceptual organization? How do piecemeal, unrelated bits of neural excitation become organized into perceived segregated Gestalten, familiar and unfamiliar specific objects organized in space and time?

The 1923 paper contains numerous simple patterns of dots and figures that elegantly show the reader in an immediate demonstration how the various ‘principles of perceptual organization’ operate, and permit the reader even to observe what happens when those principles are set in opposition to one another as well as when they cooperate to generate the same Gestalten. The overarching principle of organization Wertheimer called the ‘principle of Prägnanz’: the organization of any whole will be as ‘good’ as the prevailing conditions allow. All the specific individual principles of organization are, in effect, special cases of the principle of Prägnanz. Among these principles are proximity, similarity, common fate, closure, and habit.

Other things being equal, items that are close together in space and time are more likely to be organized as belonging together in a unit than items that are farther apart. For example, in a horizontal series of dots, if there is a space of two millimeters between the first two, then ten millimeters between the second and third, then two millimeters between the next two and ten between the next, and so on:

•• •• •• •• •• ••

then one sees a pattern of paired dots; if the distances were, say, two millimeters between dots one, two, and three then ten millimeters between three and four and again two millimeters separating four, five, and six, then ten between six and seven, and so on:

••• ••• ••• ••• ••• •••

then the pattern is organized into triads of dots. This principle of proximity, like the other principles, applies not only in vision but in other sense modalities such as audition as well. Thus a succession of pairs of knocks separated in time from one another by longer intervals:

!! !! !! !! !! !!

is indeed perceived as pairs, quadruplets separated by longer time intervals:

!!!! !!!! !!!! !!!! !!!! !!!!

are grouped as quadruplets, etc. Proximity in time works as a principle of perceptual organization just as effectively as proximity in space.

If equally spaced small colored circles are placed in a row, two black, then two white, then two black, then two white, etc.:

● ● ○ ○ ● ● ○ ○ ● ● ○ ○

then the principle of similarity indicates that pairs will be seen. If a series of three loud knocks is followed by three softer ones

then three loud ones followed by three softer ones, all separated by the same time interval:

!!! ... !!! ... !!! ... !!! ...

the result is perception of a succession of triads.

If in a horizontal series of small equally spaced dots suddenly the fourth, fifth, and sixth move upward a few millimeters:

• • • • ↑ ↑ • • • • • •

that set of the fourth, fifth, and sixth dots will, since they are undergoing a ‘common fate,’ be perceived as a group. Comparably, even though different parts of the human body are composed of different visual qualities, the fact that a walking person is perceived as a unit is largely due to the different parts of the body moving together; they are undergoing a common fate.

Parts of the visual field that form a closed unit such as a circle or a square cohere in part not only because of proximity or similarity (if uniformly colored) but also because of the unifying effect of the principle of closure. This principle also applies to incomplete forms, such as a triangle made up of dashed lines or a circle the circumference of which is actually a large number of dots, say twenty-five.

If one becomes accustomed to certain units through practice, such as in cursive writing, then the individual letters can be discerned even if the other principles of organization do not facilitate such units; comparably, if one is presented with a succession of patterns of horizontal lines of dots with diminishing distances between, say, the second and third dots and increasing ones between the first and second throughout the line, starting with distinct pairs (first and second, third and fourth, etc.), then a line in which the dots are actually all equally spaced will still be likely to be perceived in the same pairs as in the series before.

This principle of habit is generally weaker than the others, and tends to lose out to the others if they are allowed to operate. Wertheimer’s 1923 article also presents the results of experiments in which the principles are pitted against each other, showing among other things that the principle of common fate appears to dominate the others.

Among Köhler’s more influential publications that had a major and lasting effect on the psychology of problem solving was a book reporting the results of experiments in which chimpanzees succeeded in the task of obtaining a lure like a banana by using a stick as a tool to reach the fruit that was otherwise out of reach outside a cage, or by building a tower of two or three sturdy boxes (towers which typically were, it is true, somewhat unstable) and climbing the tower in order to reach a banana suspended from the ceiling of a cage. Köhler’s analysis of the chimpanzees’ behavior made clear that the animals understood the physical conditions of the problem, had ‘insight’ into the situation, and were reacting sensibly to it – not just engaging in blind trial-and-error random behavior that other psychological theories of the time had assumed would characterize such behavior. Köhler’s monograph extended the Gestalt work on the psychology of thinking that had been begun by Wertheimer’s early papers, including one in the late second decade of the twentieth century that had presented a Gestalt version of the logic of reasoning.

The Expansion of Gestalt Theory

While Gestalt psychology began and flourished in Germany, it soon expanded worldwide. All three of the original founders of the movement emigrated to the United States, Koffka in the 1920s and Köhler and Wertheimer in the 1930s. Other centers of Gestalt work developed in various other countries such as Italy and Austria, as well as in Japan. By the 1930s the influence of the school was worldwide. Yet the expansion of the school was not only geographic but substantive as well.

Wertheimer had already hinted at the applicability of the Gestalt perspective far beyond psychology, and Köhler had in detail shown its usefulness in physics, in the understanding of field phenomena such as magnetism and electricity.

After his move to the New School for Social Research in New York in 1933 (to escape the Nazi menace), Wertheimer published papers that provided Gestalt analyses of the concepts of democracy, ethics, freedom, and truth. None of these four ideas can, he argued, be understood simply as arbitrarily connected elementary concepts; they all have dynamic Gestalt features that cannot be understood in a piecemeal fashion. In a true democracy, it is not just blind acceptance of the result of a piecemeal vote that is central and essential, but what is crucial are the principles of reason and justice, with respect for and accommodation of minority rights; democracy is a kind of hierarchical structure, with the interacting parts doing what is required of them by the whole. Ethics is not the application of hasty, superficial relativism, but can and should be based on the structural features and roles in a situation, their inner causation, their inner determination. Freedom is not arbitrary absence of constraints, but is a condition of an entire social field, and must be viewed in its function, its role, and its interactions, in its consequences for individual people and for the society as a whole. And truth is not just a property of a proposition comparable to falsehood; truth applies not only to assertions but rather to what people do, in what Wertheimer called the will to do justice to the situations people are in, recognizing the inner connection between truth and justice.

Productive Thinking: The Culmination of Gestalt Theory

The psychology of thinking was Wertheimer's primary concern throughout his career. He lectured on this topic since the second decade of the twentieth century, and published on it occasionally as well. For many years he worked on the manuscript for a book on creative thinking, but he repeatedly revised what he had already written. The final product, entitled *Productive Thinking*, was completed shortly before his sudden death in October 1943; the book was published two years later. It has had a profound influence on many disciplines, including modern cognitive psychology.

The book begins by asking what occurs when, now and then, thinking really works productively, when thinking truly forges ahead. What is the nature of creative thought? Earlier discussions of such processes, Wertheimer argues, seem to cover up the real problems rather than facing them directly. In daily life there are many occasions, including especially in the thinking processes of children, in which there is a

transition from a blind, pedestrian attitude, via the birth of a genuine idea, to understanding in a productive process. What are the conditions favorable to such productive events? What is the difference between good and bad thinking? Traditional logic may be precise and rigorous, but it does not help in attempts to understand what actually goes on when productive thinking occurs. The classic syllogism is incapable of describing how thought actually works in going from several premises to a justifiable conclusion. Sheer examination of processes of definition, comparison, abstraction, generalization, and the like does not provide an understanding of how thinking actually occurs. Comparably, the well-established theory of associationism, or its more recent version, the psychology of conditioning and study of the process of forming connections, with its emphasis on frequency, recency, the role of past experience, trial and error with chance success, learning on the basis of repeated success, and so on, is of little help if one wishes to distinguish between sensible thought and senseless combinations, or to deal responsibly with the productive side of thinking.

Wertheimer examines the nature of truly productive thinking by discussing in detail various specific concrete problems. He typically invites readers to deal with the problem themselves, and often deftly guides readers to the point where they themselves can experience the exhilarating process of achieving insight into the solution of the problem. Successive chapters deal with instances as mundane as finding the area of a parallelogram and other geometric issues through various mathematical puzzles and issues in specific human interactions to such sophisticated arenas as finding the sum of the angles of a polygon and Galileo's discovery of the law of inertia, culminating in how Albert Einstein's thinking led to the theory of relativity (a chapter based on many discussions with Einstein). The final chapter summarizes Wertheimer's characterization of the dynamics and logic of productive thinking. Most of the examples used in these chapters had formed the core of many earlier lectures Wertheimer had presented over the years, and several of them had already been used in earlier publications.

Blind habits, special interests, and certain kinds of school drill, as well as bias, can interfere seriously with what Wertheimer calls genuine, fine, clean, direct, productive thinking processes. Operations such as grouping, centering, and reorganization form an essential part of productive thinking. These operations are not piecemeal but are related to whole-characteristics, are determined by structural requirements of the whole in a sensible way; they are not like a summative aggregation, a succession of piecemeal, chance happenings. Productive thinking consists of realizing structural features and structural requirements of the problem itself, disregarding superficial peripheral features and concentrating on core gaps or disturbances, resulting in appropriate structural grouping and segregation; cognitive operations must be viewed and treated in their structural place, role, and dynamic meaning within the whole situation. Crucial issues concern the relations between parts and their wholes, segregation, grouping, centering, and structural transposability. Productive thinking involves the successful transition from a situation that is murky, confusing, incoherent, and makes no sense into one that is clear, clean, transparent, and understood.

Furthermore, successful productive thinking is a supremely rewarding activity; few pleasures match those contingent on finally understanding, finally having a genuine insight into a problem that at first was recalcitrant and incomprehensible.

The book was reissued in an enlarged edition (containing three new chapters and a series of appendices based on material found in Wertheimer's papers after his death) in 1959, has been translated into Japanese and German, and continues in print. The original edition was widely reviewed, with positive evaluations, not only in psychological journals but in the popular press including the *New York Times Book Review*, with a glowing review by the poet W. H. Auden. It has had a major impact on modern cognitive psychology, especially in research on problem solving during the second half of the twentieth century, with many scholars citing it as specifying the kinds of problems which modern computer models of cognitive processes have to solve. While there has been substantial progress in the understanding of associative processes, there still has been relatively little that goes beyond Wertheimer's analysis of genuinely productive thought.

The Legacy of Gestalt Theory

The experimental work of the Gestalt theorists and their students on perception, thinking, memory, personality, and social psychology made the Gestalt approach an accepted part of Western psychology by the middle of the twentieth century. During the second half of that century, as was true of the other early schools of psychology, interest in it as a school waned, as psychologists concentrated more on specific circumscribed areas of research rather than on broad, overarching theories. But by late in the century, the utility of the Gestalt approach was once again reemphasized in a wide range of domains, from the psychology of art through psychopathology and social psychology to modern cognitive science and visual neuroscience, as well as education. The days of connectionistic associationism, blind conditioned processes, exclusive concentration on behavior rather than mental events, were over. It is now widely recognized that there are few if any psychological – or physical or neurological – processes that are no more than a mere sum of their constituent elements, and that most natural wholes are in fact dynamic entities in which the parts are not inert but are actually in complex internal interaction with one another – and in which the characteristics of the whole

do indeed determine the nature and structure of its parts. This recognition can in part be attributed to the rigorous and ingenious creativity of Max Wertheimer.

See also: Cognitive Style and Creativity; Insight; Problem Finding; Problem Solving.

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Women and Creativity

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Glossary

Decorative arts Also called crafts or applied art, traditionally refers to decorated functional objects, such as furniture, ceramics, clothing, and glassware. These are usually afforded less status than the fine or high arts.

Faustian bargain The term refers to the legend of Faust in which the title character offers his soul to the devil in exchange for knowledge and worldly pleasures. The term has come to represent any deal that an individual makes to give up something important to satisfy a desire for something else.

Good ole boy networks A slang term for informal networks of men who help each other in professional, social, economic, and political ways, thereby excluding others.

High arts Also known as fine arts, traditionally refers to art that has no function other than esthetic. Although some restrict this term to the visual arts such as painting, sculpture, architecture, photography, and printmaking, more contemporary usages include music, dance, theatre, and literature.

Pen names Also called noms de plume, or pseudonyms, these are invented names which are used by writers to disguise their real identities.

Brief Background and History

In the lists of eminent artists, musicians, writers, scientists, inventors, entrepreneurs, etc. the names of women are in the minority. Why? Are women less creative, or have they just had fewer opportunities and more obstacles to overcome? Women's creative productivity from earliest times belies the contention that women are inherently less creative, but an examination of the obstacles that they have had to overcome to produce publicly recognized creative work gives a good picture of why women's creativity has been limited in certain areas.

From ancient times, women have been involved in creative endeavors, from cave paintings, woven baskets, pottery, and clothing, to songs and poems. In nontechnological cultures, where the arts are an integral part of daily life, women have always been involved alongside men and children in the creation of artifacts that are both useful and decorative. There is evidence that there were women artists, writers, musicians, healers, physical scientists, inventors, and mathematicians in ancient Egypt, Rome, Greece, China, Japan, Mesopotamia, India, and other cultures.

As cultures developed into more complex and hierarchical systems, education became more formalized, and access to education was limited. The production of purely decorative art became something that only people of leisure could pursue. There began to be a separation between art that was purely aesthetic and the decoration of practical objects, with the result that the former was more valued than the latter. For example, during the Middle Ages in Europe, educated women were those in the upper class and nuns; the upper class women usually produced embroidery, and the nuns usually produced biblical illuminations. Lower classes of women continued to decorate their homes and clothing, but these were not valued and preserved as art. Thus, access to education, a privilege of males in many cultures, became a gateway to the more prestigious arts such as literature, music, drama, and visual arts such as

painting and sculpture. Women were more likely to be involved in decorative arts, such as ceramics, glassware, furnishings, and clothing design, which were useful but had lower status.

Societal Norms

In 1982, a comic strip, Frank and Ernest by Bob Thaves, showed the title characters standing in front of a theater poster advertising a Fred Astaire film festival as the female character in the strip told them, "Sure, he was great, but don't forget that Ginger Rogers did everything that *he* did, backwards and in high heels." This comic strip illustrates the concept that women who have reached a level of eminence have had to work harder and be better to achieve than men have.

Because the access, expectations, and opportunities for females have historically been limited in most societies, the few women who have achieved success have done so in spite of great odds. For example, Elizabeth I, arguably the greatest monarch of England, was only allowed to succeed her father to the throne because he failed to produce any legitimate male heirs. Yet her success as a monarch didn't do much for women's rights. Almost 300 years later, Harriet Beecher-Stowe was not allowed to speak on her lecture tour through Great Britain. British culture at the time expected women to limit their public exposure and not speak publicly. Women were allowed to sit in lecture halls if they sat behind wooden lattices in special 'ladies' galleries.' So, Beecher-Stowe sat silently in a gallery and let her husband and son speak for her. Other women had to hide under or behind furniture to listen to lectures. The hardships, trials, and sacrifices that women have had to experience in order to express their talents are many and daunting. Some areas that will be discussed include education, family and peer support, appearance, the demands of motherhood, the gatekeepers, and works falsely credited, not credited, or stolen.

Education

One of the many barriers for women has been the inaccessibility of the education they need to progress in many fields, including the sciences. Only nine women have won Nobel Prizes in science compared to more than three hundred men.

In Europe, most high schools for girls were nonacademic finishing schools until the 1920s. Thus, women were not only prevented from enrolling in universities, they were also denied the educational training to prepare them to enter universities. Mathematician Emmy Noether (1882–1935) was prevented by German law from enrolling at the university, so, like other females who desired a career, she attended a teacher training institute. However, at age 18, she got permission from some professors to audit classes at the local university. Only one of two women auditing classes in a university of a thousand men could not have been comfortable. Eventually, the laws changed, and she was able to enroll for credit. Due, in large part to her ability to work with her father, a mathematics professor, and his mathematician friend, Max Gordan, Noether was able to submit a thesis at age 25 that won her highest honors. However, this did not open the doors for her as it would have for a man. For the next eight years, she taught at the university without pay. As her father's health worsened, she gradually took over his duties. She had to teach, submit articles, and even edit a mathematical journal under pseudonyms. Working without pay was not unusual – Marie Curie also taught at the university level for years without pay. In fact, in the United States, women university professors often taught without pay until the 1950s.

In the United States, in the late 1800s, some major universities established separate facilities for women when it became clear that the pressure to enroll women was increasing. Columbia University, which had allowed women to take examinations but not attend lectures, established Barnard College as a female affiliate institution in 1889. Harvard followed soon after with the opening of Radcliffe in 1894. Other universities avoided admitting women by following suit. The idea of separate but equal, which US courts would later rule is inherently unequal as applied to racial segregation, was allowed to stand for years in regard to the separation of the genders. Thus, females were prevented from studying with the most outstanding researchers, Nobel Prize winners, and leading professors who were being drawn to the more prestigious male institutions. Women university professors taught without pay in the United States until the 1950s.

In other parts of the world, females in third world countries are often denied any education at all; they are also denied adequate food, hospital care, or even life if they are born in some parts of the world to a family that desires a son. Thus, the severity of discrimination around the world ranges from infanticide to unequal pay. The historical unequal access to education has prevented many women from achieving the same levels as men.

Family and Peer Support

In addition to a good education, talented children need the support and dedication of their families to achieve eminence,

especially in certain fields that require early and intense specialized training. Benjamin Bloom and his colleagues studied the development of 120 individuals who achieved world-class status in athletics, the arts, and science. They concluded that the families of these highly talented individuals supported their training, often at great sacrifice to themselves and the rest of the family. These sacrifices include financial commitments and even separating the family so that the talented child can work with the best trainers, coaches, etc. When this happens, there is almost always one child who is supported, and historically, the chosen child has been a male. The benefits to the chosen child of being designated special include both the resources that such a designation brings as well as the psychological boost.

In addition to family support, there is the critical support to nascent creators from friends and colleagues. When those friends and colleagues can promote each others' careers, an important network can be established. In the United States they are called 'Good Old Boy Networks' emphasizing the elements of friendship and maleness of the members. Such networks serve to support and help members professionally, while there is *de facto* exclusion of nonmembers. Much has been made of the opportunities afforded to men who play golf with the boss, belong to male-only social clubs, or take male-only trips because of the opportunities that are discussed in such informal settings. Because women have not traditionally been in places of power, corresponding women-only social networks have not been as helpful. On a more formal level, the opportunities for males to study and work with the most eminent leaders in their fields have undoubtedly given the budding creators both the benefits of their older men's expertise and the value of their social networks. For example, a view of the network of Nobel Prize winners shows that Nobel winners have usually studied with Nobel Prize winners. Women have traditionally been denied access to such training and networks.

Appearance as a Complication

Another complication for women is the emphasis on their looks. The possession of good looks or the lack thereof has a much bigger impact on women's success in various fields than it does for men. This is a complicated situation because although good looks can promote a woman in some areas, they can also be limiting in others.

The global proliferation of blonde jokes demonstrates the ubiquitous nature of the stereotype that beauty and intelligence cannot coexist. Although potentially applicable to both genders, the jokes are almost always about women, and specific to blondes. Common elements of the jokes are a beautiful but dumb woman who is typically promiscuous and misunderstands common sense facts or simple life processes. How such a stereotype affects women's attitudes and opportunities is hard to measure, but there are many examples of beautiful women who are not taken seriously.

For example, Hedy Lamar was considered one of the most beautiful women in the world in the heyday of Hollywood, and her beauty undoubtedly enabled her to become a famous

actress. Yet, her image as a beauty masked her quick mind, as the stereotype of a beautiful woman has often implied that she must also be dumb. Hedy recognized this dichotomy in her oft-quoted statement, "Any girl can be glamorous. All you have to do is stand still and look stupid."

Hedy experienced this stereotype in her youth in Vienna. Hedy's much older first husband was an Austrian munitions manufacturer who did research on control systems. In the years leading up to the Second World War, he and his colleagues frequently discussed this information freely in front of the very young and lovely Hedy believing that she could hardly be interested in or understand such technical discussions. However, Hedy was listening and understanding. Years later, she divorced her husband and moved to Hollywood. When the US went to war with Japan and Germany, she and a musician friend, George Antheil, were determined to do what they could to stop the Nazis. Hedy recalled what she had learned about German weapon systems and combined that knowledge with George's understanding of the workings of a player piano to devise a system to protect US radio-guided torpedoes in the Second World War from being intercepted by the Nazis by frequency hopping. However, the US Naval Department would not take an idea proposed by a beautiful actress and a musician seriously, even when that idea had the support of the newly established National Inventors Council. Hedy was encouraged to support the war effort by selling kisses to promote the sale of war bonds, and she did so very successfully.

Although Lamarr and Antheil patented their idea in 1942, the invention was not used in US military ships until 20 years later, after the patent had expired. However, the value of the invention extends beyond military use and is considered the precursor of other inventions that depend upon spread spectrum technology – things such as traffic signals, cellular phones, pagers, wireless Internet, and the Milstar Defense Satellite.

The Demands of Childbirth and Child Rearing

One of the biggest challenges to creative women is that of balancing the demands of childbirth and child rearing with the demands of creative productivity. Of course, it can be argued that many women have focused their creativity into creating nurturing homes and raising their children, but these efforts are not recognized as public creative achievements, nor do they satisfy the creative drive of some women who aspire to express their creativity in other ways. Kate Chopin wrote of this struggle in the novel *Awakenings*.

So, many women, like Camille Claudel and Mary Cassatt, eschewed child rearing in order to dedicate themselves to their art. Explaining this point of view, Austrian artist Maria Lassnig, explained:

When I was young, I was clever enough to know that if I got married or had children, I would be eaten. I would be sick if I couldn't paint, and I would be schizophrenic because I would have wanted to do both [paint and have a family]. So I renounced it. I don't understand young women who have a big family and want to make art. I don't think it is possible. (Saner, 2008)

Yet, at many times in history and in many cultures the option to remain single has not been available to women. Men have not typically had to make such a choice.

As Sharon Bertsch McGrayne observed in *Nobel Prize Women in Science* about the dilemma for women scientists, "They were expected to remain single, but they needed husbands in order to gain access to research laboratories." Women artists were in no better position to support themselves while single and pursue their art.

Some women, like Sylvia Plath and J. K. Rowling, who have attempted to have both a family and creative career, took time from their sleep to write in the early mornings while their children slept. Such options are not available in all creative endeavors. For example, a 2008 study by Dawn Bennett found that women professional musicians are more likely to teach than perform because of the difficulties of balancing family commitments with a performing schedule. Thus, the term 'Mommy Track' has been coined to explain the career options that many women take to have flexibility in their work schedule or work fewer hours in order to raise their children. Women who take these options usually find that their career options are temporarily or permanently stunted.

Two painters who were sisters, Berthe and Edna Morisot, chose different ways to address the tension between the traditional female role of wife/mother and artist. The sisters studied art and painted together until Edna married and had children, and she no longer had the time and energy to dedicate to painting. However, Edna's letters to her sister revealed that she missed the painting. Perhaps that is why Berthe continued to pursue her art after her marriage and the birth of her children. Also, Berthe was fortunate in that she married a man who had enough wealth and artistic interest, as the brother of the artist Manet, to encourage and enable her to continue to work on her art.

The Gatekeepers

In praising the art of Camille Claudel, art critic Octave Mirbeau declared her, "A revolt against nature: A woman genius." In writing this, he offered her the highest praise and emphasized how rare such talent was assumed to be in women. Indeed, it was rare for women to be featured in art expositions or other creative venues. This was due, in part, to the few women who followed such careers, but it was also due to the limits that were placed on women and their work. Gallery owners, symphony directors, publishers, faculties, corporate boards, journal editors, producers, etc. have controlled not only what work is promoted, but also whose work is promoted. Consequently, even those females who have managed to do great work have not always had the opportunity to disseminate it. So, when possible, many chose to put male names – either real or imaginary – on the work to have it published.

Work Falsely Credited, Not Credited, or Stolen

As in the case of Emmy Noether, work done by women is often credited to a man in order to get published. Some

of Camille Claudel's early sculptures were signed by Rodin. The first woman inventor in the American colonies, Sybilla Masters, invented a method of making cornmeal out of maize and saw her husband awarded the patent by the English courts for the new invention "found out by Sybilla his wife." In some cases, such as that of George Sand, George Eliot, and Isak Dinesen, female writers invented male pen names in order to get published and sell books. In other cases, such as that of scientist Rosalind Franklin, their work was used without credit. In still others, such as the collaborative work of Frieda Robschheit-Robbins and George Hoyt Whipple on the cure for pernicious anemia, only the work of the male was acknowledged; only Whipple was awarded the Nobel Prize for physiology in 1934, although he shared the money with Robschheit-Robbins.

Because for so many years it was difficult for women to have their work accepted, they were willing to have their work credited to real or fictional men, or powerless to prevent it. Even today, some women writers, such as J. K. Rowling, prefer to use initials to publish rather than try publishing under a clearly female name.

The Price

Phyllis Chesler queried in *Letters to a Young Feminist* said:

Some say that Plath, Woolf, and Claudel were 'mad' geniuses who'd have ended up the same sad way even if they'd each been nourished in a woman-loving family and culture. How can such cynics be so sure?

It is certainly hard to predict how things would have been different for female creators if they had been allowed access to education, in societies that expect and encourage female creative productivity, and with families, both through birth and marriage, that nurture and support creative endeavors. The few cases of highly creative productive women have illustrated how they were able to obtain the training they needed in spite of the odds, find at least one supporter, and persist at their work. Yet, even the most successful have found that their success had a price. In the cases of Plath, Woolf, and Claudel, the price may have been sanity, though it is not clear what relationship, if any, their creativity had to their mental problems. Other creative women gave up having a marriage or children, female friends, the approval of their families, the comforts of a supported life, the credit for their work, the respect of their peers, as well as their own health and well-being. Although all choices in life require sacrifices, so many of the sacrifices that creative women have made and continue to make were and are

unnecessary. One could only conjecture how much more beautiful, disease and problem free, and easier to live in our world would be if all creative individuals were allowed to pursue their passion to create.

See also: Mary Cassatt 1844–1926; Mentors.

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Virginia (Stephen) Woolf 1882–1941

Novelist and essayist

Author of *To the Lighthouse*, *The Waves*, and *A Room of One's Own*

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English novelist VIRGINIA WOOLF is acclaimed for her innovations in novelistic structure and for a writing style perhaps best represented by her fifth novel, *To the Lighthouse* (1927). Although Woolf considered her nonfiction efforts secondary to her novels, she was a productive and influential essayist. Her best-known essay, *A Room of One's Own* (1929), argues for financial security and independence as essential to women writers. In the preponderance of her essays, Woolf attempted to detail the English novel as re-formed by stream-of-conscious writers such as herself. Plagued by mental illness from childhood, Woolf ended her own life in 1941.



Virginia Woolf. Used with permission of Frederick R. Koch Collection, The Harvard Theatre Collection, The Houghton Library.

Background

Virginia Stephen (Woolf) was born on January 25, 1882, in Victorian England into an upper middle-class family. Her father, Leslie Stephen, was a distinguished literary figure who developed friendships with many members of the literary elite, such as Thomas Hardy and Henry James, childhood acquaintances of Woolf. Some years later, Woolf was a distinguished member of another group of intellectuals that came to be known as the Bloomsbury Group (named for the district in London to which Woolf and her sister and brothers moved in 1904 after Leslie Stephen's death). The Bloomsbury Group originated when Woolf's older brother invited friends he had made at Cambridge University to the Stephen siblings' residence. Discussions at informal Thursday evening gatherings, which began in 1905, ranged over a number of topics including history, philosophy, art, sexuality, and literature. In addition to Woolf, other well-known members among the original participants in the Bloomsbury Group included Leonard Woolf (her future husband and a novelist, political activist, author of political treatises, editor, and publisher), biographer Lytton Strachey, economist John Maynard Keynes, and novelist E. M. Forster.

To her father's delight, Woolf expressed an interest in becoming a writer during her childhood. Among her first literary efforts was a household newspaper, *The Hyde Park Gate News*, named for the longtime Stephen family residence. This newspaper was a compendium of household events, essays, and Woolf's first fiction efforts, with issues dating from shortly after her ninth birthday until just weeks before her mother's death in early 1895. The passion for writing that began during Woolf's childhood persisted throughout her lifetime. For Woolf, however, writing was a double-edged sword. She characterized writing as a pleasurable, essential, and consuming aspect of her life but, also, as analogous to coal mining, subduing a python, and galloping at fences. Woolf wrote in her diary when she was 39 years old: "I shall never write out all the books I have in my head, because of the strain. The devilish thing about writing is that it calls upon every nerve to hold itself taut" (v. 2, p. 128–129).

The strain of writing that Woolf spoke of was arguably attributable to the task she set herself. Almost without exception, the novels of her contemporaries continued in the realistic/materialistic style of Charles Dickens and Jane Austen—relying on descriptions of what characters said, did, and wore as primary components. In "The Art of Fiction," written the same year as *To the Lighthouse*, Woolf hoped English novelists would "cut adrift from the eternal tea-table and the plausible and preposterous formulas which are supposed to represent the whole of our human adventure. . . . Then the novel . . . might become a work of art" (p. 112).

The novel Woolf envisioned would chart the mental as well as the material lives of the characters. As early as 1908, Woolf recorded in her early journals (published as *A Passionate Apprentice: The Early Journals, 1897–1909*) the intent that her writing reflect "all the traces of the mind's passage through the world and achieve . . . some kind of whole made of shivering fragments" (p. 393). And in "Modern Fiction," Woolf wrote:

Life is not a series of gig lamps symmetrically arranged; but a luminous halo, a semi-transparent envelope surrounding us from the beginning of consciousness to the end. Is it not the task of the novelist to convey this varying, this unknown, this uncircumscribed spirit, whatever aberration and complexity it may display, with as little mixture of the alien and external as possible? (pp. 154).

Although it was clear to Woolf that the prevalent realistic novel was inadequate, it was, as yet, unclear what novelistic forms might accommodate her new kind of novel and how the English language might be stretched to capture the dynamics of mental processes. Whereas Woolf admired Dorothy Richardson's and James Joyce's efforts to expand the novel to include the workings of the mind, she felt the novels of

these authors were limited in that each provided access to the uncontradicted psychology of a single character. Eventually Woolf constructed stream-of-consciousness novels that embodied a shifting chorus of consciousnesses so the reader knows what the characters think of the unfolding events and each other.

She married Leonard Woolf on August 10, 1912. Throughout their 29-year marriage, Leonard was meticulously solicitous of Woolf's health and acted as her editor and sole prepublication critic. He also collaborated with Woolf in the 1917 establishment of the Hogarth Press (named for Hogarth House where the Woolfs resided from 1915 to 1924). The Woolfs' primary intentions were that the press would free Woolf's efforts to re-form the novel from being subject to the approval of established, often conservative, publishers and publish works of literary merit that other publishers declined. The press succeeded in both respects. In England, Woolf's short stories, essays, her third and following novels, and the second and later editions of her first two novels all appeared with the Hogarth Press as publisher. Further, the press published Katherine Mansfield's short story "Prelude," short fiction and nonfiction works by E. M. Forster, the poetry of Robert Graves and Herbert Read, was the first publisher in England of "The Waste Land" and other poems by T. S. Eliot, and was the sole English publisher of all but one of Sigmund Freud's works from 1920 to 1938. The Hogarth Press was also intended to provide Woolf with therapeutic work to fend off or assist her recovery from mental collapse.

Woolf suffered a number of nervous breakdowns, which included alternating periods of debilitating depression and mania with accompanying suicide attempts, violence toward family members and nurses, and hallucinations. It is likely that she suffered from bipolar disorder (manic depression). Woolf's first bout of what she referred to as madness occurred shortly after her mother's death. This and Woolf's subsequent breakdowns, including one shortly after her marriage, were often followed by extended periods of convalescence, with Woolf estimating that she had lost five years of her life to insanity. Woolf's letters to her husband and sister before her suicide indicate she was fearful of impending insanity, from which she might not recover. She committed suicide by drowning herself (having forced a large stone into her coat pocket) in the river near the Woolfs' country home on March 28, 1941.

Woolf's writing legacy includes 10 novels, numerous short stories, a play, a biography, and several volumes of essays. Woolf's first publication—an unsigned review published several days before her 23rd birthday—followed a lengthy writing apprenticeship. Her last novel was completed 1 month before her death (and published posthumously).

The Writing Apprenticeship

From childhood, Woolf engaged in a self-assigned writing apprenticeship. Her surviving diaries and correspondence document her writing ambitions, practices, and developing philosophy of literature, and they chart the progress of this apprenticeship. Woolf's intent was that her diaries be a place to practice her craft and collect observations she might

incorporate in her fiction. A July 30, 1903, entry—which preceded her first publication by several months—recorded her intent that her early journals

serve for a sketch book; as an artist fills his pages with scraps and fragments . . . so I take up my pen and trace here whatever shapes I happen to have in my head. It is an exercise—training for hand and eye (pp. 186–187).

Woolf continued to use her diaries to practice her craft, writing on April 20, 1919, by which time she was a well-known essayist and had finished her second novel, that she believed "the habit of writing . . . for my eye only is good practice. It loosens the ligaments" (v. 1, p. 266). In the same entry, Woolf identified her diaries as a receptacle for observations to be used in her fiction; these volumes were

to resemble some deep old desk or capacious hold-all, in which one flings a mass of odds and ends. . . . I should like to come back . . . and find that the collection had sorted itself and refined itself and coalesced . . . into a mold transparent enough to reflect the light of life and yet steady, tranquil, composed, with the aloofness of a work of art (v. 1, p. 266).

Woolf's writing apprenticeship included a reading program. As was customary for girls of her socioeconomic class, Woolf had little formal education; but she did have access to her father's vast library. Leslie Stephen was enthusiastic about sharing his books with the daughter who would be a writer; although by the time Woolf was 15, her father expressed concern regarding the volume of his daughter's reading. Notations in her early journals indicate that, during a 6-month period, the 15-year old Woolf read 59 volumes of biographies, novels, history, and essays. Woolf regularly tested her ability to grasp the contents of her reading in discussions with her father and, later, with fellow members of the Bloomsbury Group. Clearly, Woolf placed a high value on extracting the essences of the books she read. In a 1926 lecture at a girls' school, published in 1932 as "How Should One Read a Book?," she stated:

To receive impressions with the utmost understanding is only half the process of reading. . . . We must pass judgment upon these multitudinous impressions; we must make of those fleeting shapes one that is hard and lasting. . . . Continue reading without the book before you. . . . Hold one shadow-shape against another. . . . Read widely enough and with enough understanding to make such comparisons alive and illuminating (pp. 241–242).

As with her diaries and writing, Woolf recognized a connection between her reading program and writing ability. For Woolf, reading enabled familiarity with the possibilities and peculiarities of the English language and an understanding of the relation between author and readers.

Eventually, Woolf's writing ability, her commitment to reading critically, and an acquaintanceship with a journal editor led to her first publication; an unsigned review in the December 14, 1904, issue of *The Guardian*. Woolf's excitement at subsequently becoming a regular contributor to several literary journals quickly gave way to disillusionment. She came to see assigned essays as failing to challenge her intellectually and as taking time away from novel writing. However, she continued to critique what she read informally in her diaries and

correspondence and to publish occasional reviews. Woolf also retained a lifelong interest in writing essays for which she could pick the topics, a concession many editors were eventually willing to make, in light of her growing fame as a novelist and critic.

A final aspect of Woolf's writing apprenticeship is her short stories, which she referred to as sketches—akin to the sketches prepared by an artist contemplating a complex painting or the pilot studies of a scientist. While completing her first two novels, *The Voyage Out* (1915) and *Night and Day* (1919), which were primarily materialistic in style, Woolf wrote a number of sketches experimenting with the lyric and essayistic limits of English and the employment of alternative perspectives and revised plot forms. Woolf envisioned her third novel, *Jacob's Room* (1922), as an extension of the techniques and forms developed in three of these sketches. The writing experiments continued; in a July 30, 1925, diary entry, just prior to beginning to write *To the Lighthouse*, Woolf recollected: "My summer's wanderings with the pen have . . . shown me one or two new dodges for catching my flies. I have sat here like an improviser with his hands rambling over the piano" (v. 3, p. 37).

The Writing of *To the Lighthouse*

For Woolf, novels frequently originated with a scene. She wrote in "A Sketch of the Past" that

Scenes . . . are not altogether a literary device—a means of summing up and making a knot out of innumerable little threads. . . . A scene always comes to the top; arranged; representative. This confirms me in my instinctive notion . . . that we are sealed vessels afloat upon what it is convenient to call reality; at some moments, without any reason, without an effort, the sealing matter cracks; in floods reality; that is a scene . . . I almost always have to find a scene; either when I am writing about a person . . . or when I am writing about a book (p. 142).

Woolf would later write in "A Sketch of the Past" that the idea for *To the Lighthouse* came

in a great, apparently involuntary, rush. One thing burst into another. Blowing bubbles out of a pipe gives the feeling of the rapid crowd of ideas and scenes which blew out of my mind, so that my lips seemed syllabbling of their own accord as I walked (p. 81).

On May 14, 1925, Woolf recorded in her diary the scene from which this novel emerged:

This is going to be fairly short, to have father's character done complete in it, and mother's, and St. Ives, and childhood. . . . But the center is father's character, sitting in a boat, reciting "We perished, each alone," while he crushes a dying mackerel (v. 3, pp. 18–19).

Once one has gotten hold of the scene that is the germ for a work of art, "one must hold the scene . . . in a vise and let nothing come in and spoil it" says the painter who is a character in *To the Lighthouse* (p. 201). The next step for Woolf was to devise a novelistic form appropriate to the germinal scene, a form that would not spoil it.

To the Lighthouse is the story of the Ramsay family at their summer home—not unlike St. Ives where the Stephen family summered until the death of Woolf's mother. Mr. and Mrs. Ramsay are modeled on Woolf's parents. Among the Ramsay's

guests are a painter named Lily Briscoe. There are two parallel stories in this novel: the first about a postponed boat trip to the lighthouse and the second about Lily's struggle with the composition of an abstract painting.

The form of *To the Lighthouse* is a three-part structure, which Woolf depicted schematically in her notebook as two rectangles joined by a narrow passageway. Per Woolf's July 20, 1925, diary entry, this novel was to be about a

father and mother and child in the garden, the death, the sail to the lighthouse. . . . When I begin it I shall enrich it in all sorts of ways, thicken it, give it branches and roots which I do not perceive now. . . . I conceive the book in three parts: 1. at the drawing room window; 2. seven years passed; 3. the voyage (v. 3, p. 36).

The first part of the finished novel, "The Window," records the happenings in and around the Ramsay's summer home. The next day's trip to the lighthouse is canceled because Mr. Ramsay anticipates poor weather; Lily is unable to solve the problems of her painting of Mrs. Ramsay. The second, passageway, part of the novel, "Time Passes," records the passage of 10 years during which Mrs. Ramsay dies. In the third and last part, "The Lighthouse," Mr. Ramsay and his children return to their summer home and Lily Briscoe is again a guest. The trip to the lighthouse finally takes place—with Mr. Ramsay reciting poetry while piloting the boat; meanwhile, Lily Briscoe resumes work on the unfinished abstract painting she abandoned 10 years earlier. The novel ends as the expedition reaches the lighthouse and Lily is able to successfully resolve the problems of her painting.

Once Woolf had settled on the form of her novel, she shifted her attention to its microstructure. For example, Woolf intended that the rhythms of the sea be heard throughout this novel. In *To the Lighthouse: The Original Holograph Draft*, Susan Dick indicated that Woolf began each writing session by rereading what she had written to refresh her memory and "help start a particular rhythm in her mind" (p. 14). Woolf may have also read *To the Lighthouse* aloud to ensure it had the right sound. In *Recollections of Virginia Woolf*, a cook hired by the Woolfs in 1934 recalled hearing Woolf talking to herself while taking a bath:

When Mr. Woolf saw that I looked startled he told me that Mrs. Woolf always said the sentences out loud that she had written during the night. She needed to know if they sounded right and the bath [room] was a good, resonant place for trying them out. He was so used to hearing her talk to herself in this way that he did not notice it at all (pp. 155–156).

In *To the Lighthouse* and her other experimental novels, Woolf intended that the words she wrote carry meaning and convey atmosphere (e.g., the ever present sound of the sea) and the moods of the characters. The writing of a provisional draft of *To the Lighthouse* was accomplished between the latter part of 1925 and the fall of 1926. The commitment of the constructed novel to paper initially progressed rapidly. On February 23, 1926, Woolf recorded in her diary:

At last, at last, after the battle of *Jacob's Room*, that agony—all agony but the end—*Mrs. Dalloway*, I am now writing as fast and freely as I have written in the whole of my life, more so—20 times more so—than any novel yet (v. 3, p. 59).

Perhaps Woolf's ease in writing his novel can be explained. Although she claimed she had to solve the problems of *Jacob's Room* (1922) as she wrote it—because she was initially unsure of her destination—and hoped to plan *Mrs. Dalloway* (1925) more thoroughly, *To the Lighthouse* (1927) was outlined in detail some time before she began to record it. On June 14, 1925, several weeks before she wrote the first words of this novel, Woolf commented on how extensively she had already planned it, fearing she had “thought [it] out perhaps too clearly” (v. 3, p. 29). Curiously, it appears Woolf devoted not less but increasingly more effort to the prewriting planning of each successive experimental novel.

By September 5, 1926, Woolf worried in a diary entry that *To the Lighthouse* might “run too fast and free, and so be rather thin” (v. 3, p. 106). Eight days later on September 13, 1926, Woolf's diary indicated:

This is the greatest stretch I've put my method to, and I think it holds. By this I mean that I have been dredging up more feelings and character. . . . But . . . until I look at my haul this is only my feeling in process (v. 3, p. 109).

Three days later, on September 16, 1926, the first draft was completed. Now the questions regarding the quality of her “haul” that had crept into preceding diary entries became paramount during revision and rewriting.

Earlier, while working on her previous novel, *Mrs. Dalloway*, Woolf had described revising in her diary as “the duller part of the whole business of writing, the most depressing and exacting” (v. 2, p. 4). Although she had written *To the Lighthouse* relatively quickly, its revision presented some difficulty. On November 23, 1926, Woolf's diary indicated:

I am re-doing six pages of *To the Lighthouse* daily. This is not, I think, so quick as *Mrs. Dalloway*; but then I find much of it very sketchy and have to improvise on the typewriter. . . . My present opinion is that it is easily the best of my books (pp. 117–118).

Leonard Woolf read the revised version on January 23, 1927, and pronounced it a masterpiece; Woolf then completed her revisions in March of 1927. The publication of *To the Lighthouse* on May 5, 1927, did not represent an end to Woolf's writing experimentation but, rather, the beginning of a whole new series of experiments that culminated in what is perhaps Woolf's most innovative, although not universally critically accepted, novel, *The Waves* (1931). Later she attempted a novel-essay, which was eventually separated into a novel, *The Years* (1937), and a book-length essay, *Three Guineas* (1938).

The development of *To the Lighthouse* was guided by the intuition of a scene. On the heels of this “aha” experience followed a series of incremental discoveries. First, Woolf constructed an appropriate novelistic form. The constructed form was then used to constrain the selection of language to delineate aspects of the scene. Ultimately, the process of revision, a meticulous reconsideration of the multiple problem solutions that constituted earlier drafts of *To the Lighthouse*, served as a final constraint—the last tightening of germinal scene, novelistic form, and language, to ensure integrity of fit. Her creativity encompassed the large moment of the seemingly instantaneous appearance of a unifying scene as well as the innumerable small moments of incrementally evaluating and constructing nested constraints of this scene.

Woolf's novels clearly benefited from the conscious refinement of her writing, reading, and critical skills. Her writing practices indicate that she never completely relinquished her status as an apprentice; she continued to read extensively, challenge her ability to critically evaluate what she read, and practice writing. Woolf's creativity resulted from the interaction of large and small discoveries—a blending of emergent scenes, purposefully developed writing craftsmanship, and novelistic forms developed via experimentation—against the backdrop of an enduring passion for her art and a longstanding ambition to re-form the novel to capture the dynamics of mental life.

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William Wordsworth 1770–1850

Poet

Author of *The Prelude*, *Lyrical Ballads* (co-published with Samuel Taylor Coleridge), and *The Excursion*

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WILLIAM WORDSWORTH, *English Lake poet, is revered as a major literary figure and early leader of Romanticism. Ranked with Shakespeare and Milton by Coleridge and later by Matthew Arnold, Wordsworth's radical self-consciousness, intense naturalism, interest in the lives and speech of common people, and strong sense of poetic vocation transformed the subsequent development of poetry and poetics. Remembered today as the supreme nature poet, Wordsworth was also a poet, as Keats observed, of human suffering who could "think into the human heart." He was vitally interested in the development of the imagination. As he wrote in his autobiographical masterpiece, The Prelude, "the mind of man" is "the main region of my song."*



Portrait of William Wordsworth, 1806. Used with permission from The Wordsworth Trust, Dove Cottage.

Background

Wordsworth was born April 7, 1770, in Cockermouth, a village in the English Lake District, an area whose "craggs, and forest glooms, and opening lakes" inspired in him a deep love for nature. He was the second child of five born to Ann and John Wordsworth who both died by the time that he was 13 years old. After a period of formal education at Cockermouth, Hawkshead, and Cambridge (St. John's College), youthful walking tours on the Continent, and a sojourn in France during the French Revolution that included a love affair resulting in the birth of an illegitimate French daughter, most of his life was spent in his beloved Lake District in the company of his extraordinary sister Dorothy and his exemplary wife Mary and their children.

Although it is probably often the case that a creative person's quality of productivity is uneven, with periods of

breakthroughs and exceptional generativity interspersed with dryer, less productive periods, in Wordsworth's case a decline in the quality of the poetry written in his later years has received much critical comment. His early work and youthful democratic zeal have met with much greater contemporary critical approval, whereas the more conservative political views of his mature years have been viewed by some as something approaching a moral lapse. Certainly the poetic creativity of his youth was stunning, and to some extent the mature Wordsworth is doomed by comparison with the romantic figure of the poet as a young man, engaged by the French Revolution, alienated from his unimaginative, stodgy relatives, and in deep passionate communion with nature and sensory experience.

Readers and critics alike today may find it harder to admire the mature Wordsworth, worried about the financial responsibility of a large household, imposing upon his children his ideas of what they should do with their lives, and reshaping his poems to be more orthodox. It is ironic that though today Wordsworth's later work is not critically celebrated, in his own time his reputation as a poet increased as he aged. DeQuincy wrote, "Up to 1820 the name of Wordsworth was trampled under foot; from 1820 to 1830 it was militant; from 1830 to 1835 it has been triumphant."

Wordsworth experienced a period of exceptional poetic productivity from 1798 to 1808, including the *annis mirabilis* (1798), in which he and Coleridge published *Lyrical Ballads*, a volume of historic literary significance opening with Coleridge's "Ancient Mariner," and closing with Wordsworth's "Tintern Abbey." In 1800 he published the second edition of *Lyrical Ballads*, including his famous "Preface" in which he defined poetry as "the spontaneous overflow of powerful feelings: it takes its origin from emotion recollected in tranquillity" and argued that poetry should be written in "the real language of men."

Wordsworth's poetry was roundly condemned by the critics for its "low" subject matter and language. Francis Jeffrey, a highly influential critic writing in the *Edinburgh Review*, severely attacked Wordsworth's radical poetic departure and, in response to the 1814 publication of *The Excursion*, issued his famous dismissal, "This will never do." Wordsworth's poetry was also the target of satire. In 1808 *The Simpliciad: A Satirico-didactic Poem* offered "Hints for the Scholars of the New School." *The British Critic* referred to *The Simpliciad* and pronounced this judgment on *Poems, in Two Volumes*: "such flimsy, puerile thoughts, expressed in such feeble and halting verse, we have seldom seen." Wordsworth's task was difficult indeed for he had to create the audience for his poetry of, in the words of the preeminent Wordsworth biographer, Stephen Gill, "the familiar, the homely, and the unregarded."

Intimacy, Sorrow, and Creative Work

Close associations and intimate friendships were important throughout Wordsworth's life although he expressed reticence in making new acquaintances. The early deaths of their parents influenced the close bonds between Wordsworth and his four siblings. Upon their mother's death Dorothy was sent to live with her mother's cousin, Elizabeth Threlkeld, and she did not see her brother William again for 9 years.

When they were reunited in young adulthood, William and Dorothy Wordsworth shared a brother-sister intimacy of unique complexity and passionate devotion. He called her "My hope, my joy, my sister, and my friend,/Or something dearer still, if reason knows/a dearer thought, or in the heart of love/There be a dearer name." She refers to him in her journal as "my Beloved" and "my darling." Wordsworth grounded his being and his creative work in the loving domestic community that he and Dorothy, and later Mary Hutchinson, his wife, established. In addition to the emotional support offered by his circle, Wordsworth also found a group of ready helpmates to transcribe his poetry and offer useful criticism. Of fundamental importance to his creative work was their belief in his calling as a poet.

Wordsworth's friendship with the poet Coleridge was among the most important relationships of his life and was central to the development of both poets' creativity. Coleridge described the bond that he felt with William and Dorothy Wordsworth in 1798 as "three persons and one soul." In 1810 Wordsworth became estranged from Coleridge, and although there was a reconciliation of sorts, their intimacy never regained its previous intensity or level of trust. Coleridge thereafter referred to the break in the friendship as one of the greatest sorrows of his life.

Though Wordsworth was blessed with a devoted circle of friends and family, his adult life was not without pain and loss. His brother John's death in 1805 in a shipwreck came as a serious blow. Almost 40 years later Wordsworth's grief over the loss of his brother was still powerfully evident in the 1842 volume, *Elegiac Verses: In Memory of My Brother, John Wordsworth*. In a period of 6 months in 1812, two of Wordsworth's children died: Catherine, aged 3 years, and Thomas, aged 6 years. Wordsworth grieved the loss of his children intensely, expressing his feelings about Catherine, whom he called his "heart's best treasure," in the sonnet, "Surprised by Joy." In the 1812 revisions of *The Excursion*, Wordsworth drew on his own losses to incorporate themes of pain, disillusion, and fear into the character of the Solitary.

Following the deaths of the two children, the Wordsworth household moved to Rydal Mount and rebuilt their domestic security. In the last 20 years of Wordsworth's life, however, the haven of personal stability that had been so important for his productivity was shaken to its roots. Beginning in 1829 his sister Dorothy suffered a series of physical and mental breakdowns, requiring long periods of bed rest and nursing. She developed a dependency on opium and displayed senile dementia resembling Alzheimer's disease. She was nursed at home during her quarter-century decline, which dramatically altered the normal social life of the household that had been so precious to them all.

Dorothy outlived Wordsworth, dying in 1855. Ironically, at the time that public acclaim for his poetry was increasing, the

people who had supported his creative work, and served as the sources of his personal stability and strength, began to die. In the last years of his life, Wordsworth was deeply affected by the series of deaths of family members and friends, including the deaths of Mary Wordsworth's sisters, Sara Hutchinson (1835) and Joanna Hutchinson (1843); Edward Wordsworth, a 5-year-old grandson (1845); Christopher Wordsworth, his brother (1846); John Wordsworth, his nephew (1846); Dora Wordsworth Quillinan, Wordsworth's beloved daughter who had married against his wishes (1847); and Hartley Coleridge (1849) to whom he demonstrated a lifelong fatherly protection.

Fiscal Survival in the Life of the Poet

Wordsworth struggled to survive financially through much of his life. When their father died, the Wordsworth children had been unable to collect a sizable claim for funds that their father had spent conducting the affairs of his employer, Lord James Lonsdale. Eighteen years of economic dependency on rather unsympathetic relatives elapsed before the claim was settled at the death of Lord Lonsdale.

Modest economic help came to Wordsworth early in his career through an inheritance from Raisley Calvert, whom Wordsworth had nursed until he died from tuberculosis. In *The Prelude* Wordsworth recognized Calvert, along with Dorothy and Coleridge, as having enabled him to realize his destiny as a poet. His financial position finally changed in 1813 when he acquired the position of distributor of stamps, leading Browning to lament, "Just for a handful of silver he left us." He held that position until 1842 when he was given a civil list pension.

Wordsworth's Accomplishments

The Organization of Poetic Purpose

The creativity theorist Gruber has suggested that each creative person has particular conceptions of his or her life tasks. This network of enterprise constitutes the person's organization of purpose, defines the working self, and provides a structure that organizes a complex life. Wordsworth had a highly individualized sense of vocation as a poet that he described in *The Prelude*. In the context of his intimate friendships, especially that with Coleridge, he elaborated a plan that occupied his creative efforts for decades. One of the difficulties of his creative life was that his friend Coleridge had aspirations for Wordsworth to be a philosophical poet when his true gifts and vision lay elsewhere. Plans for *The Recluse* were not abandoned until 1838, several years after Coleridge's death. Another difficulty of his poetic career was that for a considerable part of it he did not seek to publish his major poems, which were being revised in manuscript. Hence he faced the dilemma of privately feeling a strong sense of poetic vocation without an accompanying public recognition of that identity. He had started writing verses as early as 1786 about his "thoughts and images" of the Lake District scenery in which he was raised. While a freshman at Cambridge University he composed a large part of the *An Evening Walk*, completing it in 1789. In 1790 he took a walking tour with his Cambridge friend Robert Jones in France and Switzerland, which is celebrated in *Descriptive Sketches*. In January 1791 Wordsworth

took his B.A. degree and went to France, ostensibly to spend a year learning French. During his sojourn in France he wrote much of *Descriptive Sketches*, which was published with *An Evening Walk* in February, 1793, the same month in which England declared war on France.

Wordsworth experienced a deep sense of alienation from his own country and was at a loss to plan his personal future during this period. Complicating his personal outlook was his inability to return to France where Annette Vallon had given birth to his child. In the autumn of 1793, he began work on *Guilt and Sorrow*, his first considerable poetic project. Finished in 1794, a part of it, under the title of *The Female Vagrant*, was printed in the *Lyrical Ballads* in 1798. A revised form was published in 1842. He was occupied with *The Borderers: A Tragedy* in 1795 and 1796. In 1795 he and his sister Dorothy settled at Racedown where Wordsworth began *Margaret, or The Ruined Cottage*, finishing the work at Alfoxden where the Wordsworths moved in 1797 to be near Coleridge at Nether Stowey. In *The Prelude* Wordsworth describes the healing influence of his sister and Coleridge during this period. Following the September, 1798, publication of the *Lyrical Ballads*, in one of the coldest winters of the 18th century, the Wordsworths spent several lonely months in a provincial town in Germany where he began writing what would later become his great autobiographical poem, *The Prelude*. Far from his beloved English Lake District, he deeply examined the memories of his childhood and took the first tentative steps in a major literary enterprise that would occupy him at intervals for close to 40 years.

In October 1799 he settled in Grasmere and was a permanent resident of the region for the rest of his life, leaving only for an occasional trip to Scotland, London, or the Continent. In 1800 he added a preface to the second edition of *Lyrical Ballads*, and a second volume of poems, including some of his finest works. A third and fourth edition appeared respectively in 1802 and 1805. In 1804 he married his childhood friend Mary Hutchinson. In 1807 he published the *Poems in Two Volumes*, including the "Ode to Duty" and the "Ode on Intimations of Immortality." These volumes established Wordsworth as a great innovator of poetic form. Indeed, by 1807 arguably much of his greatest work had been completed, including the volumes of 1800 and 1807, *The Prelude*, the *Recluse* fragment, and *Margaret, or the Ruined Cottage*.

An account of Wordsworth's oeuvre is complicated by his habits of revision, often extending over decades, and his rearranging poems for publication. *The Excursion* was published in 1814, followed in 1815 by the first collected edition of his works and *The White Doe of Rylstone*. Five years elapsed before the series of his later works began to be published, including *The River Duddon* and *Miscellaneous Poems* (1820), *Ecclesiastical Sketches* (1822), and *Evening Voluntaries* (1835).

The Poet Writing Prose

Although Wordsworth is remembered primarily as a poet concerned with the human relationship to nature, he also wrote at least two prose works of continuing general interest, "Preface to *Lyrical Ballads*," his statement of poetics, and "A Guide through the District of the Lakes," his tourist handbook to the landscape of his native region. His political writings

include "A Letter to the Bishop of Llandaff," written in 1793 but not published until 1876, *The Convention of Cintra* (1809), and *Two Addresses to the Freeholders of Westmoreland* (1818). Although *The Convention of Cintra* has been criticized as a reactionary nationalistic rejection of Wordsworth's youthful embrace of revolutionary radicalism, the essay is grounded in Wordsworth's view of the potential of human nature and the human heart. Statesmen, he asserted, living in their isolation and artificial world, lack vital knowledge, "a knowledge of human kind." Although Wordsworth's essay had no significant impact on subsequent political decision making or public opinion, and 178 of the 500 copies printed were sold as waste paper, writing the essay provided focus for ideas to be expressed in *The Ruined Cottage*, later a part of *The Excursion*.

Constructive Repetition and Revision

Constructive repetition is a fundamental process in creative work. As Bernstein wrote in *The Unanswered Question*, "the repetitive principle is at the very source of musical art (and of poetry)." Repeated contact with ideas, images, or sounds may enable a creator to discover new meanings and to reorganize and modify previously formulated views or expressions. Revision may be understood in this sense to be one form of constructive repetition. Writers may differ as to the value that they place on revision in their work process. For many creators, the patience, discipline, and willingness to put time and energy into reworking a creative product are crucial for the accomplishment of their creative goals. By the same token, compulsive revision may become counterproductive in creative work.

Wordsworth was internally driven to revise. Gill has suggested that Wordsworth found the idea of finality unbearable. For Wordsworth to republish a poem without first subjecting it to revision was to him unthinkable. Moreover, multiple fair copies had to be produced as Wordsworth continued to cross out, substitute words and phrases, and interline even as the printing process commenced. One marvels at the patience of Dorothy, Mary, and his daughter Dora who frequently served as his transcribers. Even his son-in-law, Edward Quillinan, was enlisted on occasion as scribe and recorded in his diary his disappointment that "helping Mr. W. to tinker" prevented his partridge shooting. In addition, intense revision put Wordsworth out of sorts and made him irritable and unwell. In an 1840 letter from Salzburg to his wife, he apologized to his "inestimable fellow-labourer" for his irritable state caused by "overstrained labor."

Revision and Elaboration: Microanalysis

Composing is a process that requires, as Vera John-Steiner in *Notebooks of the Mind* has suggested, an ability to synthesize germinal ideas with elaborative structures. The record of Wordsworth's worksheets reflects a work process in which constant revision takes place as the poem is created.

The earliest drafts for *The Prelude* may serve as an example of this process. Unpublished during the poet's life, *The Prelude* took the form of three major versions. The 1799 *Prelude* is the

first version. Twenty-four pages of drafts toward Part I of the 1799 *Prelude* are found in a notebook, MS JJ, dating from Wordsworth's trip to Germany. A rich source of information concerning the process of poetic creativity, these drafts are the record of the birth process of a poetic masterpiece.

The 24 pages of drafts contain approximately 420 lines. Only about 26 lines were not later used in the 1799 *Prelude*, for a later version of *The Prelude*, or for some other poem. Wordsworth displayed a frugality with his poetic creation, and apparently found it difficult to discard lines. About 140 lines of Part I first appear in MS JJ, and are included unchanged in the 1799 version. The Gestalt of Part I of the 1799 *Prelude* emerged in the MS JJ worksheets. Lines composed early in the MS JJ drafts serve as the opening of 1799 *Prelude*, and lines composed toward the end of the drafts became the conclusion of Part I. There are over a hundred revisions in these 24 pages of drafting, mostly instances in which Wordsworth substituted a word, phrase, or line for another. Rarely did he delete material without replacing it. The 24 pages each vary markedly in the number of revisions that they contain, ranging from 12 to none with an average of about four revisions per page. The number of revisions per page declined as composition proceeded, reflecting an interaction between the poet and his poem. The growing structure of the poem both guided his composition and limited his alternatives.

The MS JJ drafts had been completed in Goslar, Germany, during the winter of 1798–1799. After these drafts were written, the Wordsworths left Goslar, travelling for a period in Germany before returning to England in early May. At Sockburn, the home of Mary Hutchinson who would later marry Wordsworth, Wordsworth began writing again. By the end of 1799, approximately a year after the first MS JJ drafts were composed, Wordsworth completed the two-part *Prelude*. Gill has offered an account of revisions in other Wordsworth poems, including most of the poems in later editions of the *Lyrical Ballads* and *The Female Vagrant*. Wordsworth changed single words, phrases, and occasionally wrote lines as well as moving stanzas around. He also changed the titles of poems on occasion. Characteristic of Wordsworth's style of revision was a blindness to scale of revision, treating all revision as important.

Poems as Living Presences

Writing poetry is a way of thinking. The thinker as poet may revise a previously written poem as his or her thinking changes about an idea or image or experience. In the process of writing, a dialogue between the thinker and his or her written words, as Bruner has described it, may develop. Wordsworth had this kind of relationship, in a sense, a conversation, with his poetic creations. He treated his poems, as Gill has pointed out, not as discrete objects, but rather as "living presences" of a mind that registered its evolution not only in the creation of new work but in the transformation of old work. Although the subtitle of *The Prelude* was "Growth of a Poet's Mind," the true record of the development of Wordsworth's mind is in the revisions that he made in his poems throughout his long life.

The Final Years

In 1843 Wordsworth succeeded Southey as poet laureate at a time in his life when he had, ironically, for the most part stopped writing poetry. In the early 1840s he became an increasingly pious man, identifying himself as a Christian poet, and revising *The Excursion* of 1845 to be an explicitly Christian poem. Preparation of the 1845 volume constituted Wordsworth's last major poetical effort.

To a degree troublesome to Mary Wordsworth who complained of the American visitors, Rydal Mount became a shrine for those seeking the venerable sage, and the tourists came in droves. He continued his lifelong habit of walking, even crossing the Malvern Hill twice in the last year of his life. In his final illness, pleurisy, he was bedridden for a month. In pain and with trouble breathing, he suffered at the last until he died at noon on April 23, 1850.

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Wilbur Wright 1867–1912 and Orville Wright 1871–1948

Inventors

Inventors of the first successful powered airplane

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WILBUR AND ORVILLE WRIGHT placed their names firmly in the pantheon of great American inventors with their creation of the world's first successful, powered, heavier-than-air flying machine. The airplane they designed and built in Dayton, Ohio, and flew at Kitty Hawk, North Carolina, on December 17, 1903, inaugurated the aerial age, one of the defining characteristics of 20th century. The Wrights began serious experimentation in aeronautics in 1899 and perfected their craft by 1905. In this short period, with remarkable originality, they defined the essential elements of the problem, conceived creative technical solutions, and built practical mechanical design tools and components that resulted in a viable aircraft. They did much more than simply coax a machine off the ground. They established the fundamental principles of aircraft design that are still in place today. In 1908, they demonstrated their invention publicly in the United States and Europe and became instant international celebrities. By 1910 the Wright Company was manufacturing airplanes for sale and the brothers were on their way to becoming wealthy men. Despite the Wrights' dramatic leap ahead of the rest of the aeronautical community, contemporary experimenters and would-be aviators quickly caught up to the brothers and surpassed their designs. Nevertheless, it was Wilbur and Orville Wright who made the pivotal breakthrough after countless others had failed, and they did so virtually alone. Transport by air of material and people, quickly over great distances, and the military applications of flight technology have had an incalculable economic, geopolitical, and cultural impact all over the globe. The Wright brothers' invention not only solved a longstudied technical problem, but it helped create a new world.

Background

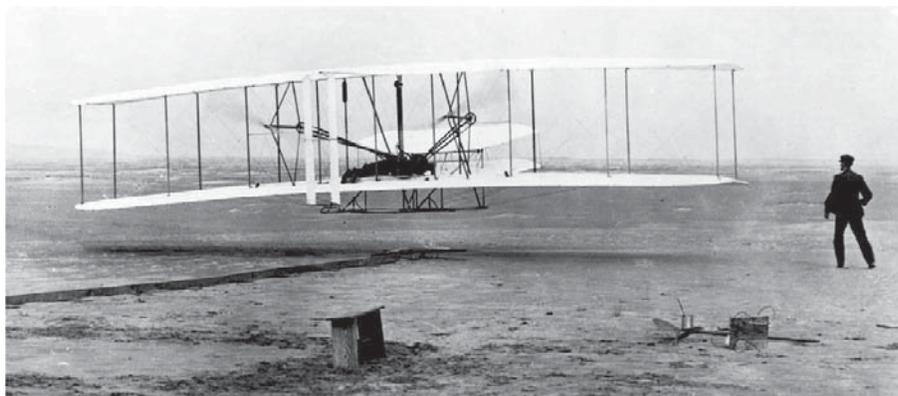
The Wright brothers were the product of deep midwestern American roots. Several generations on both sides of the family

had been early settlers on the Ohio and Indiana frontier. Their father, Milton Wright, was an itinerant minister, a bishop in the Church of the United Brethren in Christ. His calling would take the family to numerous church posts throughout the region.

Milton's wife, Susan, already a member of the United Brethren when they met, was a bright, shy, capable woman. She had studied literature at Hartsville College, though she left 3 months short of graduation. She also possessed considerable mechanical aptitude, a trait passed on to her sons. After a long courtship and lengthy separations due to Milton's missionary travels, he and Susan were married in 1859 to begin a Christian life devoted to the Church. Wilbur and Orville were two of five surviving children borne by Susan Wright. Two older brothers, Reuchlin and Lorin, arrived in 1861 and 1862. Wilbur was next, born on April 16, 1867, near Millville, Indiana. After giving birth to a set of twins that died in infancy, Susan delivered another healthy son, Orville, on August 19, 1871, in Dayton, Ohio. The Wrights' last child, a daughter named Katherine, was born three years to the day after Orville, in 1874.

Despite their frontier heritage, Wilbur and Orville lived and worked in the suburban, middle-class neighborhood of West Dayton, Ohio. They grew up during the early industrialization of America, and by the time they began their aeronautical experiments in the 1890s, they had witnessed the emergence of numerous technologies that would define the modern era. Milton and Susan were stern disciplinarians but warm, loving parents.

They encouraged the intellectual curiosity and creative pursuits of all their children. Although neither Wilbur nor Orville received a high school diploma, both were committed to broad learning and were excellent students. They made good use of the rich family library and supplemented their formal



The "moment" of invention. On December 17, 1903, at 10:35 a.m., the Wright *Flyer* lifts off the beach at Kitty Hawk, North Carolina, with Orville Wright at the controls. Wilbur Wright, at right, observes the brothers' triumph. Courtesy of the Library of Congress.

schooling with a great deal of private study. Though technically high school dropouts, such a characterization belies their extensive self-education and strong intellect.

By 1890 Reuchlin and Lorin had moved out and started families of their own, and Susan Wright had succumbed to tuberculosis. The remaining four Wright family members became an extremely close-knit group, all continuing to live in the same household, providing a network of support that carried them through all manner of crises and triumphs. Despite their powerful commitment to family, Wilbur and Orville remained lifelong bachelors and had no children of their own.

As teenagers the Wright brothers showed little direction or focus toward their future. Wilbur's early plans to attend Yale Divinity College were thwarted by a series of health problems and a funk he fell into following the death of his mother. Orville flitted about from one interest to another. The printing trade was an early pursuit that seemed to hold some sustained interest for the younger Wright, and ultimately Wilbur joined him in several small printing business ventures. But it was in 1892, when the brothers opened their first bicycle rental and repair shop, that Wilbur and Orville found a livelihood to support themselves. At ages 25 and 21, they had settled into the comparatively ordinary life of hardworking local businessmen. It was also during this time that the close relationship and teamwork that would be so important to their aeronautical work solidified.

Creative Methodology

The Wright brothers' story always begs the basic question: How did these two modest, seemingly unremarkable bicycle shopkeepers develop such a world-changing invention as the airplane? How were these men, working essentially alone with little formal scientific or technical training, able to solve a problem so complex and demanding as heavier-than-air flight in only a few short years when it had defied better-known experimenters for centuries? In short, why Wilbur and Orville?

On the surface, the fact that the Wrights did invent a successful airplane quickly and with little assistance would suggest that sheer genius had to have been at the core of their achievement. Probing deeper, however, it becomes apparent that there were a number of specific research techniques, innate conceptual skills, and personality traits that came together in a unique way to largely explain why these two men invented the airplane.

In short, Wilbur and Orville had a definable inventive method that in very direct terms led them to the secrets of flight. The Wright brothers unquestionably were talented people. They do indeed deserve much of their towering reputation as inventors. But their genius should be understood in terms of the approach they evolved and employed to create the technology of flight, not just the singular act of getting a machine into the air. Examining the Wrights' inventive methodology peels away some of the mystery behind their rapid and startling success and adds even more luster to their accomplishment.

First and foremost, the Wright brothers' approach to mechanical flight was grounded in strict engineering techniques. They did not develop their aircraft using uninformed trial-and-error methods like so many of their contemporaries.

Nor did they tackle the problem as scientists. Wilbur and Orville did not set out to discover the theoretical principles of flight in the same sense that Newton or Einstein sought to explain physical phenomenon in nature. The Wrights' work focused explicitly on determining the design features required to make an airplane fly. Indeed, they not only invented the airplane, but they invented aeronautical engineering in the process.

Merged with this basic engineering perspective and its associated practices were a number of conceptual capabilities and approaches present in the Wrights' method that in large measure explain their inventive success. Among the most important was their capacity for developing conceptual models of a problem that could then be transformed into practical hardware. The brothers' considerable ability for turning abstract concepts into workable machinery reveals itself over and over again in their aeronautical work.

Another prominent feature of the Wright brothers' creative thought process was the great extent to which they used mental graphic imagery and nonverbal thought to conceptualize basic structures and mechanisms, even aerodynamic theory. There is invariably a distinct facet of design that is aesthetic in nature, an aspect that results from the maker's particular sense of what will or will not work or what looks right or wrong. Frequently, truly ground-breaking technological innovations are not based solely on articulated scientific or engineering principles, mathematical calculations, or other forms of knowledge that can be expressed verbally. The designer literally has a vision of what the object or structure should look like and how it will work and, in conjunction with verbal forms of knowledge, produces a tangible article based on these nonverbal ideas. Wilbur and Orville's keen facility for nonverbal thought was among the most prevalent and salient aspects of their inventive method. The Wrights reinforced these innate talents with several sound approaches to technological innovation.

They developed a series of gliders and powered airplanes that were based on a single, evolving basic design, modifying only a few factors at a time. This continuity of design allowed them to isolate flaws and capitalize on design successes, and thereby move ahead rapidly. Though seemingly an obvious approach, many of the Wrights' contemporaries jumped from one radical design to another.

Wilbur and Orville also understood that an airplane was not just one invention but numerous inventions all working in concert to produce a workable flying machine. The airplane is a technological system, each component of which, including the pilot, had to be addressed.

The Wrights saw no individual component to be more important than any other. Aerodynamics could not be focused on at the expense of structure, propulsion at the expense of control, and so on. The Wrights' unwavering attention to the complete technological system of mechanical flight was crucial to their success. Technological transfer, drawing concepts and even hardware from seemingly unrelated fields, also played a valuable role in the Wrights' creativity. The most conspicuous example was the bicycle. In addition to utilizing a number of mechanical devices from bicycles, such as sprockets and chain drives, the vehicle was the source of an important conceptual idea regarding flight control. The bicycle is an utterly unstable

machine but completely controllable. Intimate familiarity and comfort with this characteristic in bicycles freed the Wrights to think of airplanes in the same way. The Wrights were not bound by the idea that airplanes must be inherently stable, as were so many other aeronautical experimenters of the day. This concept was critical to the development of the brothers' effective control system, a key element of their invention.

No less important to understanding the Wright brothers' creative achievement was their personal relationship and outlook. More than simply a closeness between brothers, they possessed a synergy, sometimes forged through heated yet constructive argument, that produced collaborative solutions to vexing technical problems. Moreover, their closeness with the other members of the family, often serving as protection from what they perceived as a pernicious, untrustworthy outside world, provided a supportive environment.

This instilled confidence to reject the theories of well-known and experienced aeronautical researchers when the brothers felt their own ideas were correct. Finally, when seeking to explain the Wright brothers' inventive success, the factor of timing cannot be ignored. They took up the problem of heavier-than-air flight at a propitious moment. By the time the Wrights entered the field, the study of aeronautics had been legitimized by several prominent late-19th century experimenters, and a foundation of aeronautical knowledge was coalescing around their work. Although the Wrights worked alone, they did not operate in isolation of the advancements contributed by their predecessors. Despite the high degree of originality in their work, there is no reason to believe that the Wright brothers would have invented the airplane no matter when they took up the problem.

The creation of any fundamentally new technology is the result of a myriad of unique factors. The airplane is no exception. The elements cited here, however, were central to the Wright brothers' inventive success. This particular combination of engineering techniques and approaches, innate conceptual abilities, and personality traits and circumstances go far toward answering the basic question: Why Wilbur and Orville?

Invention

The Wright brothers did not possess a lifelong passion for flight when they began their investigations in the late 1890s. Wilbur in particular was casting about for something to quell his restless intellect. The bicycle business furnished an adequate living, but it did not offer the mental rigor the brothers' active minds craved. The airplane quickly became a consuming passion, but at first it was only an outlet for the Wrights' inquisitiveness.

They began with a literature search to acquaint themselves with the work of their predecessors. A letter to the Smithsonian Institution in 1899 was among their initial inquiries. After absorbing the information the Wrights received from the Smithsonian and other sources, they quickly recognized that control of the aircraft was a fundamental problem to be solved, and to their surprise, few experimenters had theretofore given it much thought.

In the fall of 1899 the brothers developed a basic means of lateral control and tested the mechanism with a small 5-ft

wingspan biplane kite. The idea would prove to be among their most significant and creative innovations. It would in fact be the central element of their later 1906 patent on the airplane. The idea was also one of the more striking illustrations of their creative skills and method.

Of the Wright predecessors who concerned themselves with control at all, some balanced their craft by continually altering the center of gravity of their aircraft by shifting the body weight of the pilot. Others simply tried steering with a rudder similar to how a ship maneuvers in water. Recognizing that the first approach was limited and that the second was technically flawed, the Wrights chose to control their aircraft aerodynamically. They reasoned that if a wing generates lift when presented to an oncoming flow of air, producing differing amounts of lift on either end of the wing would cause one side to rise more than the other. In other words, it would cause the wing to bank. If the pilot could mechanically alter the amounts of lift on either side of the aircraft when and to the degree the pilot chose, the aircraft could be maintained in level flight in the face of wind gusts or other forces and could be turned when desired.

The Wrights achieved this control by a means they termed *wing warping*. To induce the differing amounts of lift on either side of the airplane, the brothers literally twisted, or warped, the wing structure such that one side was presented to the wind at a higher angle than the other, which increased the lift on that side, thereby setting up the bank of the whole craft. Lines were attached to the ends of the wings and manipulated by the pilot via a hip cradle mounted at the center of the wing to induce the warp. The idea was seminal because it contributed to a method of effectively controlling an aircraft in three-dimensional space, and since it was aerodynamically based, it did not limit the size of the aircraft as body weight shifting obviously did. All aircraft continue to use this basic means of lateral control developed by the Wright brothers.

This aspect of the Wrights' work was not only at the heart of their invention, but it is a telling illustration of their creative methodology and thought processes. They adeptly moved from the abstract idea of aerodynamic control to a concrete structural and mechanical means of employing the concept. Wilbur hit upon the idea of warping the wings after serendipitously twisting a bicycle inner tube box in his fingers one day. He noticed that the box could be twisted longitudinally and still maintain its structural form. The Wrights' biplane wing arrangement mirrored the structural cell of the box. This is a powerful example of visual thinking at work in the design process. Further, even though they worked this idea out on small kites and gliders, they kept the goal of a practical airplane in mind and knew they had to conceive something that could be used in a larger, powered vehicle later. All these aspects of the Wrights' development of the critical wing warping system demonstrate their creative talents at their finest.

Encouraged by the success of their small wing warping kite, the brothers went on to build and fly two fullsize, piloted gliders in 1900 and 1901, testing them on the isolated sand dunes at Kitty Hawk, North Carolina. Although the control system worked well and the structural design of the craft proved sound, the Wrights continued to experience aerodynamic problems with these designs. The gliders simply did not produce the amount of overall lift that their

calculations predicted they should. Now at a critical juncture, Wilbur and Orville decided to conduct an extensive series of aerodynamic tests of their wing shapes. They built a small wind tunnel in the fall of 1901 to gather a body of accurate aerodynamic data on which to design their next glider.

The heart of the Wright wind tunnel was the test instruments mounted inside to measure coefficients of lift and drag, the terms in the equations for calculating lift and drag about which the brothers were in doubt. Like the wing warping system, these wind tunnel instruments are striking examples of the Wrights' ingenuity and skill. They were in essence mechanical analogues of the mathematical aerodynamic equations the brothers were using to design their aircraft. They were physically constructed such that all the factors other than the one they wished to investigate dropped out of the readings taken from the instruments. The resulting data could then be used directly to determine the shape and to calculate the size of wings. The ease with which the Wrights incorporated an abstract mathematical relationship into a practical piece of hardware that yielded concrete design information goes to the heart of their creative capabilities and approach and their inventive success.

The Wrights' third glider, built in 1902 based on the wind tunnel experiments, was a dramatic success. The lift problems were solved, and with a few more refinements to the control system they were now able to make numerous extended glides. An important element could easily be overlooked—not only had the brothers built a viable flying machine, but they were now able to gain valuable practice in the air; they could teach themselves to fly. This skill would be vital when attempting to fly a heavier, more complex powered airplane later. The Wrights understood that the pilot was yet another component of the overall system that had to work properly to achieve mechanical flight.

Buoyed by the success of their 1902 glider, the Wrights were now convinced they stood at the doorstep of realizing the age-old dream of human flight. During the spring and summer of 1903 they built their first powered airplane. Maintaining the basic continuity of their proven glider design, the only fundamentally new element of the 1903 craft was the application of power. The brothers made a small, 12-horsepower gasoline engine, which was no insignificant achievement. But the truly innovative aspect of the propulsion system was the propellers.

After realizing that marine propeller theory was nearly non-existent and inapplicable to flight, the Wrights designed an aerial propeller that stands out as one of the most creative

aspects of their entire airplane. They reasoned that if a wing moving horizontally in a flow of air produces a vertical lift force, a similar airfoil-shaped structure turned on its side and spun to create the flow of air over the surface would produce horizontal thrust; in essence, they envisioned a rotary wing.

The details of actually designing the propeller proved to be quite complex, but this basic concept was sound and revolutionary. All aircraft propellers since have been of the Wright design. Again, it is apparent that Wilbur and Orville's facility to see abstract principles in physical structures and materials, and their mental agility at manipulating these visual forms in their mind's eye, enabled them to create a critical component of the airplane.

By the fall of 1903, with the powered airplane ready for trial, the brothers headed south to their flight test site of Kitty Hawk. Once they had resolved some teething problems with the engine transmission system, the Wrights were ready. After four years of intensive effort, Orville lifted the Wright *Flyer* off the beach at 10:35 a.m., on December 17, for a 12-s flight. They made three more flights that morning, alternating pilots. With Wilbur at the controls, the fourth and last flight covered 852 ft in 59 s. With this long, sustained flight, there was no question the brothers had flown. The aerial age was born.

At the conclusion of this flight, a gust of wind picked up the *Flyer* and cartwheeled it across the beach. Badly damaged, the world's first airplane was never flown again. After bringing their design to practicality with two more powered machines in 1904 and 1905, the Wrights stopped flying entirely for 2½ years to secure their patent, which was granted in 1906, and to try and sell their invention. In the summer of 1908, they demonstrated their creation in the United States and Europe, amazing crowds of observers on every occasion. They were no longer Wilbur and Orville Wright, proprietors of the Wright Cycle Company. They were now the Wright brothers, inventors of the airplane.

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Writing and Creativity

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Glossary

Alcoholism Dependence on alcohol that results in increased physical, psychological, occupational, and financial problems that may result in death.

Depression A psychoneurotic or psychotic disorder marked especially by sadness, inactivity, difficulty in thinking and concentration, a significant increase or decrease in appetite and time spent sleeping, feelings of dejection and hopelessness, and sometimes suicidal tendencies.

DSM The diagnostic and statistical manual issued by the American Psychiatric Association.

Hypomania A mild mania, especially when part of a manic-depressive cycle.

Manic-depression Characterized either by mania or by depression, or by alternating mania and depression.

Schizoaffective disorder A class of mental disorder characterized by symptoms of schizophrenia and by disturbances in mood that are similar to those in the affective disorders.

Schizophrenia A psychotic disorder characterized by loss of contact with the environment, by noticeable deterioration in the level of functioning in everyday life, and by disintegration of personality expressed as disorder of feeling, thought (as in hallucinations and delusions), and conduct – called also dementia praecox.

Schizotypal personality disorder A mental disorder less severe than schizophrenia characterized by more mild disturbances in cognition and affect.

Techniques

Studies of Biographies

Researchers seek generalizations about eminent writers by compiling statistical data using biographies. They compare this data with information about other creative achievers and the general population, looking for any significant differences. Conclusions from these types of studies may apply to writers as a group, but do not indicate the characteristics of any individual writer.

Interviews and Assessments of Writers

Researchers interview eminent writers about their work and in some cases give them psychological evaluations and tests. The majority of these studies evaluate the characteristics and mental health of writers. Other researchers conduct semi-structured interviews focusing on a writer's background, career path, motivation, work habits, internal processes, and personal life. When multiple interviews are conducted, connections that indicate similarities and differences between the subjects are usually offered. Researchers have also used archival interviews in books, magazines, and newspapers to analyze prominent writers.

Case Studies

Researchers prepare case studies about individual writers by studying their life and work. The results presented in this entry will not emphasize individual case studies since they are usually complex and vary widely depending on the training, methodology, and perspective of the author. Study of collaborative creative writing is just beginning. A combination of interviewing, observation, and evaluation of changes in the work offer

insights into the decision-making process as well as the personal dynamics and leadership factors which may encourage or discourage creativity. Case studies may provide valuable insights but the results can not be generalized.

The psychobiography

Freud expressed admiration for creative writers who he said were far in advance of everyday people, because they draw on sources which have not yet opened in science. Freud wrote about the life of DaVinci which served as the prototype for the psychobiography, a format in which key psychological elements in an author's life, which theoretically influenced their work, are presented. Psychobiographies are almost always made without the subject's participation. Critics of this methodology complain there is a great deal of unproven speculation involved, as analyses are not based on experiments or independent evidence. The psychoanalytic method may reduce life to psychological processes, ignoring social, economic, or political forces. More recent researchers in creativity, such as Howard Gardner, concluded that Freud's characterizations apply to noncreative as well as creative individuals and thus do not distinguish the effective artist or scientist from the banal one. Others believe that though Freud's work was not scientifically accurate, his method might provide an imaginative look into the mystery of creativity.

The literature includes many articles by psychological practitioners who analyze the content of a writer's work including themes and specific characters in relation to a specific personal characteristic of the author, such as psychopathology, addiction, disease, or wish fulfilment. A few psychoanalysts and psychologists, most notably Albert Rothenberg, worked with writer-clients who allowed them to write about their creative process using aspects of their therapy.

The systems approach

The evolving systems approach examines the creative person's life in five contexts, including: total body of work, the milieu in which they worked, their family and personal life, and the sociohistorical period in which they lived. This approach has been used in studying writers by examining their creative process based on different drafts of their work and their own recollections.

Results of the Research

Early Family History

Large scale biographical studies consistently indicate that successful writers came from more turbulent family backgrounds and suffered more emotional instability when they were children. Mildred Goertzel, Victor Goertzel, and Ted Goertzel studied the lives of 717 eminent personalities who had two or more biographies written about them since 1962. The Goertzels compared 92 literary figures with other eminent personalities who lived in the twentieth century. They found writers were:

1. More likely to be only children (26% vs. 17% overall).
2. Tended to be voracious readers (77% vs. 48%).
3. Disliked school (52% vs. 33%).
4. Came from homes described as very unhappy (67% vs. 44%).
5. Had more alcoholic parents (one or both) (11% vs. 7%).

Jane Piirto reviewed the lives of 160 writers using survey questionnaires, essays, published interviews, and reference books. She found family trauma was a theme including alcoholism, parental suicide, weak or absent fathers, being orphaned, poverty, physical and sexual abuse, divorce, and mental illness. A few writers had placid childhoods but they represented a small percentage. Numerous writers and researchers have commented that writers may often find a way in their work to create a new world for themselves.

Arnold Ludwig examined the lives of 1004 eminent people who had a biography reviewed in *The New York Times Book Review* between 1960 and 1990. Included in the total were 180 fiction writers, 64 nonfiction writers, and 53 poets. He found that writers were more likely to have fathers, mothers, and siblings with identifiable pathological problems. In a separate study, Ludwig found that significantly more women writers came from families with mothers or fathers with psychopathology and that more of these writers were physically or sexually abused as children.

Kay Jamison made a long list of writers who had close bipolar relatives which included Robert Burns, Charles Dickens, Ralph Waldo Emerson, Henry James, William Faulkner, and F. Scott Fitzgerald. This may have be a creative advantage since research conducted by Ruth Richards and Dennis Kinney indicated that an individual who has a close relative with manic-depression is more likely to be creative.

Education

Not surprisingly, the majority of children who became writers were voracious readers who escaped into the world of books and in some cases movies. Freud wrote about the relationship

between childhood fantasy and writing: "Might we not say that every child at play behaves like a creative writer, in that he creates a world of his own, or, rather, rearranges the things of his world in a new way which pleases him?" (1908: 131-132).

Exceptional curiosity was a common trait along with an early interest in writing. Young writers such as Eugene Ionesco, Sylvia Plath, and Pearl Buck displayed promise and received encouragement from teachers for their writing skills. However others such as Academy Award winning screenwriters William Goldman and Tom Schulman did not display any particular talent for writing until later in life. Many creative writers were bored or just felt they did not fit in. High school dropouts include famous writers such as Herman Melville, Mark Twain, Ring Lardner, Will Rogers, and Noel Coward.

However the romantic notion of the dropout writer who lives in poverty until discovered is changing as the path for many successful writers, especially novelists, includes an undergraduate and graduate school degree, often from top-flight schools that may allow them to teach as their writing career evolves. Programs such as the Iowa Writers Workshop and UC Irvine and top film schools such as USC and UCLA are training successful writers.

Mental Illness

Writers, along with other creative artists, have been subject to the speculation that genius and madness are linked. This association has been traced back to Plato's colorful description of poets' 'divine madness' as well as Aristotle's claim that all creative people were touched with melancholia. Biographical studies support the notion that fiction writers and poets had much higher rates of psychopathology than other creative professions and the general population.

For example, Arnold Ludwig reported that 28% of his total sample of writers had a mental disorder in their lifetime including a striking 87% of poets, 77% of fiction writers, and 72% of nonfiction writers. Women writers may be even more at risk. Ludwig interviewed and compared 59 female writers matched with a control group. He found female writers had higher rates of depression (59% vs. 9%), alcoholism (20% vs. 5%), drug abuse (17% vs. 5%), panic disorder (22% vs. 2%), generalized anxiety (14% vs. 5%), and eating disorders (12% vs. apparently none). Women writers, like men, suffered more bipolar illness and depression, but they also had had more problems with alcohol, were more suicidal, and had a lower life expectancy than other eminent professionals.

Nancy Andreason conducted structured interviews with 30 faculty members at the Iowa workshop over a period of 15 years. She performed a psychiatric diagnosis of both writers and their relatives, comparing them with a matched control group. She concluded that 24 of the 30 writers (80%) suffered from an affective disorder compared to nine (30%) of the control sample. She diagnosed 13 writers with a bipolar disorder and 11 with a major depressive disorder. In fact, two writers committed suicide while the study was taking place. Using the family history method, she also diagnosed the writers as having many more first-degree relatives with affective disorders and creative ability. Andreason recognized the limitations of her study, including the fact that she was cognizant of the writers and the controls. Also, writers might have more awareness

of affective illness both in themselves and in their relatives. She also commented that the degree of illness diagnosed might be exaggerated by the broad definition of bipolar illness in the DSM. Andreason was the sole interviewer and this particular group of writers may have turned to teaching because of depression.

Kay Jamison interviewed 47 British prize-winning writers and artists with a mean age of 53.2 years, asking them if they had been treated for mental illness. She discovered that 38% had been treated for affective illness at some point, 23.4% had taken antidepressants, and 6.4% had been diagnosed as manic-depressive (all poets). She compared this with 'normal lifetime rates' of 5% for depression and 1% for manic-depression.

The most comprehensive face to face study of professional writers was analyzed by Frank Barron, who, with other psychologists, interviewed and psychologically tested 30 professional writers nominated by the faculty of the University of California at Berkeley. Also included in this study were 26 'successful and productive' student writers and nonwriters. Barron tested for the presence of psychopathology by administering the Minnesota Multiphasic Personality Inventory. He found the most eminent writers scored high on scales measuring schizoid, depressive, hysterical, and psychopathic tendencies and in terms of femininity of interest pattern. However, these writers also registered higher scores on ego strength, so Barron concluded that while they suffered psychological turmoil, they also possessed more resources to deal with it. He felt this conclusion was reinforced by their social behavior since they presented themselves as clearly effective people with pride and distinctiveness while sometimes showing pain, protest, distance, and withdrawal, as well as being very emotional. Barron's study warrants replication with a contemporary group of writers because his conclusions might vary with subjects who lived in a different time frame.

There is also evidence that more successful writers who win Nobel Prizes and Pulitzer Prizes may be more likely to have mental illness. James Kaufman found similar results in two historiometric studies of 986 twentieth century writers and 889 writers who lived from 1600–2000. He concluded that: "In both studies, both types of prize-winners were more likely to suffer from mental illness than nonwinners. In addition, Nobel Prize winners were more likely to suffer from alcoholism . . . and experience a personal tragedy" (2000–2001: 305). A partial list of writers thought to have serious mental illness problems are listed in Table 1.

Ludwig suggested that writers demonstrate more psychopathology because writing and poetry rely on a 'personal vision' which is based on an internal subjective experience as opposed to science where more stability may be required to do work that has 'predictability, replicability, reliability, and testability.' The arts tolerate eccentric and irrational behavior much more readily than other professions. In fact, the creative writer's uniqueness is his or her stock in trade, and it takes a strong, independent personality to go one's own way. The characteristics that support this kind of abnormality are similar to the traits that characterize psychotic behavior.

There is also the distinct possibility that the characteristics of mental illness can be a detriment or benefit to creativity, depending on the individual case. For example, creative writers and poets may be far more sensitive to their emotions. Freud

Table 1 Writers thought to have mental illness

James Barrie (playwright/fiction)
Charles Baudelaire (poetry/nonfiction)
Honore de Balzac (fiction)
William Blake (poetry/fiction/nonfiction)
Louise Bogan (poetry/nonfiction)
Elizabeth Barrett Browning (poetry)
Robert Browning (poetry/playwright)
Truman Capote (fiction/nonfiction/playwright)
Thomas Carlyle (nonfiction)
Thomas Chatterton (poetry/playwright)
John Clare (poetry)
Samuel Taylor Coleridge (poetry/nonfiction/playwright)
William Collins (poetry)
Joseph Conrad (fiction/playwright/nonfiction)
William Cowper (poetry)
Hart Crane (poetry/playwright/nonfiction)
Charles Dickens (fiction/playwright/nonfiction)
Theodore Dreiser (fiction/nonfiction/poetry/playwright)
F. Scott Fitzgerald (fiction/nonfiction)
Ian Fleming (fiction)
Robert Frost (poetry)
Nikolai Gogol (fiction/playwright)
Graham Greene (fiction/nonfiction/screenplays/playwright)
Ernest Hemingway (fiction/nonfiction)
Friedrich Holderlin (poetry/playwright)
Franz Kafka (fiction/nonfiction)
Charles Lamb (poetry/playwright/nonfiction)
Nathaniel Lee (playwright)
Jack London (fiction)
Robert Lowell (poetry/playwright)
Guy du Maupassant (fiction/nonfiction/poetry)
John Stuart Mill (nonfiction)
Gerard de Nerval (poetry)
Frank O'Connor (fiction/nonfiction/playwright)
Sylvia Plath (poetry/fiction)
Edgar Allan Poe (poetry/fiction/playwright)
Ezra Pound (poetry/nonfiction)
Arthur Rimbaud (poetry)
Theodore Roethke (poetry)
Jean-Jacques Rousseau (nonfiction/fiction/playwright)
William Saroyan (fiction)
Friedrich Schiller (poetry/drama/nonfiction)
Arthur Schopenhauer (nonfiction)
Delmore Schwartz (poetry/fiction/nonfiction)
Anne Sexton (poetry/fiction/nonfiction)
Percy Bysshe Shelley (poetry/fiction/nonfiction/playwright)
Christopher Smart (poetry/nonfiction/librettos)
Edmund Spencer (poetry/nonfiction)
August Strindberg (playwright/fiction/poetry)
Jonathan Swift (fiction/nonfiction/poetry)
Torquato Tasso (poetry/playwright/nonfiction)
Alfred Tennyson (poetry/playwright)
Leo Tolstoy (fiction/nonfiction/playwright)
Virginia Woolf (fiction/nonfiction)

Note: Many authors are classified as having mental illness automatically if they demonstrated heavy use of alcohol or drugs.

Sources: Ludwig, Magill, Prentky, Simonton, and others.

felt writers use fantasy to satisfy these needs. This anticipates other researchers who concluded the difference that composes what has been called the thin line between genius and madness is control. This point of view acknowledges that creative writers

may at times exhibit traits of mental illness, but argues they are essentially healthy because they can make critical judgments about their thoughts and work that would be impossible if they were truly pathological. Other researchers take the opposite position that psychotic thinking is an essential ingredient in creativity.

A third possibility accepts both psychopathology and creativity as ingredients which may vary along a continuum. At times creativity and schizophrenia may be inextricably linked together in varying degrees. Examples include the poet Holderlin, who was diagnosed as schizophrenic; Strindberg, who had a schizoaffective disorder; and writers who displayed a schizoid or schizothymic temperament, including Baudelaire, Kafka, and Beckett. It may be the schizoid or schizotypal propensities and world view which gave these writers' creative contribution its uniqueness.

Hypomanic traits have been cited as a positive force giving some writers energy, concentration, and confidence which enhanced their work. Depression inspired a small percentage of writers to work harder, perhaps attempting to escape their pain. Other writers such as Edgar Allan Poe used their dark moods as a source for some of their best work.

However, most writers with mental illness paid a heavy price in both their personal and their professional lives. Most reports by psychiatrists, psychologists, and writers indicate that being in the throes of mental illness is not a good place to work. Richard Berlin argued that: "Severe depression interferes with motivation, energy, drive realistic self-assessment, and pleasure" (2008: 4). Sylvia Plath said "When you are insane, you are busy being insane all the time . . . When I was crazy, that's all I was" (Flaherty as cited in Berlin, 2008: 4), Ezra Pound, Virginia Woolf and Sylvia Plath spent parts of their lives in mental institutions. Depression and manic-depression hampered the ability of many eminent writers, including Joseph Conrad, Leo Tolstoy, John Ruskin, and Ernest Hemingway.

Summing up, there are impressive indications that eminent writers as a group suffer more problems than other eminent creators or the general population. Despite the robustness of the statistics, they must be considered cautiously. Diagnoses have often been made posthumously using loose and inconsistent diagnostic criteria. In many cases the validity of a diagnosis of mental illness, alcoholism, or suicide cannot be verified. In addition, solid statistical evidence of the extent of mental illness, alcoholism, and suicide in the general population is still far from precise. Finally, it is possible writers with dramatic lives and early deaths are more likely to become eminent and have biographies written about them.

Suicide

Individuals who have problems with traumatic childhood loss, mental illness, alcoholism, and drug abuse are more likely to commit suicide, so it is not surprising the suicide rate among writers is higher than average. Difficulty with their writing is a factor contributing to writers' suicides. A partial list of writers who are believed to have committed suicide is in [Table 2](#).

In Ludwig's study, eminent people in general were more likely to commit suicide (4.4%) than the general population, which had an estimated rate of 1.0 to 1.4%. However, 20% of the poets were considered suicides. Fiction writers had an

Table 2 Some writers thought to have committed suicide

Ryunosuke Akutagawa (fiction)
John Berryman (poetry/nonfiction/fiction)
Richard Brautigan (Fiction)
Truman Capote (fiction/nonfiction/playwright)
Thomas Chatterton (poetry/playwright)
Hart Crane (poetry/playwright/nonfiction)
Sergei Esenin (poetry)
Maxim Gorky (fiction)
Spalding Gray (screenwriter/performer)
Tom Heggen (fiction/playwright)
Ernest Hemingway (nonfiction/fiction)
Yasunari Kawabata (fiction)
Heinrich von Kleist (fiction/playwright)
Arthur Koestler (fiction/nonfiction)
Vachel Lindsay (poetry/nonfiction)
Ross Lockridge (fiction)
Jack London (fiction/nonfiction/playwright)
Malcolm Lowry (fiction/poetry)
Lucretius (poetry)
Vladimir Mayakovsky (poetry)
Yukio Mishima (fiction/nonfiction/playwright)
Charlotte Mew (poetry)
Gerard de Nerval (poetry/playwright/nonfiction/fiction)
Cesare Pavese (fiction/poetry/nonfiction)
Sylvia Plath (poetry/fiction)
Anne Sexton (poetry)
Sara Teasdale (poetry)
Hunter S. Thompson (journalist)
Marina Tsvetayeva (poetry/playwright/nonfiction)
Virginia Woolf (fiction/nonfiction)
David Foster Wallace (fiction/nonfiction)
Stefan Zweig (fiction)

Sources: Hendrickson, Ludwig, Magill, Prentky, Simonton, and others.

average rate of suicides while nonfiction writers were below average. Ludwig proposed that emotional problems often interfered with creative productivity, but actually improved performance for 16% of eminent creative people by increasing productivity, overcoming writing blocks, and generating new ideas or better performances. The Goetzels found that 11% of writers committed suicide compared to 5% of their total sample.

Poets are more at risk than other groups and female poets represent the highest percentage of writers who commit suicide. James Kaufman and John Baer pointed out that female poets are introspective and the expressive nature and style of their poetry does not provide the health benefits of other kinds of writing. They cited other salient reasons including the implicit expectations of illness by the gatekeepers who evaluate poetry, the higher evidence of mental illness in female poets and the fact that poets tend to peak at an earlier age when bipolar illness and other mood disorders are more likely to strike.

Substance Abuse

Alcoholism has been a problem for many accomplished writers, including Nobel prize-winning authors Sinclair Lewis, Eugene O'Neill, and William Faulkner. The generation of American expatriate writers in post-First World War Paris that included Ernest Hemingway and F. Scott Fitzgerald

glamorized and romanticized drinking, making it a more sophisticated and respectable behavior. A partial list of alcoholic writers includes James Agee, Charles Bukowski, Truman Capote, Raymond Chandler, John Cheever, Dashiell Hammet, O. Henry, James Joyce, Jack Kerouac, Norman Mailer, Dorothy Parker, Edgar Allen Poe, John Steinbeck, Robert Louis Stevenson, William Styron, Dylan Thomas, Tennessee Williams, and Thomas Wolfe, Writers who used their drinking experiences for major works include Eugene O'Neill (*The Iceman Cometh*), William Burroughs (*Naked Lunch*), and Malcolm Lowry (*Under the Volcano*). Jack London wrote an alcoholic memoir (*John Barleycorn: Alcoholic Memoirs*) and Charles Bukowski's semi-autobiographical fiction and poetry were filled with his alcoholic experiences.

Arthur Rothenberg reviewed biographical and autobiographical data of writers known for their use of alcohol. He found very few did their actual writing or their thinking about writing, while under the influence of alcohol. In Ludwig's study of the biographies of 34 well known heavy-drinking writers, artists, and composer/performers, he found that alcohol negatively affected the work of 75%, especially as the drinking continued. Long-term drinking has physiological effects which directly hinder the concentration required of creative individuals. However, Ludwig believed that drinking actually benefited 9% of the subjects. Writers such as Hemingway, O. Henry, Raymond Chandler, and John O'Hara claimed that drinking improved the quality of their writing. Many writers recognized they could not write well while they were drinking. F. Scott Fitzgerald and Ring Lardner said they went on the wagon when they worked.

Anja Koski-Jannes reviewed 60 interviews with prominent Finnish writers who started writing between the 1920s and 1950s. Only 32 writers commented on their use of alcohol while they wrote since this was not a primary question in the interviews. Writers who used alcohol occasionally saw it as an aid in getting started or a stimulus when they were tired. Duplicating results of studies in England and the United States, poets reported more alcohol use than other types of writers. The most heavy use for all writers occurred between writing projects.

Immediately after a project was finished, writers reported they felt "empty, depressed and dissatisfied with themselves." They considered going out and drinking as a way to loosen up and relax, make social contacts with other writers, and generate new ideas. Writers also said they used alcohol to dissociate themselves from common concerns, and to facilitate the writing process. Koski-Jannes suggested that among the reasons writers use alcohol frequently are that the job is insecure, highly valued but poorly paid (at least in Finland), and the profession is subject to conflicting expectation from the reading public, critics and the writer her or herself (lose publicity pressures). As actual work it is unstable, lonely and at times emotionally highly demanding. Because of the marginality of this profession the identity of the writer is continually at stake (1985: 131).

These comments sum up the hazards of the job mentioned by a number of researchers. However, it does not explain why some writers respond to these pressures by drinking heavily while other writers drink in moderation or abstain. A few researchers have attempted to determine if alcohol facilitates creative writing under laboratory conditions. There were

indications that alcohol significantly increased the number of words produced, which confirms anecdotal accounts of writers who found alcohol an aid in writing. However, these studies did not examine professional writers, so any determination of the quality of thinking under actual working conditions remains unknown.

Often the term 'depression' is mentioned when it comes to writers who drink, which indicates that it may be used as a form of self-medication. If, in fact, more writers tend to be alcoholics than the general population, it is still not clear if the job makes writers depressed or depressed people are more likely to choose writing as a profession. Since most alcoholic writers were drinking before they started writing, perhaps professional writing was attractive because it allowed the individual the freedom to continue drinking. It is also possible that writing, like alcohol, serves as a way to escape negative feelings. A questionnaire given to writers on just this topic indicated that writers experience positive emotions significantly more often than negative emotions when writing. Furthermore, during the actual writing process, positive emotions tended to intensify, whereas negative emotions resisted change.

Ludwig's analysis indicated that poets and fiction writers trail only musicians and theatrical performers when it comes to drug use and abuse. Coleridge allegedly wrote about the palace of Kublai Khan while on opium; Keats tried the drug and described his experience. Elizabeth Barret Browning, Louisa May Alcott, and Jean Cocteau used opium. Aldous Huxley made no secret of his fondness for mescaline, which he wrote about in *The Doors of Perception*. Phillip K. Dick was addicted to amphetamines. Stephen King wrote in 2000 about being hooked on alcohol, cocaine, and prescription medicines.

It's impossible to accurately measure the level of drug use because, aside from the question of legality, some writers might be afraid their reputations would suffer if they publicly admitted they used drugs. As times change, writers' use of alcohol and drugs may change. Recent studies challenge the popular notion that creatively successful individuals lead excessive life styles. A survey of 22 writers, 27 artists, 12 musicians, and 25 controls about use of cocaine, marijuana, alcohol, etc. found no significant difference in the use of most substances between groups. However, a high rate of heavy use (23%), a small sample, and an even smaller control group preclude any definitive conclusions.

Life Span

Researchers concluded the stresses caused by being a professional writer result in a measurably lower life expectancy. A comparison of the age of death of 160 writers with that of 80 members of nine other creative occupations found that writers died at an average age of 61.7 years, which was 8.3 years less than composers and painters. Several hypotheses have been put forward to explain the cause of writers dying at an earlier age:

1. The theory that poets produce their major works at a younger age so they could die at a younger age and still be considered eminent in their field.
2. The differential-resources hypotheses, which suggests the lower financial rewards and standard of living in the literary arts results in a shorter life expectancy.

3. The stimulation–deprivation explanation which posits the meager financial rewards and sensory stimulation found in writing leads to risk-taking behaviour elsewhere.

A study by Vincent Cassandro found creative writers living an average of 62 years, which was three to seven years less than contemporaries in other disciplines. Scientists and inventors lived the longest. Cassandro concluded evidence supported the first two hypotheses, but not the third. He also made the logical link between a writer's psychopathology and a lower life expectancy. This is exemplified by the fact that poets are definitely more at risk than fiction and nonfiction writers. In 2003, Kaufman (2003) found this higher risks for poets cut across cultures in a study that looked at 2000 American, Chinese, Turkish, and Eastern European writers. This is not surprising in view of the fact that poets suffer more mental illness, substance abuse problems and suicide.

Cassandro's study offered significant evidence that the more writers diversified, the longer they lived. However, the sample was of subjects born no later than 1800 and thus might not generalize to the twenty-first century. Similarly, the findings might not apply to less eminent creative people or for writers in different fields. In 2009, Steven Pritzker and David McGarva found that Academy Award winning screenwriters lived to an average age of 72 although it has slipped below 70 since the 1970s. More in-depth research verifying the actual economic status of the creators studied, the actual cause of death, and the interaction of psychopathology upon these variables could help build knowledge in this area.

The Creative Process

Motivation and Personality

Why do writers write? It has been proposed that mental disturbances contribute to a state of 'psychological unease' which generates creative tension that is relieved by constant work, and that creators who do not have emotional problems are able to internally generate this unease. Others have theorized that writing may satisfy a biological drive, a search for meaning, or a means to fame and fortune. Barron theorized that writers are constantly creating a universe of meaning. This need to find meaning in life may be based on childhoods in which writers felt isolated and unhappy. This theory could explain why so many writers find the act of writing difficult. Creating a world that reveals lasting truths is bound to be frustrating as the writer searches for the right words.

However, despite all the pressures and frustrations, many writers have found great satisfaction in their work. For some, writing provides an escape from the pressures of life, offering a place where he or she is in control. Positive aspects frequently mentioned include the pleasure in discovering more about themselves and making new intellectual and emotional connections, feeling they have a real purpose, communicating with others and sharing their reactions when they find something which represents some underlying 'truth' about life, and the enjoyment of working with words. Some individuals found a long-sought sense of identity when they became writers.

Two motivations to write which have not been explored in depth are fame and fortune. Research in experimental settings has indicated that the relationship between intrinsic motivation and extrinsic motivation varies according to circumstances. It is probable that in the real world fantasies of celebrity and wealth helped some writers keep working through the lean times. Economic necessity motivated some writers. Dostoyevsky produced some of his best work when he needed money.

Many novelists and playwrights in the twentieth Century took lucrative offers from movie studios. Some including Fitzgerald and Faulkner felt that they 'sold out' to Hollywood where they had no control over their work. Usually they wrote bitterly about the experience.

Fame, once achieved, has been a part of the career fabric for many authors who enjoyed the attention. Ernest Hemingway's macho image helped sell his work while giving him ego gratification. However, fame also creates tremendous pressure. Expectations can become so high that writers become blocked. Writing became especially competitive in the 1920s when writing a great novel was not enough – it had to be a best seller.

Today's authors are expected to sell themselves on talk shows and do interviews so they can generate enough publicity to become a 'name brand.' The alcohol and drug problems many writers experience may be exacerbated by the drive for success, prestige, fame, and money, and the burden put on the creative self.

Work Habits

Creative writing may be sparked in many ways (e.g., a glimpse of a person or imagining a scene) and inevitably encompasses autobiographical elements. Once the subject is chosen, some prolific writers such as Stephan King can produce work with incredible speed. Isaac Asimov reported he would write at the 90 words a minute he could type, and stated he wrote most nonfiction books in 70 hours. However, many writers struggle finding the form which fulfills their vision.

Writers' work habits are as individual and idiosyncratic as their work. Some professional writers discipline themselves by treating writing as a nine to five job. Others may give themselves a daily quota of words or pages to fill. There are writers who like to isolate themselves while others enjoy working in cafes. Some write a specific number of pages every day while others procrastinate until they are faced with a deadline and then put in marathon hours.

Most writing decisions offer a number of choices, so often writers develop different drafts of stories and scenes, learning as they rewrite what works for them and what must be changed. During this evolutionary process their original perceptions may radically shift – a minor character may grow into a central figure, or the theme of a story may go in a completely different direction.

Thus the creative process in writing is usually not linear, but rather a series of steps that are repeated over and over as refinements are made. Many writers will look for feedback from one or more trusted sources while the work is in progress. Some writers may complete hundreds of pages and decide the idea does not work at all. The most constructive work is done in a state of total concentration which almost seems effortless

at the time, referred to as 'flow.' The author must remain open to the message whispered by the unconscious, while at the same time maintaining critical judgment.

Writer's Block

A common complaint among both amateur and professional writers is the inability to work known as writer's block. This experience is intimately connected to the uncertainty and tension inherent in facing a blank page every day. Factors contributing to writer's block are self-doubt, perfectionism, procrastination, unrealistic expectations, and fear of failure. Some strategies suggested for countering blocks include writing anything (even about being blocked), setting up a regular time and place to write, isolating oneself from distractions, stopping writing when there is some momentum left so the work can be continued the following day, going to another project for a while, and using positive self talk. The fact that even blocked writers may eventually produce important work is exemplified by Karl Marx, who spent 18 years writing the first volume of *Das Kapital*.

Collaborative Writing

The act of writing is usually an internal process so it has been difficult to make independent observations of elements that encourage or discourage creativity. Research about collaborative writing in television script writing, indicates that specific elements encourage creativity, including the willingness to take risks and providing a safe atmosphere where members of the group build upon each others' ideas while they are free to argue (Pritzker, 1997). Negatives include unresolved emotional conflict between the writer and supervisors, differences in communication styles, settling quickly on a predictable story, and the tendency of executives to demand massive rewrites generating fear of change and fatigue.

Creative Writing as an Aid to Mental Health

Writing has been used as a tool for self-healing by both amateur and professional writers for thousands of years. Ronald Kellogg observed that well-known writers often talk about constructing meaning. He quoted E. M. Forster who had one of his characters say: "How do I know what I think until I see what I say?" (1994: 25).

James Pennebaker and other researchers completed a number of studies indicating that writing about personally significant events with emotional implications, even for a short time, can generate significant benefits. Pennebaker summarized various studies which indicated:

- Improved biological effects represented by enhanced immune system functioning and healthier medical markers such as lower blood pressure and reduced stress levels,
- Psychological impact including improved short and long-term mood changes.
- Behavioral changes such as better grades at school, greater success in finding work and more effective social skills (2004: 7–10).

However, as Stephen Lepore and Joshua Smyth pointed out, a certain degree of skepticism is probably healthy since this is a relatively new area of research.

Creative Writing in Institutions

Creative writing is used as a tool to help prisoners and patients in mental institutions. Cognitive researchers concluded that creative writing takes tremendous effort and requires a great deal of attention; thus for some troubled people it helps center the thinking process and provides insight into problems. William Styron and Art Buchwald wrote about their deep depression as a catharsis and with the hope the public would understand more about the debilitating nature of their illness. Political prisoners such as Thomas Paine, John Bunyan, and Daniel Defoe used their time in jail to write books that furthered their own cause. Prisoners committed for other crimes who wrote notable works while in jail include O. Henry, William Penn, Marco Polo, Oscar Wilde, Eldredge Cleaver, and Malcolm X. The Marquis de Sade completed the circuit since he began his writing career in prison and continued it in a mental institution.

Conclusions

Work on writing and creativity has consistently indicated that many writers suffer problems with psychopathology, alcoholism, and drug abuse. The next step is to go beyond the interesting and logical theories proposed for this connection and develop verifiable causal explanations.

Information on the life expectancy of writers needs further investigation. If writing inherently contains occupational hazards, then therapists and creative writing teachers can develop a proactive stance to help some of their clients understand and cope with the stress of the job and deal with their personal demons.

Much of the research has concentrated on eminent writers. Learning more about professional writers who are more 'ordinary' can widen our knowledge and possibly lead to training which can encourage creativity.

While a great deal of attention has been paid to dysfunctional writers, the healthy writer (if one exists) is barely represented in the literature. It might prove worthwhile to look closely at the lives of writers with less dramatic histories since they may serve as positive models other writers may emulate.

See also: Bipolar Mood Disorders; Collaboration; Flow and Optimal Experience; Interest Inventories; Mental Health: Affective Disorders; Rewards and Creativity; Substance Abuse and Creativity; Suicide.

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- <http://www.pw.org/magazine> – Poets & Writers Magazine.
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Z

Zeitgeist

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Glossary

Anomalies According to Kuhn's theory of scientific revolutions, anomalies occur during normal science when puzzle-solving research obtains results that conflict with the prevailing paradigm. Sometimes these anomalies can eventually be accommodated by the paradigm, and even prove to confirm the paradigm. Other times anomalies resist accommodation, and can lead to the discipline entering a crisis state that is only resolved by scientific revolutionaries who introduce a new paradigm.

External Zeitgeist Conditions that are extrinsic to a particular domain of creativity. Examples include political events, economic circumstances, and sociocultural conditions outside the discipline itself.

Generational time-series analysis A statistical method in which a transhistorical sample of eminent personalities gets assigned to consecutive 20-year periods and then subjected to various statistical analyses.

Internal Zeitgeist Conditions that are intrinsic to a particular domain of creativity. Examples include research paradigms in the sciences and stylistic conventions in the arts.

Multiples The event where two or more scientists (or inventors) independently come up with the same discovery (or invention). Some multiple discoveries and inventions are not just independent but also nearly simultaneous. The phenomenon has been traditionally used to define the doctrine of sociocultural determinism, the extreme form of Zeitgeist theory.

Ortgeist The 'spirit of the place,' just as the Zeitgeist is the 'spirit of the times.' This includes all political, economic, sociocultural, and disciplinary conditions characteristic of a given locale, such as a university, city, or nation. In practice, the term Zeitgeist is often used to encompass the Ortgeist. That inclusion occurs because the Zeitgeist only applies to a specific place as well as time.

Paradigms Theories, methods, and exemplary works that serve as models for research in normal science. Normal scientists are engaged in establishing and extending the paradigm, and do so through the practice of puzzle-solving research. Revolutionary scientists, in contrast, propose a new paradigm in order to resolve anomalies that have emerged in the application of the old paradigm.

Premordial cognition A key variable in Colin Martindale's theory of stylistic evolution. Originally termed primary process imagery, it concerns the cognitions associated with dream states, altered states of consciousness, fantasy, and basic drives, and sensations. It is to be distinguished from conceptual cognition or secondary process.

Premordial cognition is assessed using content analysis, most notably through Martindale's Regressive Imagery Dictionary.

Role-model availability In generational time-series analysis the number of creators in generation $g - 1$ (and perhaps also $g - 2$) for creators in generation g . Because creators in generation g are in their developmental period in generation $g - 1$, the number of creators in the latter period serves as an indicator of potential role models. The autocorrelation between consecutive generations thus indicates the impact of role-model availability.

Scientific revolutions Periods in the history of paradigmatic sciences in which the old paradigm is replaced with a new paradigm that resolves the anomalies that put the science in a crisis state. Once a revolution succeeds, the scientific discipline returns to the state of normal science in which practitioners engage in puzzle-solving research. Scientific revolutions include the Copernican model of the planets, Newtonian celestial mechanics, and Darwinian theory of evolution.

Sociocultural determinism The doctrine that the individual is totally influenced by the larger milieu. This milieu may include political, economic, social, and cultural conditions. In the specific case of creativity, advocates of sociocultural determinism argue that both the type and level of creative achievement is shaped by the Zeitgeist, both internal and external. Multiples are often taken as empirical proof of this position even though that inference has shown to be incorrect.

Stylistic change In artistic or aesthetic evolution when one set of stylistic conventions are replaced with another. All of the arts undergo such shifts. Cases include the shift from Baroque to Neo-Classicism, Neo-Classicism to Romanticism, and Romanticism to Modernism in literature, painting, sculpture, and music. Such shifts are roughly analogous to paradigm shifts in the sciences.

Introduction

In Shakespeare's *Twelfth Night* a character utters the famous lines "Some are born great, some achieve greatness, and others have greatness thrust upon them." The first option would seem to apply to royalty and aristocrats, and the second to the great geniuses who make history. The third possibility suggests that sometimes greatness is not a matter of being the right person but rather can be attributed to being at the right place at the right time. Even creators as outstanding as René Descartes, William Shakespeare, Leonardo da Vinci, and Ludwig van Beethoven are nothing more than products of larger sociocultural circumstances beyond their control. In a sense, geniuses are mere epiphenomena – effects rather than true causal agents. That is, geniuses are pawns of the *Zeitgeist*, a German word that literally means 'time spirit,' or 'spirit of the times.' The word 'Zeit' has the same origins as the English root 'tide' still seen in such words as eventide, Christmastide, and Shrovetide. And the German word 'Geist' has the same source as the English 'ghost,' which came from the Old English word for breadth or spirit. The term *Zeitgeist* is closely linked with *Ortgeist*, another German word that signifies 'spirit of the place.' In practice, the two terms can be used interchangeably. The near equivalence ensues from the fact that the 'spirit' is invariably confined to a particular time and place. For example, when we speak of the Age of Pericles we are simultaneously talking about a particular place (Athens) at a specific time (about 445–429 BCE) – the Athenian Golden Age. There was no Periclean Age in Rome, and even less in Africa, Asia, and the Americas. Hence, throughout this article *Zeitgeist* will be used in the inclusive sense to encompass the *Ortgeist* as well.

As the preceding example illustrates, the *Zeitgeist* is often associated with eponyms – names of persons that became labels for eras or periods in history. Other examples include the Elizabethan Age in England or the Age of Louis XIV in France. Even so, sometimes the *Zeitgeist* is identified by more impersonal names, such as Renaissance Italy or the British Industrial Revolution. The latter usage is more consistent with the tenor of the *Zeitgeist* theory of history. The expression Victorian Age seems to imply that the British Queen Victoria had something to do with the making of the age. Yet *Zeitgeist* advocates, such as Leo Tolstoy in his *War and Peace*, are emphatic that eponyms have no causal significance. On the contrary, the Queen was the pawn rather than agent of her age. Her sole contribution was to live long enough to provide an all-encompassing label for a whole period in history.

In its extreme form, *Zeitgeist* theory becomes equivalent to sociocultural determinism and reductionism. All individual behaviors, including creativity, is determined by social and cultural variables. As such, the individual is reduced to a set of norms, roles, and other factors that exist outside the person, and prior to the person. However, it is possible to acknowledge the impact of the *Zeitgeist* without adopting such an extremist stance. The *Zeitgeist* then provides a set of variables that join psychological and biological factors in the making of the creative genius.

To understand better how the *Zeitgeist* affects creativity, we must first recognize that the *Zeitgeist* assumes two forms: the internal and the external.

Internal Zeitgeist

At the level of everyday creative behavior, creativity can often be generic. Thus, a person who writes imaginative American haiku might also produce a creative collage. In contrast, high-level creativity tends to be much more domain specific. It is as unlikely that T. S. Elliot could have painted *Guernica* as it is improbable that Pablo Picasso could have penned 'The Waste Land.' Accordingly, to some extent the *Zeitgeist* must also be domain specific. The *Zeitgeist* associated with Newtonian or 'Classical' physics will have a far greater influence on the creativity of physicists than it will on the creativity of sculptors. Likewise, the *Zeitgeist* connected with Socialist Realism had a bigger impact on the arts than on mathematics.

One illustration of this domain-specific contingency is seen in the phenomenon of role-model availability. It has been long observed that creative genius is not randomly distributed across time and place. Instead, geniuses tend to congregate into temporally and geographically restricted clusters – the best of which are often called 'Golden Ages.' Moreover, these clusters take time to emerge and time to dissipate. Typically, a given civilization might begin with a few progenitor or precursor geniuses, and in successive generations the creativity attains a climax, after which activity trails off in a series of epigones or inferior successors. Hence, although the Golden Age of Greek philosophy is clearly defined by the apex represented by Socrates, Plato, and Aristotle, this peak was preceded by pre-Socratic thinkers and succeeded by post-Aristotelian thinkers of lesser merit – such as Democritus and Theophrastus, respectively.

Detailed generational time-series analyses have identified the basis for this clustering. Each generation of creators tends to build upon the work of the previous generation. As Plato builds upon Socrates, so does Aristotle build upon Plato. It is extremely rare for a creator to appear *de novo*, sans predecessors, and whenever that happens the creativity tends to be inferior to what occurs during the climax. In a nutshell, creative development is contingent on the availability of role models during the creator's childhood and adolescence, when the individual is acquiring creative potential. And, obviously, that role-model availability is most effective if its domain specific. Albert Einstein's creative potential is going to be fostered more by senior physicists than by older architects. When Newton famously said that he saw farther than the rest by standing on the shoulders of giants, he certainly meant figures like Kepler and Galileo.

Unfortunately, once the Golden Age attains the acme, subsequent generations tend to exhibit a progressive decline. The reasons for this decadence are complex, and probably in part domain specific. Alfred Kroeber, the cultural anthropologist, attributed the decline to 'pattern exhaustion.' After everything has been said within the constraints of a given cultural milieu, or *Zeitgeist*, there is no place to go next but down. Once painting has culminated in perfect photographic realism, then where can painters go next? They either must scramble to paint ever more exotic objects or they must find some alternative stylistic goal. Another disabling influence may be imitation. Too many potential creative geniuses of the post-climax generations may be tempted to imitate the masters of the Golden Age rather than risk developing their own unique voice. And

ultimately such imitation may be antithetical to genius, as argued by the philosopher Immanuel Kant. At the end of the Second World War the Dutch minor painter Han van Meegeren was revealed to have painted imitation Vermeers that art experts had actually certified as authentic. But rather than being hailed as an artistic genius he was condemned as a mere forger of fakes. It is one thing to create one's own distinctive style from scratch and quite another to ape the style of others.

Whatever the details, role-model availability exemplifies one way that the *Zeitgeist* operates to influence creativity in every generation and in every creative domain. In part, the *Zeitgeist* in any give period consists of the inventory of recent creative achievements that can inspire subsequent creativity. Below we turn to more specific processes that are confined to particular domains. We first look at the sciences, and then turn to the arts.

Scientific Creativity

Thomas Kuhn's *The Structure of Scientific Revolutions* presented a highly influential internalist theory of scientific discovery. The theory applies to paradigmatic disciplines in which practitioners exhibit a high theoretical and methodological consensus. An example would be physics which in the seventeenth and eighteenth centuries was largely governed by the Newtonian or 'classical' paradigm. Scientists operating within a paradigm are engaged in 'normal' science, a puzzle-solving enterprise that aspires to extend the paradigm's explanatory scope and precision. However, over time 'anomalies' begin to accumulate. These are results that do not fit within the accepted paradigm. On occasion, these anomalous findings can be assimilated. For example, Newtonian celestial mechanics managed to explain a perturbation in the orbit of the planet Uranus by predicting the existence of a new planet. When that planet, Neptune, was observed, it became a triumphal confirmation of the paradigm. Other times the anomalies cannot be easily assimilated without introducing post hoc alternations that undermine faith in the paradigm. For instance, an anomaly in the orbit of Mercury resisted all attempts at a Newtonian explanation (including the prediction of an unknown planet). If enough of these anomalies accumulate the discipline may enter a 'crisis' state that can only be resolved by the introduction of a new paradigm. These paradigm shifts are promoted by practitioners of 'revolutionary' science. An example was Albert Einstein's introduction of relativity theory in the early twentieth century. And the cycle continues. The key feature of this process is that the *Zeitgeist* is defined by the discipline (viz. the paradigm) rather than being determined by sociocultural factors outside the discipline, such as war.

Interestingly, normal scientists can be psychologically distinguished from revolutionary scientists. To illustrate, the latter are more prone to be laterborns and to exhibit higher rates and intensities of mental illness. So the paradigmatic *Zeitgeist* has psychological as well as disciplinary consequences.

Artistic Creativity

Like Kuhn, Colin Martindale was fascinated with disciplinary change, but in his case the focus was on stylistic change in the

arts, especially in literature. Just as the paradigmatic sciences show paradigm shifts, so do the arts display stylistic shifts. A Romantic poet does not write the same kind of poetry as a Neo-Classical poet. To explain these changes, Martindale proposed an evolutionary theory. The theory begins by assuming that all creators are operating with a given set of aesthetic conventions that define a particular style. However, creative individuals are also under pressure to maintain the 'arousal potential' of their products. This impetus means that they have to generate ever more novel and surprising works within the given style. To attain this end, creators have to increasingly rely on 'primary process' imagery (or primordial thinking). Yet after a few generations this cognitive regression goes so far that the stylistic constraints begin to break down. The style then becomes exhausted in a manner similar to Kroeber's concept of pattern exhaustion. The only salvation is to introduce a new style. Because the style itself is novel, arousal potential can be maintained without much regression into primary process. And the cycle then repeats.

Martindale has conducted a large number of empirical investigations that provide support for his evolutionary theory. Most notably he has used computerized content analyses to show that over the history of any given literary tradition both primary process imagery and stylistic change tend to exhibit inverse oscillations. When a new style is introduced primary process declines. At the same time, Martindale has shown that these stylistic changes are internal to a given art form. That is, such changes are affected very little by external events.

External Zeitgeist

The German philosopher Georg Wilhelm Friedrich Hegel argued that history was driven by a dialectic process involving pure ideas. A given ideational thesis would yield an antithesis which in its turn with produce a synthesis – and the latter would be a new thesis for the continuation of the cycle. Political, social, and economic systems were nothing more than manifestations of that intellectual history. In contrast, Karl Marx famously 'turned Hegel on his head' by arguing that the dialectic was materialistic rather than idealistic. In particular, the economic system, as defined by the means of production, underwent a dialectic process that drove history through the successive stages of slavery, feudalism, capitalism, and finally communism. In the Marxian view, the world of ideas – including both artistic and scientific creativity – was but the external consequence of the resulting economic conditions. Feudal art or science would have to be different than capitalist art or science because they reflected contrary materialistic circumstances. Needless to say, this reflectionist or externalist perspective is antithetical to the internalist positions discussed previously. It leads to a sociocultural determinism in which both paradigms and styles are epiphenomenal rather than causal. When artists in a communist state turn to 'Socialist Realism' it is not because the previous style had exhausted itself but rather because the new style better complies with the new economic milieu.

Although the extreme position is probably overstated, it remains true that creativity is not completely immune from the external *Zeitgeist*. The latter impact is evident in empirical

research on how political, economic, and sociocultural circumstances affect both the quantity and the quality of creativity observed at a particular point in time.

Quantity

The impact of the external Zeitgeist on the quantity of creativity can be assessed two main ways.

On the one hand, we can use generational time-series analysis to count the number of creators active in each time period, where the latter is most often taken as a 20-year interval. Specific political, social, economic, and cultural events or conditions can then be assessed in the same intervals. The relation between these two time series then provides information about the connection between the two measures. However, often the association between the two series is lagged rather than simultaneous. More precisely, the number of creators in generation g might be a function of the external Zeitgeist in generation $g - 1$. This lagged function would imply that the magnitude of creativity is contingent on the developmental experiences that future creators have in childhood and adolescence. As an illustration, for many domains of creativity the number of creators at generation g is a negative function of the level of political anarchy at generation $g - 1$, where the latter is gauged by political assassinations, military revolts, palace *coups d'état*, and the like. Another feature of the political Zeitgeist that may have a lagged effect is political fragmentation (i.e., the number of independent or sovereign states into which a given civilization is divided). Growing up under such conditions may enhance creative development, possibly via increased bilingualism and multiculturalism. In the same vein, civilizations tend to become more creative a generation or two after they have been exposed to influences from alien civilizations or cultures. In a nutshell, the aggregate level of creativity is prone to increase after an influx of sociocultural and linguistic heterogeneity.

On the other hand, we can use a smaller unit of time, such as a single year, to tabulate the number of creative products in a given temporal interval. This approach is clearly more refined. Shorter units of analysis allows for the possibility that the external Zeitgeist might have more finely-tuned effects. If certain extrinsic conditions can fluctuate rapidly from one year to the next, then their consequences will be overlooked when using larger aggregates. A prime example is the impact of war. Although war has no effect on the number of creators counted into 20-year periods, this dramatic condition does have a repercussion at the level of yearly tabulations. When war is followed by peace creators seem to make up for lost time, and thus create the works that were set aside during the military conflict. So the adverse impact is obliterated when the analysis expands from years to generations.

All in all, it is apparent that the quantitative implications of the external Zeitgeist are substantial. They can determine both the number of creators that appear in a given generation and the number of creative products that appear in a given year.

Quality

The qualitative impact of the Zeitgeist is perhaps even more interesting than the quantitative. During a specific period in

history, the number of creators in Chinese civilization might equal the number of creators in European civilization, and yet the products generated by these two sets of creators might be radically different in qualitative characteristics. In the case of painting, for example, Chinese painters might be creating highly idealistic landscapes that exist only in the artist's mind while European painters are creating highly realistic portraits of actual people.

Fortunately, some empirical research does indeed show that external conditions affect qualitative features of creative products. To illustrate, consider the following set of findings: (a) compositions in the classical repertoire exhibit distinct stylistic aspects depending on whether they were composed during peacetime or wartime conditions; (b) specific features of Greek ceramic paintings reflect the degree to which economic and political power was concentrated in a small proportion of people; and (c) the thematic material presented in plays corresponds to a noticeable degree with concurrent political events. These effects are all contemporaneous, whereas other external influences require a substantial delay. An especially interesting lagged effect is the polarizing effect of civil disturbances. One generation after a region has seen an increase in nationalistic revolts or political rebellions there tends to be a divergence in the positions advocated by notable philosophers. That is, thinkers who grew up under such circumstances have a higher likelihood of becoming proponents of diametrically opposed viewpoints. For instance, there will appear both extreme materialists and extreme idealists, extreme empiricists and extreme rationalists, and so forth.

To be sure, the correspondences are far from perfect. Many creators will be sufficiently individualistic that their work will not accurately reflect the external Zeitgeist. Even so, enough creators in any given generation conform enough that their products taken as a whole will represent their times.

Mixed Zeitgeist

Naturally, the foregoing represented extreme positions. The Zeitgeist is not exclusively external or internal. Rather, the two guises of the Zeitgeist operate together. Creativity in most domains is the joint function of both the internal and external Zeitgeist. That conclusion can be illustrated using both artistic and scientific creativity.

Artistic Creativity

Creativity in the arts is contingent on both types of Zeitgeist. This contingency is apparent in the empirical research on the thematic material in the compositions that make up the classical repertoire. On the one hand, it is clear that themes or melodies undergo stylistic changes, just as in literary creativity. The music of the Baroque period is identifiably different from the music of the Classical or Romanic periods. Moreover, the evidence suggests that these stylistic shifts are partly driven by the same kind of processes that Martindale discusses in his evolutionary theory. For example, because of the constant pressure on composers to be original, their melodies tend to become more novel, surprising, and unpredictable over the

course of their careers. This longitudinal trend then induces a historical trend: Melodic originality tends to increase over time. On the other hand, the research also shows that the nature of the melodic material also depends on the larger sociocultural conditions. For instance, melodies become more unpredictable and variable when a composition is created under wartime circumstances – particularly if the composer is active near the war zone. There is even an Ortgeist effect. Provincial composers who were born and raised far from the music centers of their day tend to create less strikingly original themes relative to cosmopolitan composers who emerged from one of the centers of music activity.

The foregoing illustration concerns qualitative effects operating on single creative products. Yet the internal and external Zeitgeist can also exert joint quantitative effects on individual creators. This twofold influence is apparent in research on the Japanese literary tradition. One peculiarity of this literature is the conspicuous presence of female writers, particularly during the Golden Age represented by the Heian period. As a case in point, Murasaki Shikibu, who is credited with writing the world's first true novel, has something of the status of William Shakespeare in English literature. Even so, it is also clear that the appearance of outstanding female literary creators fluctuated throughout Japan's history, and in some periods they would disappear altogether. It turns out that both internal and external factors are involved. In the first instance, female literary greats are most likely to emerge in those generations that feature male literary greats. Stated differently, only when Japanese culture favored literature as a form of creative expression will women have a high probability of making a contribution. In contrast, the appearance of female writers is uniquely discouraged by such extraneous conditions as Confucianist ideology. Because Confucianism promotes a hierarchical system that places women in an inferior position, it harms female creativity but not male creativity. Indeed, the dominance of Confucian ideas inhibits female achievements in other domains besides literature.

Scientific Creativity

From time to time two or more scientists will make the same discovery independently of each other. Well-known examples include the calculus by Newton and Leibniz, the conservation of energy by Mayer, Helmholtz, and Joule, the theory of evolution by natural selection by Darwin and Wallace, and the plague bacillus by Yersin and Kitasato. Likewise, it sometimes happens that two or more inventors will independently create the same invention. Instances include the ophthalmoscope by Babbage, Helmholtz, and Anagnostakis, photography by Daguerre and Talbot, and incandescent lamp carbon filament by Swan and Edison. Such events have been termed multiple discoveries or inventions, or just plain multiples. What renders these occasions especially dramatic is that sometimes the multiples are virtually simultaneous. Alexander Bell and Elisha Gray showed up at the US Patent Office with their respective inventions of the telephone on the exact same day! Furthermore, many more than two rival claimants may be involved. The dynamo may have had as many as nine independent inventors. Nor are these multiples rare. Examples run into the hundreds.

This phenomenon has often been taken as prime evidence for sociocultural determinism, the strongest form of Zeitgeist theory. Although research shows that this inference is unjustified – multiples are largely chance events – it remains true that they illustrate the influence of the Zeitgeist. The Zeitgeist provides the necessary but not sufficient conditions for a given discovery or invention. Calculus presupposes an analytic geometry, which in its turn depends on the prior advent of algebra, the latter being contingent on the previous existence of arithmetic. In this case, this sequence of dependencies illustrates the internal Zeitgeist within the discipline of mathematics. Yet on occasion the internal Zeitgeist will be joined by the external Zeitgeist, creating a mixed effect. A particularly dramatic example is the atomic bomb. The internal Zeitgeist in nuclear physics had already demonstrated the theoretical possibility of such a weapon. But it took the external Zeitgeist, in the form of the Second World War, for physicists to receive the tremendous resources required to convert this possibility into a reality. Although the atomic bomb was not a multiple, it might have become so had not the defeat of Germany terminated its own program.

Individual Versus Society

Too often the Zeitgeist is evoked to minimize the importance of the creative individual, even the creative genius. This derogation is especially commonplace in many discussions of multiples. If both Newton and Leibniz came up with the calculus, then the calculus must have been 'in the air' just ripe for the picking. However, this implication does not follow from the evidence. Nor do the other findings mentioned earlier in this article serve to dethrone the individual creator. The creative person remains for three main reasons.

First, two individuals can be born in the same place and time – identical Ortgeist and Zeitgeist – but still exhibit greatly differing degrees of creativity. One might become a universally hailed genius while the other becomes an obscure also-ran. Conversely, two persons of comparable achievements might be born in very different times and places. Consider the four scientists credited with discovering the Mendelian laws of genetics: Mendel, born 1822 in Heinzendorf bei Odrau, Austria (now the Czech Republic); Hugo de Vries, born 1848 in Haarlem, Netherlands; Carl Correns, born 1864 in München, Germany; and Erich von Tschermak-Seysenegg, born 1871 in Vienna, Austria.

Second, even when exact contemporaries and compatriots exhibit equal magnitudes of creativity, that creativity may appear in totally distinct domains of achievement. Where one becomes a Nobel laureate in physics, the other might become a laureate in literature. Any large metropolitan area in any given year will give birth to dozens if not hundreds of creative individuals who make their respective contributions to radically different domains.

Third, the level and type of creativity is determined by numerous variables that are inherent in the singular creator. Indeed, these non-Zeitgeist influences explain the previous two observations. The most obvious influence is genetic inheritance, which will affect both the type and magnitude of creativity. In addition, different creators will grow up under distinct

family backgrounds. In fact, even if two creative individuals came from the same household, they might differ because of their birth order. As an example, the Tolman family in West Newton, Massachusetts, had two sons born five years apart. The oldest, Richard, became a famous mathematical physicist, whereas the youngest, Edward, became a famous psychologist. Beyond the family there are various other developmental influences, such as education, mentors and role models, friends and colleagues, work environments, etc. This huge inventory of developmental experiences serves to individualize each creator. Consequently, each creator becomes something more than just a pliable pawn of the Zeitgeist.

See also: Genius and Greatness; Multiple Discovery; Paradigm Shifts; War.

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Zen

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Glossary

Beginner's mind The many possibilities regarding meditation in the mind of a beginning mediator.

Enlightenment A final blessed state marked by the absence of desire or suffering.

Koan A paradoxical question that cannot be answered using ordinary logic.

Mushin The state of 'no mind' or 'no ego' in which true emptiness is achieved.

Nirvana An advanced state of enlightenment in which desire, frustration, and ignorance are dissipated so absolute silence and stillness reign.

Samadhi The state in which consciousness is stopped and the individual is no longer aware of time, space, and causation.

Satori The moment of enlightenment when one sees into one's own nature.

Zazen Zen sitting meditation.

Zen A Japanese sect of Mahayana Buddhism that aims at enlightenment by direct intuition through meditation.

Brief History of Zen Buddhism

Prince Guatama was born near the border of Nepal and India in approximately the sixth century BC. His wealthy father gave him every luxury and kept him protected within the palace walls. When the prince finally left his sheltered life, he was very upset when he encountered sickness, old age, and death. He met a holy man who seemed happy despite the problems that surrounded him, so the prince decided he would seek his own liberation. He became a holy man, wandering the country without finding peace. Finally he vowed to sit on a straw mat under a bodhi tree until he found an answer. He sat there for six days. On the morning of the seventh day, he awakened to the morning star and became enlightened.

Prince Guatama became known as The Buddha.

Tathagata developed the Four Noble Truths, which emphasized that life's suffering was engendered by selfish craving that could be overcome through following the eightfold path of right understanding, purpose, speech, conduct, livelihood, effort, alertness, and concentration. The detachment of a solitary life led to liberation. The ultimate goal was achieving Nirvana, which represented a state of undisturbed peace.

The founder of Zen Buddhism was The Bodhidharma who was the twenty-eighth patriarch of Indian Buddhism. He arrived in China about AD 520. The Bodhidharma meditated facing a wall for nine years before becoming a teacher. His teaching was based on the principles of Mahayana Buddhism, which emphasized helping others and concrete experience. His disciples continued teaching in China.

Zen became recognized as a separate branch of Buddhism about AD 700 during the time of the patriarch Hui-neng. Hui-neng stressed the concept of emptiness, which minimized the importance of the individual ego in a world where everything and everybody are connected and constantly changing.

Suspicion of language is a basic tenet of Buddhism. The Bodhidharma called for 'no dependence on words and letters' but 'direct pointing to the real person, seeing into one's nature and attainment of Buddhahood.' Buddha stated that all humans are inherently enlightened; however, there is a need to practice in order to remove the obstacles to experiencing satori. Satori is reached through the study of koans, meditation, and living a purposeful life. 'Chop wood, drink water' – concentrate on what is necessary at this moment. It takes most people a great deal of training to calm what is called in India 'monkey mind,' the constant chatter of thoughts, for even a few moments. Zazen is a form of meditation in which concentration on breathing and calming the mind helps the practitioner lose awareness of the body. The goal is to reach a state where time, space, and causation, as the framework of consciousness, drop away.

Koans are a unique method of teaching. The student is assigned a koan – for example, 'What is the meaning of Mu?' The individual repeats the koan over and over during meditation until suddenly its truth is revealed.

Reaching enlightenment is a long, challenging path for most people. Philip Kapleau suggested that the three essential qualities necessary for enlightenment include (1) strong faith, (2) a strong doubt based on the imperfect state of the individual and the world compared to the idealistic image, and (3) strong determination to dispel this doubt with the whole force of one's energy and will.

Enlightened individuals are encouraged to participate in life. D. T. Suzuki stated that "the object of Zen training consists in making us realize that Zen is our daily experience and that it is not something put in from the outside." The enlightened individual interacts with everybody in a different way because the desire for ego gratification and material things no longer dominate the individual's thinking. Success and failure, happiness and unhappiness all become an accepted part of life.

Zen and Creativity in China and Japan

By AD 800 Zen was widely practiced in China. Zen's influence on culture was relatively minor. It contributed to Chinese philosophy in the Sung dynasty and a form of thirteenth century asymmetrical painting called *one corner* that was eventually exported to Japan. This inspired the *thrifty brush* style of Japanese painting that reflected the simplicity of Zen experience. Zen gardens and calligraphy also originated in China, but it was in Japan where Zen had the most impact on culture. Zen monasteries became the primary source of learning and art for the upper classes in Japan. Creativity was inherent in the teaching practiced by the Zen masters who used improvisational methods specifically tailored to the individual student.

The model of discipline and concentration required in Zen influenced other aspects of life. Training was often done by a master teacher similar to a roshi or Zen teacher. The idea of reaching *mushin*, a state of 'no mind,' penetrated the arts in Japan and stimulated creativity in many areas. *Mushin* represents the highest state of consciousness with no thoughts or judgments clouding the mind. Students practiced calligraphy, painting, or archery until the routine requirements – the moving of the pen or brush or the firing of the bow – could be accomplished automatically without thought. This training took many years because conscious control was not surrendered easily. Students without self-consciousness could completely absorb themselves in the moment, allowing intuition rather than intellect to control their process. When the mind was clear with no duality in the way, true human nature could take over and the artist knew where the brush was supposed to go. Some professions Zen influenced include the following.

Architecture and Design

Many great Zen temples began as imperial palaces and castles. They are noteworthy because they reflect and respect the unique beauty of the gardens that surround them.

The Japanese tea room, which originated in the fifteenth century, is an excellent example of how Zen deeply influenced many aspects of Japanese culture. The tea ceremony is a ritual designed as a diversion from the everyday world. Each tea room is built specifically for the individual tea master.

The ceremony begins with a walk through a garden where stepping stones form an asymmetrical path. The walk through a tea garden is intended to foster recollection and inner peace. The tea room's construction is deliberately delicate, consisting of bamboo supports and thatched roofs. The interior is strikingly simple with a fire pit, tatami mats, and a hanging scroll or some other object of art. Tea ceramics are a Japanese art form. Each item is carefully chosen to be part of a group. After the special tea is brewed and drunk, the tea master and guests may discuss each implement or the beauty of nature. Ordinary business matters are left outside in this special world. The simplicity of tearoom decor has influenced the design of functional things, including kitchen implements, floor mats, textiles, and common bowls and cups.

Calligraphy

Calligraphy originated in China in the third century AD. The ink (*sumi*) was mixed using an inkstand to grind an ink block made of lampblack and glue. Sometimes poetry was created spontaneously, which contributed to the development of haiku.

The first Zen calligrapher was Huang T'ing-chien (1045–1105) who became enlightened and recognized this changed the quality of his writing. Dogen Kigen (1200–1253), a legendary Zen master who founded the Soto sect, was a highly skilled calligrapher, and emphasized the importance of meditation.

Art

Ashikaga monochrome ink painting began as a natural extension of calligraphy. The black ink can be mixed in various shades that suggest the perception of color. As stated by T. Hoover, the purpose of Zen painting is to penetrate beyond the perceptions of the rational mind, to show nature's essence. The artist paints the enlightenment of the moment, and therefore has no time to labor over each stroke. Absolute concentration is crucial because no retouching can be done. The artist never pauses to evaluate his work. The ink flows in an unending flurry of strokes producing a sense of rhythm, movement, form, and the artist's vision of life's inner music.

This type of painting began in the Sung dynasty in China as a rebellion against conventional art similar to the abstract expressionist movement. Ch'an monks threw ink and rubbed it in by hand or using their hair. Three types of schools emerged. Zenkiga emphasized Zen parables, insight, and practice. Chinz specialized in portraits of well-known Zen teachers.

A third school focused on landscape painting with a very specific set of rules including which items were usually present (mountains, trees, rocks, etc.). Each painting was divided into three tiers that illustrated the scene from different perspectives. These landscapes pioneered concepts that became important in other Zen art including the symbolic use of empty space and emphasis on rocks and trees, which eventually became significant metaphors.

Japanese monks who traveled in China brought Zen painting home in the thirteenth century. Sesshu Toyo (1414–81) reinvented the form so that it reflected Zen precepts in its veneration of nature's beauty. He inspired a number of other artists who worked for the next 150 years.

Gardening

Zen gardens were also inspired by Chinese models created during the Sung dynasty. The use of rocks, trees, sand, and water were replications of Ashikaga ink landscapes. The idea of depicting a garden as a three-dimensional painting inspired the development of perspective and abstraction approximately the same time as Ucello (1397–1495) was doing similar work with painting in Italy.

The Zen garden was designed, like a painting, for viewing with the hope the emotional reaction of the viewer would inspire greater awareness. Excellent examples from the

thirteenth and fourteenth centuries are in Kyoto. War and poverty in the fifteenth century inspired the creation of stark stone gardens called *kare sansu*. These monochromatic gardens were specifically designed for meditation. They anticipated several art techniques by centuries including the abstract expressionist 'symbolic arrangement of mass and space.'

Haiku

Haiku is a tightly structured poetry format that requires the use of exactly 17 syllables. The poems are written in time to the seasons and often encompass themes about nature. Created in the fourteenth century, haiku was popularized by the Zen monk Basho (1643–94). Haikus represent Zen thinking in their absolute absorption in the moment, offering a direct clear unmistakable experience without reference to anything else.

With every gust of wind,
The butterfly changes its place
On the willow

The best haikus are those which arise from the tension between the rigidity of the form and the depth of the poetic feeling.

Other Arts

The No drama, developed in the thirteenth century, used masks, dances and poetry to explore emotional experience. However, because there is no story and very little movement, most untrained Westerners have difficulty appreciating the plays. Like other Zen arts, the purpose is to inspire a profound emotional response. The Japanese puppet theater was also impacted by Zen. Zen was used to train the samurai in swordsmanship and archery. The Zen archer practiced breathing until it was second nature and the arrow could be released without thought. Intense concentration allowed Zen archers to attain phenomenal accuracy. A Zen mind-set helped warriors overcome fear and respond automatically and unconsciously with deadly accuracy during battles. In 1281, the samurai defeated Kubla Khan's army of more than 100 000 men. Zen also influenced the creation and training in martial arts such as kung fu, aikido, and judo.

In business, Zen influenced the design and development of products, the structure of companies and the way business decisions were made. Onda, a Japanese creativity researcher, stated that, compared to Westerners, the Japanese are more tolerant of ambiguity but not as logical. Intuitive thinking is more common, which may be partially based on meditation.

Psychology

Dr Shoma Morita developed Morita therapy in Japan in 1917. Fumitaka Noda noted that:

Drawing from Zen Buddhism, Morita therapy essentially helps people accept their destiny. In addition, the way people and traditional healers coexist reveals uniquely Japanese ambiguity and wisdom for accepting life as it is (2009:167)

The original method was focused on behavior change in clients with a variety of anxieties.

Naikan (which means inner looking in Japanese) takes place at a number of centers around Japan where patients stay for a week which is similar to the structure of Buddhist retreats. David Ryback, Akira Ikemi, Toru Kuno, and Yoshihiko Miki stated:

The *Naikan-sha* (client) is invited to meditate from 6 in the morning until 9 in the evening (meal and bathroom breaks excepted) in a comfortably seated position focusing on problematic interactions with significant others, taken in life-long chronological order – parents, siblings, spouse, and so on. (2001:133)

Specific themes focusing on relationships are selected and then short face-to-face meetings occur every hour or two. This format of brief highly focused meetings is what a Zen roshi (teacher) might do.

Hakoniwa is a therapy used in Japan which resembles Sand-play in the West. Zen gardens are designed to invoke both a sense of beauty and peaceful spirituality. During the session a miniature Zen garden is available where:

Clients work with sand and a variety of figurines and objects ... to construct gardens that reflect their personal worlds. (Carolyn Zerbe Enns and Makiko Kasai, 2003:93)

Renku is group therapy that directly uses the creative process in a format reminiscent of haiku. Participants each write a short verse:

The challenge of each individual is to render the previous stanza as deeply understood as if one were in the person of the author of that stanza, with both conscious as well as unconscious spheres of knowing. (Ryback et al., 2001:132)

The goal is to increase empathy and create a sense of group harmony.

Zen in the West

After the Second World War II, teachers from Japan moved to the United States and Europe establishing Zen centers in major cities and mountain retreats.

Beat Zen

Beat Zen was embraced in the 1950s by some writers and musicians who felt they were rebelling against American conformity. Alan Ginsberg's poems reached a wide audience, while Jack Kerouac wrote popular semiautobiographical novels such as *The Dharma Bums*.

John Cage developed a form of 'music' that used multiple tape recorders and wrote a piano recital where the pianist did not play a note, but a page turner still turned the pages. Drugs, especially marijuana, were identified with beat Zen enthusiasts. Alan Watts felt Kerouac "confused 'anything goes' at the existential level with 'anything goes' on the artistic and social levels." The social responsibility inherent in Zen Buddhism was forgotten.

Physiology

Meditation, mental exercises (koans), and skill training have been sources of interest for researchers in neurology and biology. Alpha biofeedback training may have originated with electroencephalogram (EEG) monitoring of Zen and Yoga practitioners who claimed that meditation may create a unique form of consciousness. Researchers found that zazen, when practiced by Monks, created slower breathing patterns and more muscle relaxation.

In 2009, Alberto Chiesa summarized key points after reviewing the literature including the finding that increased theta activity in advanced meditators helped relax various regions of the brain as well as reducing stress and lowering blood pressure. He added that:

Zen meditation practice could protect from cognitive decline usually associated with age and enhance antioxidant activity. (p. 585)

There may be similarities between meditation and the flow state in terms of total absorption.

A small study of musicians indicated that even a brief period of meditating may help reduce performance anxiety. However, there is still a great deal of research needed to understand the potential for positive interaction between Zen meditation and the arts.

Psychology

Zen has been advocated by a number of psychologists as a valuable tool that can complement traditional therapy. Modern interpretations of this include relaxation exercises, hypnosis, biofeedback, and openness to experience

Carl Jung admired Zen, but felt the states achieved sometimes had delusional elements. Like most Western psychologists, Jung believed in the concept of the self, which could never really know the collective unconscious. This viewpoint contrasted sharply with Buddhist practice, in which the experience of satori awakened and absorbed the unknown self into a world beyond human consciousness. Some theorists criticized the use of Zen in therapy. It has been suggested that Zen's fixation on enlightenment sometimes caused psychological problems, and that Morita-therapy was inappropriate for patients in the West because of its cultural dependence.

Other psychologists felt Zen could help reduce the ego, expand consciousness, and promote self-integration. It was thought that the sudden enlightenment and gradual training in Zen practice were comparable with 'insight' and 'working through' in psychology. The concept of personal growth inherent in Zen is a cornerstone of psychotherapy, especially notable in the work of Abraham Maslow and Carl Rogers. It was proposed that the psychotherapist could be compared to a Zen martial arts teacher in terms of developing specific teaching techniques and strategies for each client. Albert Ellis suggested that Zen could be integrated with rational-emotive therapy.

Morita-therapy, Naiken, and Hakoniwa have all been adapted in the West with some success. In the last 20 years, a number of American psychologists have written books and articles with their own recommendation for combining Zen and psychology.

Creativity Research

Investigation into creativity confirms the inherent worth of aspects of Zen training. Some researchers have proposed that there exists a similarity between solving koans and the creative problem-solving model of preparation, incubation, illumination, and evaluation. After preparation and incubation, a solution to a koan or a problem comes suddenly and unexpectedly. Satori is similar to the 'Aha' moment in creativity. Then the viability of the solution must be evaluated.

A few studies indicate creativity may be facilitated in sitting meditation by freeing perceptions. Other researchers identified a satiation effect, which resulted from focusing on a picture or words with intense concentration. Eventually previous meaning dissolved, which opened the possibility for new perspectives. Creative people have described a similar fixation on a specific melody when composing or a specific object when painting.

This process appears to break down previous belief systems, inhibiting cognition in favor of perception, in the same way that a Zen student must go through deconstruction of his or her belief system before arriving at enlightenment and a true understanding of the world. It is a shift in paradigms that links creativity and Zen.

The evidence that expertise takes ten years to achieve suggests that the slow learning mentor-student relationship practiced by Zen teachers may be more effective in the long run than some Western techniques. Flow, defined as the feeling of an almost automatic, effortless, yet highly focused state of consciousness, is similar to descriptions of Zen creativity.

Another aspect of Zen that could have application in creativity research is based on the concept of Beginners Mind (Shoshun). Shyunryu Suzuki explained this term in relation to meditation: "In the beginners mind there are many possibilities, but in the experts there are few" (p. 2, ND). The concept is consistent with the openness which researchers have proven is a personality characteristic of eminent creators. This openness is part of the novice effect in which an insight usually occurs within the first ten years of an individual entering a field (Robert Root-Bernstein).

Kuhn's concept of Paradigm Shifts could be considered an example of Beginner's Mind – an historian approaching science from a different angle than working scientists. The concept of Beginner's Mind has potential implications for important areas of creativity such as Problem Finding and Discovery.

Business and Sports

Zen training and ideas about creativity are working their way into mainstream thinking in Western society. The American business community has been exposed to some Zen principles since the 1970s and 1980s when Japanese businesses were thriving and American companies were struggling. Writers, consultants, and teachers gave advice about creative management using Zen principles, while others stressed meditation as a way to relieve stress. Nike had great success using the Zen-tinged slogan 'Just do it.' A movement toward spirituality in business led to further interest in Zen within the corporate world.

Books about Zen and using Zen have multiplied with training advice and application for a number of fields including

education, writing, career planning, guitar, and even stand-up comedy. Peter Matthiessen, a Zen practitioner for many years wrote about his search for inner peace in *The Snow Leopard*, which won the National Book Award in 1979.

As vegetarian diets increased in popularity, some Zen cook-books have cracked the marketplace. In sports, Phil Jackson used Zen principles to coach his teams to more NBA titles than any coach in history.

Tiger Woods is a Buddhist so now the Zen of Golf has joined The Zen of Tennis on the bookshelf. And let's not forget Zen and the Art of Windsurfing.

Conclusions

Zen has influenced both the concept and execution of many different areas involving creativity, especially in Japan. The key aspects that Zen affected include the following:

1. The training for professions, which in many ways interacted and reinforced Zen principles. Each type of training became known as a way to enlightenment. A mentor–master teacher worked with students to make routine aspects automatic and as free of ego as possible. Once the ego was minimized, the mind and body were free so creativity could become natural and spontaneous.
2. An element of deliberate incompleteness that required the audience to use their own life experience to participate in the creative process. The viewer is part of the picture. Zen art is designed to be an experience grasped as a whole, not intellectually analyzed.
3. An appreciation of asymmetry and 'happy accidents' that produced distinctive products. The term *wabi* is used to describe the nobility of simplicity and rough edges of Zen products.
4. Increasing awareness and understanding by altering perceptions and forcing the mind to stretch.
5. Emphasis on the nonverbal with only a minimum of words even in haiku and No drama.

Zen art has touched upon almost every aspect of Japanese life and its presence is still felt today. Sensitivity to nature, the awareness of beauty, and the attention to the aesthetic details in life inherent in Japanese culture are a direct legacy of Zen creativity.

See also: Expertise; Flow and Optimal Experience; Incubation; Insight; Mindfulness; Paradigm Shifts; Spirituality.

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Appendix I: Chronology of Events and Significant Ideas and Works on Creativity

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1859	Sir Francis Galton, first cousin to Charles Darwin, published <i>Hereditary Genius</i> .	1950	Guilford published his seminal article, "Creativity," based on his Presidential Address to the American Psychological Association.
1870	Galton's <i>British Men of Science</i> appears.	1950	Morris I. Stein founded the Center for the Study of Creativity and Mental Health. It was attached to the Psychology Department of the University of Chicago.
1876/1958	Charles Darwin's <i>Autobiography</i> . Howard Gruber, who refined biographical methods for the study of creative persons, claimed that Darwin's <i>Autobiography</i> is "one of the first and maybe the best autobiographies of a creator."	1952	Anne Roe's <i>The Making of a Scientist</i> is published.
1881	Cesare Lombroso, <i>The Man of Genius</i> .	1952	Frank Barron and G. S. Welsh publish the "Figure Preference Test" (later the "Barron-Welsh Art Scale").
1901	Alfred Binet, author of the first test of mental ability (later revised as the Stanford Binet IQ test) publishes "L'observateur et l'imagination" ["Imagination and the Observer"].	1952	Brewster Ghiselin's edited, <i>The Creative Process</i> .
1908	Freud published <i>Creative Writers and Daydreaming</i> .	1952	Kris describes "regression in the service of the ego" in <i>Psychoanalytic Explorations in Art</i> .
1910	Freud published <i>Leonardo da Vinci and a Memory of His Childhood</i> .	1957	Sputnik launched, drawing attention to the need for more emphasis on science, technology, and creativity.
1913	Henri Poincaré's <i>Science and Method</i> was published. It contained very influential essays and his famous insight about Fuchsian functions. [His <i>Science and Hypothesis</i> was published in 1905.]	1958	Symposium organized by H. Gruber, M. Wertheimer, and G. Terrell, published in 1962 as <i>Contemporary Approaches to Creative Thinking</i> .
1917	Wolfgang Köhler, <i>Mentality of the Apes</i> . Various demonstrations of insights.	1958	Kubie's <i>Neurotic Distortion of the Creative Process</i> is published.
1925	Louis Terman publishes the first volume from his classic longitudinal study, <i>Genetic Studies of Genius</i> .	1958	Frank Barron's "The Psychology of the Imagination" appears in <i>Scientific American</i> .
1926	Graham Wallas presents the seminal four-stage model of the creative process, with the preparation, incubation, illumination, and verification stages.	1959	Maslow tied creativity to self-actualization in "Creativity in Self-Actualizing People." He later concludes that creativity and self-actualization may be inextricable.
1926	Catherine Cox publishes <i>Genetic Studies of Genius. Vol. 2: The Early Mental Traits of Three Hundred Geniuses</i> .	1960	Donald Campbell's "Blind Variation and Selective Retention" appears in <i>Psychological Bulletin</i> .
1935/1945	Karl Duncker, <i>On Problem Solving</i> . [Reports the famous radiation problem.]	1962	Donald MacKinnon's "Nature and Nurture of Creative Talent" is released in the <i>American Psychologist</i> .
1937	Catherine Patrick's article, "Creative Thought in Artists," appears in the <i>Journal of Psychology</i> . [Her "Creative Thought in Poets" appeared in 1935.]	1962	Goertzel and Goertzel published <i>Cradles of Eminence</i> .
1942	Leta Stetter Hollingworth, <i>Children above 180 IQ</i> .	1962	Thomas Kuhn presents seminal ideas about paradigms in <i>The Structure of Scientific Revolutions</i> (Chicago University Press).
1945	Max Wertheimer, <i>Productive Thinking</i> .	1962	Jerome Bruner defines creativity as "effective surprise" in his article, "The Conditions of Creativity."
1945	Jacques Hadamard, <i>The Psychology of Invention in the Mathematical Field</i> . Probably the first questionnaire study of mathematicians and an interesting account of Poincaré's famous insight.	1962	Mednick's theory of remote associates is presented in his article, "The Associative Basis of the Creative Process" (<i>Psychological Bulletin</i>).
1946	Henri Bergson's <i>The Creative Mind</i> is published.	1962	Getzels and Jackson's <i>Creativity and Intelligence: Explorations with Gifted Students</i> stirs debate over the distinction between creativity and traditional intelligence.
1946	Division 10 (Psychology and the Arts) is one of the founding divisions of the American Psychological Association.	1963	Calvin Taylor and Frank Barron publish <i>Scientific Creativity</i> (proceedings from the Utah Conferences).
1949	Institute for Personality Assessment and Research founded (Berkeley, CA). Barron, MacKinnon, Helson, and many others would conduct significant research on creativity at IPAR.	1963	Osborn's <i>Applied Imagination</i> is published.

- 1964 Roger Sperry reports significant differences between the two hemispheres of “split brain” patients (*Scientific American*).
- 1964 Arthur Koestler introduces “bisociation” in his book, *The Act of Creation*.
- 1965 Michael Wallach and Nathan Kogan published *Modes of Thinking in Young Children*—a huge step for assessment with divergent thinking tests and clarification of the relationship between creativity and traditional intelligence.
- 1966 E. Paul Torrance publishes the “Torrance Tests of Creative Thinking” (which were previously the “Minnesota Tests of Creative Thinking”).
- 1967 The first issue of the *Journal of Creative Behavior* appears.
- 1969 Wallach and Wing’s *The Talented Student* appears.
- 1969 Rudolph Arnheim’s *Visual Thinking* is published.
- 1970 P. E. Vernon’s collection, *Creativity*, is published by Penguin.
- 1972 Getzels and Csikszentmihalyi describe the value of problem finding for artists and publish *The Creative Vision*.
- 1972 Nicholls publishes “Creativity in the Person Who Will Never Produce Anything Original or Useful” in the *American Psychologist*.
- 1973 Khatena and Torrance’s *Thinking Creatively with Sounds & Images* (rev. 1998, Scholastic Testing Service).
- 1974 Morris Stein publishes two volumes of *Stimulating Creativity*.
- 1974 Howard Gruber’s *Darwin on Man* demonstrates the value of case studies and applies systems thinking to the topic.
- 1974 E. Paul Torrance directed the first Future Problem Solving activities in Athens, GA, USA.
- 1975 Robert Albert’s “Behavioral Definition of Genius” published in the *American Psychologist*.
- 1975 Dean Keith Simonton revitalizes the historicist approach to the study of exceptional achievement (*Journal of Personality and Social Psychology*).
- 1977 Harriet Zuckerman’s *Scientific Elite* appears.
- 1983 Howard Gardner published *Frames of Mind*. It contains the most convincing argument to date for the delineation of domains.
- 1988 The *Creativity Research Journal* is founded.
- 1990 The U.S. Patent and Trademark Office publishes their *Inventive Thinking Curriculum Project*.
- 1990 Creativity Symposium held at Pitzer College in Claremont, CA (proceedings published in M. A. Runco and R. S. Albert’s *Theories of Creativity*).
- 1990 International Working Creativity Research Conference, Center for Creative Studies, State University College of New York at Buffalo (proceedings published in Isaksen et al. *Understanding and Recognizing Creativity*).
- 1990 The first Gustav Theodor Fechner Award was given to Rudolf Arnheim by Division 10 of the American Psychological Association for Outstanding Achievement in Psychology and the Arts. (Since 1990 it has been given annually but called the Rudolf Arnheim Award.)
- 1992 IBM and PBS Television develop and televise “The Creative Spirit.”
- 1993 Doris Wallace and Howard Gruber edit a special issue of the *Creativity Research Journal* which explicates the need for research on “Creativity in the Moral Domain.”
- 1993 Nobel laureates describe their work in a symposium on scientific creativity at the Royal Society of Medicine, published in a special issue of the *Creativity Research Journal*.
- 1999 The *Encyclopedia of Creativity* is published by Academic Press.
- 2005 *Psychology of Aesthetics, Creativity, and the Arts* becomes an American Psychological Association Journal.
- 2006 Sir Ken Robinson’s Ted talk *Do Schools Kill Creativity?* received two million views on YouTube by 2011.
- 2006 *Thinking Skills and Creativity* is a new journal published by Elsevier.
- 2006 *Journal of Creativity in Mental Health* debuts as a Routledge publication.
- 2007 Saybrook University offers a Masters of Psychology with an Emphasis on Creativity Studies in addition to a Creativity Studies Certificate.
- 2008 Mark Runco selected at the first E. Paul Torrance Professor at the University of Georgia, Athens, GA, USA.
- 2010 Poll by IBM of over 1,500 corporate and public sector CEO’s and public leaders in 60 countries and 33 industries indicated that creativity was considered the most important leadership quality.
- 2011 TED talks related to creativity given by Mihaly Csikszentmihalyi, Amy Tan and Elizabeth Gilbert receive over 100,000 views on YouTube.

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- Ellis H (1904) *A study of British genius*. London: Hurst & Blackett.
- Hutchinson ED (1931) Materials for the study of creative thinking. *Psychological Bulletin* 28: 392–410.
- James W (1880) Great men, great thoughts, and the environment. *Atlantic Monthly* 46: 441–459.
- Jastrow J (1898) Discussion and reports: The psychology of invention. *Psychological Review* 5: 307–309.
- Lombroso C (1891) *The man of genius*. London: Walter Scott.
- Ribot T (1900a, January-June) The nature of the creative imagination. *International Monthly* 1: 648–675.
- Ribot T (1900b, January-June) The nature of the creative imagination. *International Monthly* 2: 1–25.
- Royce J (1898) The psychology of invention. *Psychological Review* 5: 113–144.

Appendix II: Tests of Creativity

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- I. Biographical Inventories
- II. Personality
- III. Rating Instruments and Socially Valid Measures
- IV. Styles
- V. Divergent and Associative Thinking and Problem Solving
- VI. Work and Educational Environment
- VII. Competencies
- VIII. Aesthetic Sensitivity
- IX. Projective and Perception Measures
- X. Intuition, Synaesthesia, and the Unconscious
- XI. Preferences and Attitudes
- XII. Criterion Measures
- XIII. Activity Checklists
- XIV. Creative Products
- XV. Domain-Specific Measures
- XVI. Art and Aesthetics
- XVII. Play Scales
- XVIII. Emotional Creativity
- XIX. Puns, Similes, and Linguistic Creativity

This appendix reviews some of the TESTS used to assess creativity. Psychometric issues about many of these tests are given in the Mental Measurements Yearbooks, Tests in Print, and various texts on testing. Some tests listed herein were not developed for creativity but either have been adapted to that end (e.g., Tangrams) or have several scales, one of which is directly relevant to creativity or originality (e.g., the Adjective Check List and the California Psychological Inventory).

Creativity is often assessed with other techniques, such as interviews, open-ended surveys, or a tally of products. Sometimes in the research, nominations are used rather than an instrument with a score. This appendix covers only tests, inventories, and rating scales. It does not cover all assessments. It is only a partial list of some of the major tests. Some tests and assessments are difficult to categorize. Several of them target more than one thing (e.g., personality traits, attitudes, and experiences) and others have a name that may not be the best descriptor of what is actually assessed.

Some tests and assessments are difficult to categorize. Several of them target more than one thing (e.g., personality traits, attitudes, and experiences) and others have a name that may not be the best descriptor of what is actually assessed.

I. Biographical Inventories

Alpha Biographical Inventory of Creativity.

(1968). The Institute for Behavioral Research in Creativity. Salt Lake City, UT.

Biographical Inventory of Creativity: Art and Writing Scales for females; Art-Writing and Math-Science for males.

Schaefer CE (1970) San Diego, CA: Educational and Industrial Testing Service.

II. Personality

Adjective Check List (ACL). Various scales have been developed to identify creativity and at least four others are relevant (i.e., intelligence-origence).

Gough H and Heilbrun AB (1983) USA: Consulting Psychologists Press.

See also Domino G (1994) *Creativity Research Journal* 7: 21–34.

California Psychological Inventory (CPI). The CPI is now routinely scored for the Creative Temperament Scale. An older Creative Personality index was scored from the standard scales and an Empathy scale ($\text{Creativity} = 65.96 + .63\text{Cs} - .34\text{Sy} - .37\text{Gi} - 1.15\text{Cm} + .61\text{Em}$).

Gough H (1975) Palo Alto, CA: Consulting Psychologists Press.

Sixteen Personality Factor Questionnaire. The Cattell 16PF has a creativity index based on a regression formula.

Cattell RB (1986) USA: Institute for Personality and Ability Testing.

The Myers-Briggs Type Indicator includes Intuitive as one of four primary domains.

Briggs MI and Briggs K (1985) Palo Alto, CA: Consulting Psychologists Press.

The NEO Personality Inventory has an openness scale which is reportedly correlated with creativity.

Costa P and McCrae RR (1985) Odessa, FL: Psychological Assessment Resources, Inc.

Overexcitability Questionnaire-II (OEQ II): 50 items, Likert scale, ten items in each of five forms of over-excitability.

Falk RF, Lind S, Miller NB, Piechowski M, and Silverman LK (1999) Institute for study of advanced development.

What Kind of Person Are You? is a subtest of the Khatena-Torrance Creative Perception Inventory.

Khatena J and Torrance EP (1976) Bensenville, IL: Scholastic Testing Service.

Creative Behavior Disposition Scale.

Taylor IA and Fish RA (1979) The creative disposition scale: A Canadian validation. *Canadian Journal of Behavior Science* 11: 95–97.

The Creative Characteristics Rating Scale is one part of the Rating the Behavioral Characteristics of Superior Students (Renzulli, Smith, White, Callahan, and Hartman, 1976). Like the *How Do You Think Test?* It inquires about tendencies and characteristics, as well as engagement in activities that probably require creative talents. It is therefore a hybrid and covers activities as well as traits.

A Chinese version was described by Chan DW and Zhao Y (2010) in "The Relationship Between Drawing Skill and Artistic Creativity: Do Age and Artistic Involvement Make a Difference?", *Creativity Research Journal*, 22(1), 27–36.

Students' Creative Self-efficacy Questionnaire (Huang and Lin, *Creativity Research Journal*, 2005).

Creative Personal Identity (Jaussi KS, Randel AE, and Dionne SD (in press). I am, I think I can, and I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creativity Research Journal*.

MMPI Creativity Scale. See Nassif C and Quevillon R (2008). The Development of a Preliminary Creativity Scale for the MMPI-2: The C Scale. *Creativity Research Journal*, 20(1), 13–20.

III. Rating Instruments and Socially Valid Measures

Students' Self-Evaluation of Creativity.

Miller HB and Sawyers JK (1989) A comparison of self and teachers' ratings of creativity in fifth grade children. *Creative Child and Adult Quarterly* 14: 179–185, 229–238.

The Parental Evaluation of Children's Creativity—Revised.

Runco MA, Johnson D, and Bear P (1993) Parents' and teachers' implicit theories of children's creativity. *Child Study Journal* 23: 91–113.

Preschool and Kindergarten Interest Descriptor.

Rimm SB (1983) Watertown, WI: Educational Assessment Service, Inc.

Teacher's Evaluation of Student's Creativity.

Runco MA (1984) *Perceptual and Motor Skills* 59: 711–717. Scales for Rating the Behavioral Characteristics of Superior Students.

Renzulli JS, Smith LH, White AJ, Callahan CM, and Hartman RK (1976) Scales for rating the behavioral characteristics of superior students. Mansfield Center, CT: Creative Learning Press.

Co-worker and subordinate rating scales were used by Jaussi KS, Randel AE, and Dionne SD (in press). I am, I think I can, and I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creativity Research Journal*.

IV. Styles

Kirton Adaptation-Innovation Inventory (KAI).

Adaptors and Innovators: A Description and Measure. (1976). *Journal of Applied Psychology* 61: 622–629.

The Creativity Styles Questionnaire-Revised (CSQ-R) assesses seven styles of creativity, with style defined in terms of personal strategies and beliefs about being creative. The styles focus on *Belief in Unconscious Processes, Use of Techniques, Use of Other People, Final Product Orientation, Environmental Control and Behavioral Self-Regulation, Superstition, and Use of the Senses*. See Kumar, Kemmler, and Holman (1997), *Creativity Research Journal*, 10, 51–58.

Kaufmann and Martinsen's Assimilator/Explorer measure of styles.

Martinsen O (1993) Insight problems revisited: The influence of cognitive styles and experience on creative problem solving. *Creativity Research Journal* 6: 435–447.

Your Style of Learning and Thinking

Torrance EP (1977) *The Gifted Child Quarterly* 21(4): 563–573.

Creative Problem Solving Inventory.

Basadur M, Wakabayashi M, and Graen GB (1990) *Creativity Research Journal* 3: 22–32.

V. Divergent and Associative Thinking and Problem Solving

Divergent and Associative Thinking Tests

For preschool children: Multidimensional Stimulus Fluency Measure.

Broberg G and Moran J, III (1988) *Creativity Research Journal* 1: 115–121.

Guilford JP (1960) relied on Consequences, Alternate Uses, and Plot Titles. He also developed Names for Stories (1971), Plot Titles (1962), Possible Jobs (1963), Seeing Problems (1971).

Guilford's approach and tests are described in his book.

Guilford JP (1968) *Creativity, Intelligence, and Their Educational Implications*. San Diego, CA: EDITS/Robert Knapp. Meeker and Meeker (1975) further developed Guilford's ideas about the structure of intellect as part of their test battery for school children.

Meeker M (1987) Meeker creativity rating scale. Vida, OR: SOI Systems.

Wallach and Kogan (1965) used two visual tests (Pattern Meanings and Line Meanings) and three verbal tests (Uses, Instances, and Similarities).

Wallach MA and Kogan N (1965) *Modes of Thinking in Young Children: A Study of the Creativity–Intelligence Distinction*. New York: Holt, Rinehart and Winston.

Multiple Choice Test of Divergent Thinking. Abedi-Schumaker Creativity Test.

Auzmendi E, Villa A, and Abedi J (1996) *Creativity Research Journal* 9: 89–95.

Remote Associates Test (Mednick, 1967).

Word Association Test. Gough HG (1976). Studying creativity by means of word association tests. *Journal of Applied Psychology*, 61, 348–353.

Functionally Remote Associates Test (Worthen and Clark, 1971 *Journal of Educational Measurement*, 8, 113–123).

Runco MA developed divergent thinking tasks to examine "problem generation," one aspect of problem finding, and "real-world" tasks that were predictive of problem solving in the natural environment.

See Runco's 1994 book *Problem Finding, Problem Solving, and Creativity*, Norwood, NJ: Ablex.

Test for Creative Thinking-Drawing Production.

Urban KK (1991) On the development of creativity in children. *Creativity Research Journal* 4: 177–191.

Torrance Tests of Creative Thinking

(e.g., Product Improvement, Ask and Guess, Just Suppose).

Thinking Creatively with Sounds and Word, Sounds and Images, Onomatopoeia and Images.

Torrance EP, Khatena J, and Cunningham BF (1973) Personnel Press.

Thinking Creatively in Action and Movement

Torrance JP (1974) Georgia Studies.

Thinking Creatively About the Future

Torrance JP (1974).

Torrance Test of Imagination

Torrance JP (1959) Bureau of educational research, University of Minnesota.

Scores: The most common scores from divergent thinking tests are Fluency, Originality, and Flexibility. Guilford also used a remoteness score for Consequences; Runco developed an Appropriateness index; Torrance an elaboration index.

Formulating Hypotheses Test. Quantity and quality of ideas generated when formulating hypotheses, designing methods for measurement, solving problems involving the scientific method, and when evaluating research proposals.

Frederiksen N and Ward WC (1978) *Applied Psychology Measurement* 2(1): 1–24.

Remote Associates Test. Remote Associates Test: Examiners manual.

Mednick S (1967) Boston: Houghton Mifflin.

Functionally Remote Associates Test.

Worthen and Clark (1971) *Journal of Educational Measurement* 8: 113–123.

German version (Verbaler Kreativitätstest, VKT, Schoppe, 1975), with nine subtests, including uses and similarities, but also nicknames, “utopian situations,” and word-beginnings and -endings.

Cheung PC and Lau S (2010) Gender Differences in the Creativity of Hong Kong School Children: Comparison by using the New Electronic Wallach-Kogan Creativity Tests, *Creativity Research Journal*, 22(2), 194–199.

VI. Work and Educational Environment

The Creative Environment Scales: Work Environment Inventory.

Amabile TM, Gryskiewicz, and Nur D (1989) *Creativity Research Journal* 2: 231–253.

Creative Climate Questionnaire. Ekvall G and Ryhammar L (1999). The Creative Climate: Its Determinants and Effects at a Swedish University. *Creativity Research Journal*, 12, 303–310.

Climate for Creativity.

Torrance EP (1958) Bureau of Educational Research.

Classroom Climate Questionnaire.

Walberg and Anderson (1968) *Journal of Creative Behavior*.

Technical Audit for Creativity of Organizations.

Stein MI (1959) Amagansett, NY: Mews Press.

Epstein Creativity Competencies Inventory for Managers. Measures eight competencies that predict managers' ability to elicit creativity in others.

Epstein R (1998) InnoGen. West Chester, PA.

Jones Inventory of Blocks.

A self-report described in the *Creativity Research Journal* (1991), 4, 303–315.

Creativity Audit for Organizations.

Rickards' creativity audit measures self-report data on three levels: (1) local or team; (2) organizational; and (3) market environment.

Rickards T and Bessant J (1980) The creativity audit: Introduction of a new research measure in programs for facilitating organizational change, *R&D Management* 10(2): 67–75.

Climate for Creative Productivity Index, Witt and Beorkrem (1989) *Creativity Research Journal*, 2, 30–40.

Creative Environment Perceptions: A Questionnaire for Investigating Garden Variety Creativity (Mayfield and Mayfield, 2010, *Creativity Research Journal*, 22(2), 162–169.

VII. Competencies

The *Epstein Creativity Competencies Inventory for Individuals* assesses four competencies: capturing ideas, challenging tasks, broadening knowledge and skills, and surrounding and seeking new stimuli. See Epstein, Schmidt, and Warfel (2008), *Measuring and Training Creativity Competencies: Validation of a New Test*, *Creativity Research Journal*, 20, 7–12.

VIII. Aesthetic Sensitivity

Tests of Aesthetic Sensitivity.

Frois JP and Eysenck HJ (1995) The visual aesthetic sensitivity test applied to Portuguese children and fine art students. *Creativity Research Journal* 8: 277–284.

IX. Projective and Perception Measures

Creative Functioning Test.

Smith G, Carlsson I, and Andersson G (1989) *Creativity Research Journal* 2: 1–16.

Thematic Apperception Test (TAT). A projective measure often used in clinical assessments of personality. A blank card has been used to assess problem finding tendencies.

Murray H (1973) Psychological Corporation, San Antonio, TX.

(See also Eisenman R (1992) *Creativity Research Journal* 5: 175–181.)

Rorschach Psychodiagnostic Technique.

See Richter RH and Winter WD (1966) Holtzman inkblot correlates of creative potential. *Journal of Projective Techniques and Personality Assessment*, 30, 62–67.

Rawls JR and Boone JN (1967) Artistic creativity and Rorschach whole responses. *Journal of Projective Techniques and Personality Assessment*, 31, 18–22.

Rawls JR and Slack GK (1968) Artists versus non-artists: Rorschach determinants and creativity. *Journal of Projective Techniques and Personality Assessment*, 32, 233–237.

Synaesthesia Questionnaire.

Domino G (1989) *Creativity Research Journal* 2: 17–29.

Khatena Torrance Creative Perception Inventory. Contains two tests of Creative Self-Perceptions: What Kind of Person Are You? and Something about Myself.

Khatena J and Torrance EP (1998) Bensenville, IL: Scholastic Testing Service.

Physiognomic Cue Test.

Stein M (1974) Physiognomic cue test: Test and manual. Amagansett, NY: Mews Press. (See also Martindale in *Creativity Research Journal*; and Perez-Fabello and Campos (2011), Dissociative experiences and creativity in fine arts students, *Creativity Research Journal*, 23, 38–41.)

X. Intuition, Synaesthesia, and the Unconscious

Westcott (1966) developed a measure of intuition containing 20 analogy problems. See also Mumford et al. (2007) *Creativity Research Journal*.

Accumulated Cues Test. Bowers KS, Regehr G, Balthazard C, and Parker K (1990). Scores are calculated from the number of cues (and amount of data) a respondent requires before he or she produces an accurate hypotheses. The highest level of intuition is suggested when the respondent needs no cues.

Preconscious Activity Scale (Holland and Baird (1968) *Journal of Creative Behavior*, 2, 214–223).

Creative Functioning Test (Smith, Carlsson, and Andersson, (1989) *Creativity Research Journal*, 2, 1–16).

XI. Preferences and Attitudes

Barron Welsh Art Scale. (Originally the Figure Preference Test, 1949). Assumes that the preference for complexity is predictive of creative talent.

Welsh G and Barron F (1963). Palo Alto, CA: Consulting Psychologists Press.

Basadur's Attitude Measure. Originally a 14-item self-report, expanded in the 1996 *Creativity Research Journal*. The original version was scored for two scales measuring the preference for ideation and the tendency toward premature closure.

Basadur MS and Hausdorf PA (1996) Measuring divergent thinking attitudes related to creative problem solving and innovation management. *Creativity Research Journal* 9: 21–32.

How Do You Think test. A mix of achievements, attitudes, and opinions—with good predictive validity. For younger persons, the Group Inventory for Finding Interests (GIFFT) and the Group Inventory for Finding (creative) Talent (both Ed Assessment Service, Inc.)

Davis G (1975) *Journal of Creative Behavior*.

The Creative Attitude Survey. A creativity measure for 9–11 year old children, which assesses imagination, interest in art and writing, desire for novelty, and attraction to abstract and magical, e.g., I get bored easily.

Schaefer C and Bridges CI (1970) Development of a creative attitude scale for children. *Perceptual and Motor Skills* 31: 861–862.

The Personal Opinion Survey. Contains 30 item true-false items.

Eisenman R (1969) Components of creativity, verbal conditioning, and risk taking. *Perceptual and Motor Skills* 29: 687–700. What Kind of Person Are You?

Khatena J and Torrance EP (1976) Bensenville, IL: Scholastic Testing Service.

Eisenman's Preference for Polygons test

Eisenman R (1966) Perceived creativity, set, and preference for simple or complex shapes. *Perceptual and Motor Skills* 22: 111–114.

The *Obscure Figures Test*: Acker M and McReynolds P (1965) An instrument for measuring cognitive innovation. *Perceptual and Motor Skills*, 21, 815–821.

Visual Elaboration Scale. Campos A and Pérez MJ (1988). *Perceptual and Motor Skills*, 66, 411–414.

XII. Criterion Measures

Instruments in this category are typically thought to assess *actual* creative behavior rather than tendencies or the potential for creativity. Here is a sample of the better known instruments: Tel-Aviv Activities and Accomplishments Inventory.

Three forms: Primary, Adolescent, Adult.

Milgram R (1973, 1998) see her chapter in the book, *Theories of Creativity*, Hampton Press (in press).

Academic, Military, Work, and Leisure Activities sub-scales.

Creative Achievement Scale.

Ludwig A (1992) *Creativity Research Journal* 5: 109–124.

Lifetime Creativity Scales

Richards R, Kinney DK, and Benet M (1988) Developed at McLean Hospital, Belmont, MA and Harvard Medical School.

Richards R, Kinney DK, Benet M, and Merzel A (1988) Assessing everyday creativity: Characteristics of the lifetime creativity scales and validation with three large samples. *Journal of Personality and Social Psychology* 54: 476–485.

Runco Ideational Behavior Scale (RIBS) is a self report developed as a criterion measure specifically for divergent thinking tests. It is a behavior scale in that it attempts to assess actions and activities requiring ideation more than the ideational (cognitive) process. See Plucker JA, Runco MA and Lim W (2006). Predicting ideational behavior from divergent thinking and discretionary time on task. *Creativity Research Journal*, 18, 55–63.

Things Done on Your Own (Torrance, 1962) is a behavioral assessment of creativity that requires respondents to state how often they have engaged in a task outside of school, in language arts, science, social studies and art, e.g., Have you ever designed jewelry?

Statement of Past Creative Activities (Bull and Davis, 1982) asks respondents to list activities in which they have engaged and that are creative (e.g., I have put on a play).

XIII. Activity Checklists

Holland's checklists of extracurricular and academic activities. Extracurricular creative activity. Given in the book *The Talented Student*.

Wallach and Wing (1969) New York: Holt, Rinehart and Winston.

Quality and quantity of activities in seven domains.

Runco MA (1986) Divergent thinking and creative performance in gifted and nongifted children. *Educational and Psychology Measurements* 46: 375–384.

Runco's Ideational Behavior Scale (RIBS). Designed specifically as criterion for divergent thinking tests. The emphasis is on actual behavior involving ideas. Originally 93 items with Likert scale but a 23-item subscale is most reliable.

Runco MA (1992) *Divergent Thinking and Creative Ideation*. Hampton Press.

XIV. Creative Products

Tangrams.

Domino G (1980) Chinese tangrams as a technique to assess creativity. *Journal of Creative Behavior* 14: 204–213.

Creative Products Semantic Scale (CPSS) contains 55 bipolar adjective pairs, Likert Scale. Three factors are represented: Novelty, Resolution, and Synthesis.

Besemer S and O'Quin K (1989) The development, reliability, and validity of the revised creative product semantic scale. *Creative Research Journal* 2: 268–278.

XV. Domain-Specific Measures

Action Preference Test.

Alter J (1989) *Creativity Research Journal* 2: 184–195.

Manual for Evaluating Performance in Technical Personnel.

Stein MI (1961) Science Research Associates.

Musical Creativity Test (1971).

Musical Divergent Production test

Gorder W (1976) An investigation of divergent production abilities as constructed of musical ability. *Dissertation Abstracts International* 37: 171.

Measure of Creative Thinking in Music (version II)

Webster (1983).

Poetry Writing.

Kasof J (1997) *Creativity Research Journal* 10: 303–316.

Iowa Inventiveness Inventory.

Colangelo N, Kerr B, Hallowell K, Huesman R, and Gaeth J (1992) The Iowa inventiveness inventory: Toward a measure of mechanical inventiveness. *Creativity Research Journal* 5: 157–163.

Preconscious Activity Scale

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XVI. Art and Aesthetics

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XVIII. Emotional Creativity

The *Emotional Creativity Inventory* measures three facets of emotional creativity: Preparation, Novelty, and Effectiveness/Authenticity. See Gutbezahl and Averill (1996) *Creativity Research Journal*, 9, 327–337.

XIX. Puns, Similes, and Linguistic Creativity

The Similes Test (Schaefer C (1969) *Similes manual*, NYC Center for Urban Education).

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INDEX

Notes

All entries refer to creativity unless otherwise mentioned. Index entries under 'creativity' have been minimized and readers are advised to seek more specific topics.

Cross-reference terms in italics are general cross-references, or refer to subentry terms within the main entry (the main entry is not repeated to save space). Readers are also advised to refer to cross-references within each article – not all of these cross-references have been included in the index cross-references.

The index is arranged in set-out style with a maximum of three levels of heading. Major discussion of a subject is indicated by bold page numbers. Page numbers suffixed by T and F refer to Tables and Figures respectively. *vs.* indicates a comparison.

This index is in word-by-word order, whereby hyphens and spaces within index headings are given value in the alphabetization. For example, 'self-worth' is alphabetized before 'selfish genes'. Prefixes and terms in parentheses are excluded from the initial alphabetization.

Where index subentries and sub-subentries pertaining to a subject have the same page number, they have been listed to indicate the comprehensiveness of the text.

Abbreviations

DFI – Domain, field and individual (model)

RAT – Remote associates test

SNP – Single nucleotide polymorphism

SOI – Structure of the intellect mode

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